WOMEN SCIENTISTS IN THE AMERICAS

THEIR INSPIRING STORIES

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WOMEN FOR SCIENCE WORKING GROUP

Women Scientists in the Americas

their inspiring stories

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their inspiring stories

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The Inter-American Network of Academies of Sciences

IANAS is a regional network of Academies of Sciences created to support cooperation in order to strengthen science and technology as tools for advancing research and development, prosperity and equity in the Americas.

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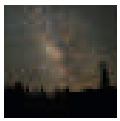

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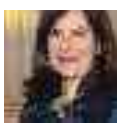

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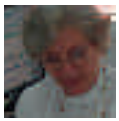
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Presentation

Science is a human enterprise. It has drama, frequent disappointments and moments of extreme excitement. Few things in life are more exciting than seeing something that no one else has ever seen before – it may be an unknown organism viewed through a new powerful microscope, a fresh insight into some aspect of the laws that govern the world (think of Newton asking why do objects fall) or proving a new mathematical relation – but it is entirely yours and it is a product of your hard work, creativity and perseverance. This is pure discovery and it is the essence of what motivates and drives scientists.

Science has been dominated throughout history by men, frequently relegating women to a minor role and in so doing losing half of human potential. Moreover, women also possess an eagerness for discovery and they bring a fresh vision and approach to science. Fortunately, things are changing owing to a fresh appreciation of the social costs of gender inequalities. The Science Academies of the Americas are committed to the ideal of equal opportunities for women in the scientific endeavor. The goal of the IANAS Women for Science Program is to encourage gender equity among our member Science Academies

and in so doing to foster gender equality in science more broadly in the Americas. One way of doing this is by telling the stories of outstanding women scientists.

The brief biographies that comprise this booklet capture the sense of awe and wonder that accompanies a scientific career and they show us why gifted and smart people choose to invest their lives in science. These brief capsules also tell us about the struggles of remarkable women who have worked, sometimes against great odds, to make a career in a world that has not always been welcoming to women. Each symbolizes countless other gifted and dedicated scientists who are working everyday to solve important problems and to add to our precious store of knowledge. So in a larger sense each story is the story of women and men who share a common passion for discovery.

This booklet has been assembled by the Women for Science Program of the Inter American Network of Academies of Science (IANAS) to tell how and why creative women choose science as a career. Our goal is to encourage young women to think of science as they evaluate their own future opportunities. All of the countries of the Americas must make maximum use of their human resources to assure a good life for future generations. This requires creating the knowledge that will solve major challenges of disease, food production, environmental degradation, climate change and others. It also means providing the basic knowledge that underpins new technologies in order to provide a higher standard of living for all. To meet these challenges our countries must attract gifted young women and men to scientific careers and what better way to do this than to tell the stories of outstanding contemporary women scientists. ■

Juan Pedro Laclette
Co-Chair
Professor and researcher at the National University of Mexico and former President of the Mexican Academy of Sciences

Michael Clegg
Co-Chair
Professor and researcher at the University of California Irvine UCI and Secretary of International A airs at the US National Academy of Science

Introduction

This publication contains a series of interviews with eminent female scientists from the Americas. It aims to offer readers throughout North, Central and South America an account of their remarkable careers. These women relate their dreams, motivations and the story behind their significant achievements in diverse fields of scientific research, in which they overcame numerous barriers and obstacles.

The booklet is the work of the Women for Science Working Group, composed of representatives ('focal points') appointed by Academies that are part of the Inter-American Network of Academies of Science (IANAS). The project began as a collection of responses to a questionnaire circulated to eminent women scientists - each focal point proposing one candidate. A biography action group of the Women for Science Working Group edited the responses for posting on the IANAS web site. From there on, the project evolved into the present collection of interviews, which were mostly conducted by professional science journalists in each of the

participating IANAS countries. The biography action group gratefully acknowledges the active participation of the IANAS Academies, the support of the journalists and the prestigious newspapers for which they work, the focal points representing our program in every country and IANAS Executive Secretary Adriana de la Cruz Molina, who coordinated the second phase of the project of which this booklet is the result.

The Women for Science Working Group has produced this booklet for a general public so it may contribute to the inclusion and empowerment of women in science and technology. We wish to introduce a wide audience to these remarkable women scientists in order to illustrate many ways in which women have become high achievers making significant contributions to a range of scientific disciplines. We also want to motivate teachers to encourage their students, especially girls, towards scientific careers, and show them that with perseverance and application they can achieve their objectives.

We dedicate this work to the families, parents and grandparents, for them to "tell" their children these stories and introduce them to these real-life figures committed to serving humanity. They are our contemporaries, everyday flesh-and-blood women with their own triumphs and troubles, joys and sadness, but also with one clear idea: to devote their life to science.

This book is dedicated in particular to young girls interested in becoming scientists, in the hope that their teachers and male classmates will encourage and support them in their development.

We wish to increase awareness among readers of the importance of debate and activism on gender issues, and in particular on questions about the roles of women in the sciences, what women can bring to the sciences, and how humanity benefits from women's participation. The life stories that emerge from these interviews provide an eloquent answer to these questions.

A study by the United Nations demonstrated that for every year a girl spends in school, the infant mortality of her future children is reduced by 1%. Indeed, education allows girls to read and become educated on vaccinations, health and childcare. This is one of many

arguments in favor of gender equality and universal education. Public awareness of scientific culture must be encouraged, to emphasize its contribution to a country's sustainable development and the solution of a variety of problems.

We hope that these stories will inspire readers considering to study science. Here they can find a message of encouragement and confidence in the future. Contemporary and future societies cannot afford to lose half their potential, intelligence and talent by failing to include women's creativity, determination, and unique perspective and approaches to science and technology.

...*Few are capable of integrating science into everyday language*, said José Martí. With these women's life stories, the IANAS Women for Science Working Group hopes to have made a small but valuable contribution to promoting science among the general public. Please enjoy this booklet! ■

The biography action group IANAS Women for Science:

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Writer, Anthropologist and Focal Point of Canada

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The Women for Science Working Group (WfS-WG) of the InterAmerican Network of Science Academies (IANAS) acknowledges the encouragement and support it has received from UNESCO, the Academy of Sciences of the Developing World (TWAS) and the Global Network of Academies of Science (IAP) for its objective of highlighting the contributions to science by women scientists throughout the Americas. WfS-WG is particularly thankful for the financial support it has received from IAP for publishing this booklet of interviews with prominent women scientists. WfS-WG gratefully acknowledges outstanding science journalists throughout the Americas who generously contributed their compelling stories for this booklet. The media for which they work are to be commended for their efforts to make the achievements of science accessible to the general public. ■

Anneke Levelt Sengers
co-Chair
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Lilliam Álvarez Díaz
co-Chair
IANAS Women for Science Program

What the Women Said:

Interviews with Women in Science[1]

"I am convinced that it is important for women to participate in all human activities and not to be excluded from them. For example in my discipline there were women who made significant contributions, and were only able to do so by assisting their husband or brothers, since they were not allowed to carry out their work freely. Only a few of them were recognized, and this was done belatedly. I consider that those women that are interested in scientific research should have similar opportunities as men"

"Scientific information and opportunities are there for both women and men, and women are very capable of the data management, perseverance, discipline and compassion required by science"

For most of the women in this brief study, their roles and lives as scientists were extremely important to them. As women of great accomplishment with many honours and achievements to their credit, most are in their mid to elder years although at least two of the twelve[1] were still in their fifties. Thus, their views and perspectives reflect many years of work and experience in their fields and the quotes above represent their feelings about the role that women can play in science.

1. The biography project of the Women for Science Working Group of the InterAmerican Network of Science Academies (IANAS) was started in 2011 as one of their first initiatives. The focal points representing each country, in consultation with their respective academies of science, were each asked to select one outstanding woman scientist to be interviewed. After the selection was made, each of the focal points conducted the interview following a list of questions that had been developed by the biography committee of the Working Group. Most of the interviews conducted were translated into English and/or Spanish and placed on the group's website. Because the interviews were rather formal, the group decided more recently that science journalists were to be contacted in each county to re-write and, if necessary, re-interview the women so that the final presentation in this publication would be more readily accessible to younger readers. The brief analysis presented here, however, is based, with a few exceptions, on the first more formal interviews and presents a compilation of answers to the questions. 12 interviews were read and analyzed for this purpose.

Where did their interest in science come from? Without exception, the women traced their interest to the experiences of early childhood. These ranged from living close to the sea and wanting to eventually unravel its mysteries, field trips as a child to explore tropical landscapes which led to an interest in nature and biology and playing with grandfather's microscope in order to see "really tiny" things. Other childhood reminiscences included falling in love with the 'sky and stars' as a young person, being exceptionally good in disciplines such as math and physics, wanting to become a doctor in order to heal people, collecting "things" and playing school as a child. Some just said that they had always liked science and "investigation."

Most of the interviewees were convinced that **women brought important and possibly unique gifts and talents to the field of science**. Some women merely said that woman have great talent and can therefore make important contributions to science and especially to research. A few actually mocked this question, asking basically why it is necessary to even raise it since the answer is so obvious; "why would one even think of wasting the brains of half of the scientifically inclined population" or "isn't it really important not to lose the brain power of half the population"? Some thought women's ability to do science is beyond discussion as demonstrated by the many who have won Nobel and other special prizes or who now hold important positions in universities, laboratories and research centers. Some of the answers were particularly interesting because they suggested that women had special qualities which set them apart from men. The special traits mentioned were:

- Particular sensitivity that enables them to focus in greater depth on biological problems
- They are more patient and persistent, even "pig-headed" which is important for research
- They are more intuitive which is also important for science
- They have a different way of thinking which complements that of men
- They approach science differently from men in terms of their intelligence and activity
- Fortitude, spirit of sacrifice and the certainty of a woman make her a good scientist
- Their labs are more nurturing, welcoming and interactive
- They are important as role models and mentors to young women

Almost without exception, the women in this sample named specific scientists **who were their inspiration** for attempting a career in science. They mentioned leading

scientists, most of them men who had gained recognition in their own countries and famous scientists with international reputations. A few noted that talented and inspiring professors at university provided them with the encouragement to continue a scientific career. Some mentioned specific professors who became mentors to them in furthering their development as young scientists. Several named the great scientists of history such as Pasteur and Madame Curie for being their inspirational models. A second category of inspirational figures were family members. One mentioned a father who took her and her siblings for walks and taught them about nature; one woman cited a strong mother who "pushed' her into university; one mentioned the importance of both her parents who made her feel "that I could do whatever I wanted" and one interviewee remembered the support and inspiration provided by her husband.

One of the most frequently discussed issues involving women in scientific careers revolves around the **exclusionary barriers** they face in gaining access to education and employment. One of the main barriers frequently mentioned was the resistance of their families to higher education for women. In one case, an interviewee said she was raised in a very traditional family in a country where women were not expected to achieve outside of the family. Her greatest barrier therefore was overcoming that belief in herself, "my own expectations of the role of women were the main challenges to overcome". She found that raising her children as well as pursuing a scientific career was challenging but she was glad to be able to do it successfully. Another said that studying medicine in her country was almost unheard of and her family reacted negatively to her decision. One woman frankly admitted that she sometimes found it difficult to share her dedication between work and family.

There were also a few women who had faced divisive political situations in their countries which frequently prevented them from developing their careers. The need to "begin all over again" after political disruption created a significant barrier to career advancement.

Some women distinguished between formal, structural or systemic barriers and the often subtle and understated emotional feelings and experiences. For example, rather than being overtly discriminated against, was the feeling of not being included. One woman maintained that she did not remember any "blatant or severe acts of discrimination" but she survived by not focusing on this issue saying that if others did not include her, she simply "carried on" with her work. Another distinguished between her experiences in her own country compared to the United States where she did her graduate work. "There I had

to work very hard to show that even though I was a woman and a South American, I could also think". Some experienced not formal barriers but the 'only' phenomenon, and spoke about the "loneliness" of being the only woman in meetings, at scientific conferences and as members of university departments. Also mentioned were some of the relatively small behavioural acts of men as they interact with women in the workplace. For example, "men had a tendency to interrupt me when I was talking", which she solved by being more forceful and "interrupting back" or some men who did not look at her when she was talking but would instead look at the men on her left or right. One woman recounted that although she has had no obvious discrimination in her career, it was when she applied for her first university position that she was asked inappropriate questions during the job interview. She formally complained to the administration of the university and a committee was formed to change interview procedures and regulations.

At least two of the women in this small study claimed not to have experienced any barriers or discriminatory behaviours or attitudes. One noted that although she did not experience any major barriers she nevertheless understood the dynamics of male-female inequality especially in the professional realm. Others maintained that they have been able to integrate the professional and personal aspects of their lives without any difficulties or major sacrifices. In one instance, an interviewee said that she was aware of cultural barriers that "force women to double their efforts" but that there is also now a greater recognition of those efforts. In a similar vein, it was noted that women must still work especially hard to overcome the traditional dynamics that "legitimate inequality among men and women".

Although it was not always clear from the interview protocols, it would appear that a considerable amount of discrimination or exclusion was experienced during their periods of graduate study abroad rather than in their home countries.

Marriage and motherhood characterized the personal lives of the majority of these women. With one exception all were married and had children. Most were married to fellow scientists or academicians. This point became particularly salient as a female astronomer noted that science involves specific priorities, and if they do choose to marry a fellow scientist or academician it makes their lives easier because their partners also understand the priorities. This means that they can assume child care when necessary. (This woman also mentioned that she has female colleagues married to businessmen, which makes combining marriage and a science career more difficult.)

A number of women mentioned that balancing career and family life left very little **leisure time**. However, many of them enjoy reading and outdoor activities, but the most mentioned reponse was that they like to spend what leisure time they had with their families and friends.

When asked **what advice** these interviewees would give to other women and particularly younger students there was a strong and unanimous consensus that they should pursue their dreams and ambitions and work hard to become the scientists of the next generation. Women should "aim for the highest levels of achievement". The young women of today should create a "new history" that "strengthens a woman in all the roles of her life". These eminent women are very passionate about the work they do and they advise young women to continue to work on what they love. Specifically they should bring such traits as perseverance, inspiration, commitment, collaboration and enthusiasm to their work. Within their families and in the educational spheres, they should provide equal opportunities for men and women. Women scientists (and men) should also do what they really are most interested in and do it as well as possible in order to be proud of their achievements.

In addition to working hard in their professional lives as scientists, several women specifically advised that young women should not "relinquish motherhood for the sake of a scientific career. To be a mother is a fabulous experience and even though for a few years life will be more difficult due to maternity, it is possible to reconcile a career with being a mother." Another said that "women need especially to realize that leading a balanced life between family and academic work is possible - in fact, probably more so than in other professions".

Conclusions

What can we learn from this small study of the biographies of eminent women scientists that would help future generations of young women enter into these professions? A number of main points stand out. One is that early childhood socialization into the world of inquiry including some degree of support from family members, especially parents, is critical to young women as they begin to think about their future. Another is that social class appears to play an important role in deciding who can become a scientist because, with perhaps only one exception, these women come from backgrounds which were able to provide opportunities for education enabling them to reach university and then later post-graduate studies in their own countries or abroad.

It has often been said that one of the main reasons for the small numbers of women in professional careers is that it is difficult,

if not impossible, to combine the demands of a scientific career with that of marriage and the family. It is, however, feasible as this small study demonstrates, because eleven out of the twelve women interviewed were married and had families. In fact, several of them warned, in their advice to young students, not to give up motherhood because it is such a vital component of a woman's life. Without exception, these women were able to successfully combine family life with a significant and highly honoured career. But what makes this possible? In all instances, a supportive partner or husband was the critical factor that made a woman's career achievable. Support from other family members was also mentioned. Some women even noted that science could be particularly enabling for a woman because it was often conducted in groups such as in laboratories which others could temporarily take over in event of a crisis in the director or professor's family. (Although it was not specifically noted in these interviews, the socio-economic status of the women once they became employed probably allowed them to hire household help.)

With respect to barriers facing women in scientific careers, there was a strong consensus that whatever barriers exist can be overcome by perseverance, patience and hard work. In some cases, taking some form of action against exclusionary barriers was also considered. Failure or dropping out was not an option for these women. Most expressed great satisfaction at lives well lived, achievements made and in most cases, great recognition in the form of honours and awards. These eminent women of science are now mature professionals who serve as inspiring role models for younger women. ■

Frances Henry
Writer, Anthropologist and
Focal Point of Canada

Interviews

their inspiring stories

Eugenia Sacerdote de Lustig

Argentina

“During the polio epidemic, I set an example by vaccinating myself and my o□spring, after which I set about vaccinating the other children in Buenos Aires”

Compilation of texts and editing by Norma Nudelman*

Eugenia Sacerdote and Rita Levi-Montalcini

Doctor, chemist and biologist (1910-2011)

In the late 1930s, the Histology Department at the University of Turin in Italy was one of the most advanced research centers in Europe. It was then that its tenured professor Giuseppe Levi honored his four best students by making them internal assistants. Their names were Rita Levi Montalcini, Renato Dulbecco, Salvador Luria and Eugenia Sacerdote. The anti-Semitic laws introduced by Italian Fascism forced them to emigrate. Montalcini, Dulbecco and Luria fled to the United States, where each of them later received the Nobel Prize for Medicine. Eugenia Sacerdote, a scientist of the same intellectual and professional caliber, moved to Argentina. There, with less support to develop her creative abilities, she did not earn the Nobel Prize but became a veritable scientific pioneer in the country.

She never forgot Italy, where she was born in 1910. But Argentina was the setting for her most productive years of research. Eugenia Sacerdote had married Maurizio Lustig just before arriving in the country, and was already a specialist in a technique then unknown in Argentina: in vitro living tissue culture.

On Sunday November 27, 2001, as the scientist was chatting affectionately with her daughter, she passed away suddenly but painlessly. A mother of three, Eugenia's life was marked by a passion that bravely defied contemporary standards.

The scientific results and successes that constitute her greatest source of pride

Her first job was Professor of Histology at the Faculty of Medicine. There, Eugenia Sacerdote de Lustig tenaciously overcame the adversity imposed on immigrants by the political situation and obtained a post in the national scientific plan, though sometimes her salary was merely the money leftover from the purchase of test tubes.

She then moved to the Malbrán Bacteriological Institute, where in 1956, as head of the Virology Department, the Government sent her to the United States to study the polio vaccine technique developed by Dr Jonas Salk. This coincided with a severe epidemic in Argentina, and Eugenia was the only person who could carry out the laboratory analysis. Upon returning from the United States, she became the first person in Argentina to receive the vaccine. To convince the population of the effectiveness of the vaccine, she carried out a public inoculation on herself and her three children.

Later, at the Oncology Institute, she employed histology in the fight against cancer, and her research there had a worldwide impact. She was also a teacher and member of the Biology Department in the Faculty of Exact and Natural Sciences.

Honors and prizes

- In 1992, Eugenia Sacerdote de Lustig won the Hippocrates Prize, the highest award in Argentinean medicine.
- She is a reference in the country's scientific research, having published over 180 works in national and international scientific journals and instilled her own professional caliber in dozens of disciples.
- Senior researcher at CONICET, President of the Albert Einstein Medical Research Institute and Research Director of the Angel Roffo Institute, she also produced work on Alzheimer's disease, genetics and experimental oncology, and worked tirelessly into her nineties.
- In 2011, at the age of 101, she received a Commemorative Medal for the Bicentenary of the May Revolution, awarded by the National Senate to distinguished Argentinean figures.

Who or what inspired you to work in science?

Giuseppe Kevi, a tenured Professor of Histology at the University of Turin (Italy), one of the most advanced research centers in Europe, made three other students and me internal assistants.

Dr Paredes, a Professor of Histology and Embryology in the Faculty of Medicine at the University of Buenos Aires, where I took my exams because I had already written a thesis and knew some new techniques: cells cultured in vitro. Professor Parpeto Brian, the director of the Roffo Institute, who was a pathologist and knew my professor back in Italy, introduced me to studies on cultured cancerous cells.

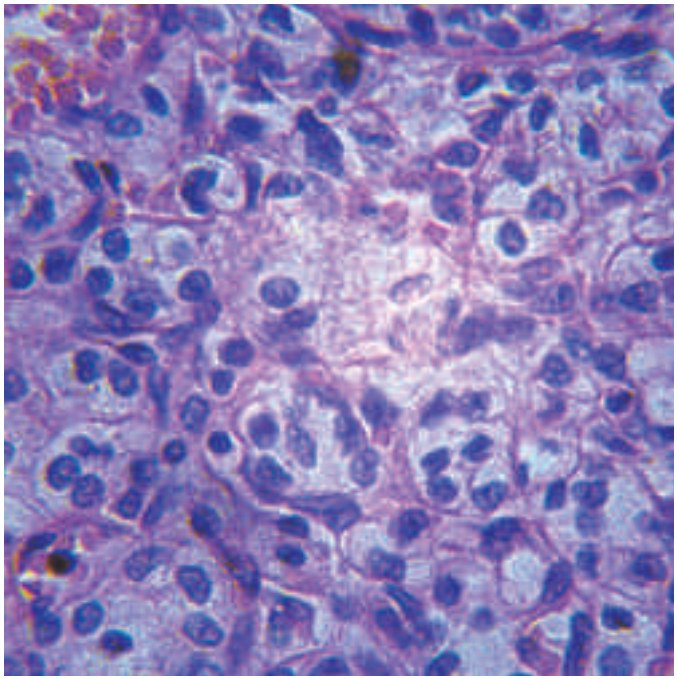
And lastly Doctor Parodi, head of the Virus Department at the Malbrán Institute, wanted to grow viruses in living cells. As a result of the polio epidemic in the 1950s I was able to develop techniques to detect cases. I was then sent to the United States to learn about the brand-new vaccination. I worked with monkeys from the north, as the virus multiplies in monkey as well as in human tissue. I saw that the vaccination worked well and protected the monkeys. So I launched a campaign here to convince the Public Health Minister to vaccinate the whole population. They were a little apprehensive in Argentina because they did not yet know the result. They knew that it protected humans but they thought that other problems might arise.

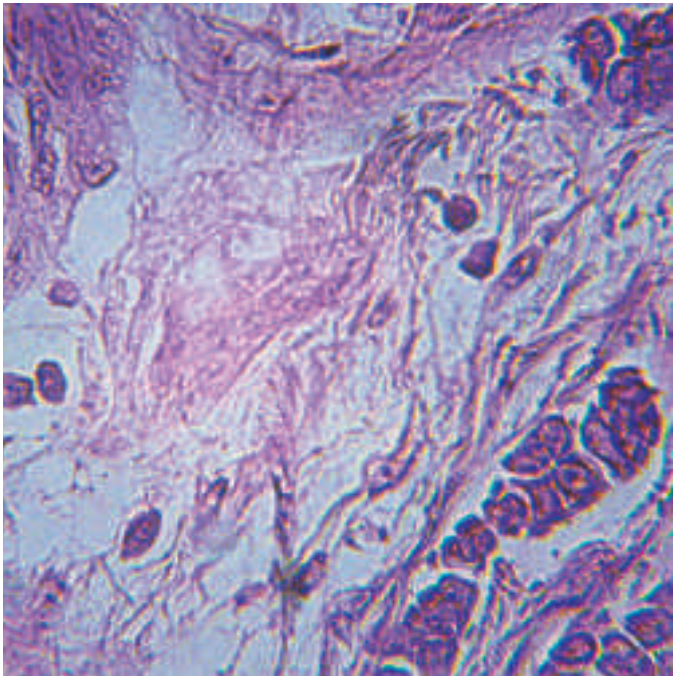
So I set the example by vaccinating myself and my children, then I began to vaccinate the children of Buenos Aires. However I personally had to make that decision to launch a campaign.

What are the main obstacles that you have come across and how have you overcome them?

When I decided to go to university my family reacted very negatively, because it was almost unheard of for women to study medicine. In the end my cousin and I were accepted at Turin University, where there were only four women alongside 500 men. We finally graduated, but in 1938 Mussolini introduced his social laws. As my family is Jewish they immediately took away my medical license, so I never worked as a doctor in Italy.

Eugenia Lustig became the first woman to test the polio vaccination in Argentina. In order to convince the population of the e ectiveness of the vaccination, she innoculated herself in public and did the same with her three children.





Eugenia Sacerdote specialized in in vitro tissue culture, a technique that was unheard of at the time

I had to start all over again. I worked in the Histology Department until 1947, the year when Perón expelled Professor Houssay for not supporting him. So my professor in the Embryology and Histology Department resigned from his post in 1946 out of solidarity with Professor Houssay. I remained there until the director of the Roffo Institute, Professor Parpeto Brian rescued me.

In 1966, when Onganía came to power, I was in the Cell Biology Department in the Faculty of Exact and Natural Sciences and many people were expelled. I was immensely fortunate to avoid being imprisoned, as several professors were. The following day I cannot recall whether I resigned or was expelled, but I found myself again with nothing. It had happened to me so many times that I simply had to start again from scratch. Luckily I still had my laboratory at the Roffo Institute. In recent years we have thankfully worked well, and have survived despite our many difficulties. I have also studied Alzheimer's disease, with

groups of neurologists that I have worked with for several years, and biochemists who have helped me with the final stages of cells.

Do you have any family?

My family is composed of my husband, three children, nine grandchildren, four great-grandchildren and my nephews, nieces and cousins.

What do you like to do in your spare time?

I lost my sight when I was 80, so I cannot read. It is important for people to come to read to me, and apart from that I listen to cassettes all day. I am a member of a library for the blind and have already finished all the books there. I have also become a member of a library for the blind in Italy, and they send me cassettes from Italy once a month. That is how I spend my days. People from the Faculty and the Department also visit me.

What advice would you give to female scientists?

Do not let anything hold you back. ■

*Norma Nudelman is a distinguished chemist and member of of the National Academy of Exact, Natural and Physical Sciences of Argentina, and a promoter of the inclusion of young women in sciences, Co-Chair of the IANAS Science Education Program and focal point of the IANAS Women for Science Program.

Mónica Moraes R.

Bolivia

> “...I made the best decision in my life, because biological research is an inspiring recreation of Nature”

Interview by Eliana Sdenka Asunta Vásquez Berazaín*

Why was studying biology the best decision that you have ever made?

Making a definite choice about one's professional future after finishing high school is a very complicated matter, so when I had to choose the subject of my degree - which I was certain would be my career – I first applied for veterinary and animal science, then changed to pedagogy and the option of biology appeared. From the moment I applied, it has been the best decision I have ever made, because biological research is such an inspiring study of Nature. It allows one to constantly review and consolidate the areas of specialization in which one can make contributions, however small, to scientific knowledge.

How was your interest in botany and documenting the flora and vegetation of the Bolivian lowlands born?

The trips I made as a child and young girl definitely gave me a particular fascination for tropical landscapes, especially the trips to Riberalta – where my father was born (in the north east of Bolivia) – and deep into Amazonia. Our field trips to the Bolivian lowlands during my Biology degree at the Universidad Mayor de San Andrés in La Paz built up this interest, as did my work as an assistant at the National Natural History Museum. Later, at the National Bolivian Herbarium, I went on my first scientific expedition along the Río Madre de Dios, and then worked on projects organized by the Beni Biological Station. My greatest challenge was definitely the information gaps that several regions of Bolivia suffered from, regarding their natural landscapes and groups of plants. As a result, whenever a comparison was made of the state of knowledge in American countries, Bolivia always registered at the lowest levels.

What was the subject of your study projects on Bolivian tropical flora?

Science has developed by adapting itself to the opportunities for implementation, the logistical conditions and of course the financing options. In my case, the options were very favorable for me to concentrate on tropical landscapes, to study their vegetation formations and typical plant species. My botanical collections motivated me to increase my knowledge of the floristic composition: the dominant species, state of conservation, and biogeographical implications, among others. Palms (Arecaceae) are a typical tropical plant group, and I have contributed for more than 25 years to experiments and projects on them. I began with taxonomy, then ecology, distribution, conservation and finally handling native species with considerable potential benefits for humans.

Is it difficult for scientists to share the achievements and progress they make in biology? Why?

Though there is "material to be shared with the scientific community," any effort

to disseminate it becomes simplified. The findings derived from research into natural phenomena pose new questions and new variables to measure or contrast. It is a chain of progress and research, and the teams involved strengthen and diversify the possibilities for scientific documentation. When one is part of these chains, sharing this progress is just another activity, an inherent part of science. Publishing the results is also a responsibility towards the scientific community and society - at least it is among the groups of specialists or students with whom we interact throughout any research process. Therefore, it is not hard to share scientific results.

Dr. Moraes joining the first Bolivian congress on ecology in Cochabamba, 2009.

Did you find it hard to join the scientific world?

As a matter of fact, science created such an attractive environment and sense of empathy that I could not resist it. There were several key moments in my professional training that reinforced my scientific specialization. These are mainly memories from college, my first experiences of field work and, in particular, the most significant milestones for a scientist: the mentors whom I met throughout my professional career. They were both professors and tutors, and helped me to create and develop research projects. Forming groups that cooperate is also an incentive to “share” the work, and activities are easier to bear when opportunities arise to make scientific progress.

Mónica Moraes sharing with her students at the Bolivian herbarium.

Mónica Moraes in palm nursery facilities when visiting the Montgomery Botanical Center in Miami.

What sacrifices have you had to make to achieve your scientific goals?

To be honest, I do not feel that I have had to sacrifice anything in my life to work as a biologist in Bolivia. On the contrary, I think I have learned to include all the different aspects of my personal and professional life.

In your opinion, and based on your professional experience and dedication, what are the golden rules for working in this field?

Perseverance, inspiration, commitment, collaboration and enthusiasm.

What were the best and worst moments of your professional and scientific experience? Which memory do you treasure especially?

I do not mean to focus exclusively on the positive aspects (because unfavorable experiences give balance to our professional plans, and there were indeed obstacles and challenges to overcome), but I prefer to concentrate on two significant elements: 1 My most treasured moments were fostering the hard work and enthusiasm of several students, some in their final year, alongside the teams of biologists and other professionals. 2 Future professionals have been guided at college with great flexibility, scope and creativity, which have had a very positive impact. I am proud that they are going beyond my own achievements and have a bright future ahead of them.

Is it difficult to divide one's time between a family and scientific research?

There were moments when it was hard to share my dedication between my work and

A species of Crinum (Amarillydaceae) widely used as ornamental

Coconut palms (*Arecaceae*) from the tropics

my family. Perhaps the time that I spent with my son was to the detriment of my career. I hope that he understands how much love there has been in his life, especially in such a motivating atmosphere of progress.

Finally, do you recommend students in high school to study biology? What advice would you give them?

Of course I would recommend that young people study biology, particularly in a country with such a valuable, inspiring nature, a richness of landscapes and species, a close relationship between plants, animals and human communities, and the never-ending list of "pending issues" to make progress in documenting Bolivia's biological diversity. Biology is a discipline that builds on this progress and allows for dynamic, creative scientific research, whether in the field or the laboratory. In addition to its specificities as a scientific area, it lends itself well to the formation of interdisciplinary groups. These offer a more comprehensive answer to research topics, and also help resolve environmental and ecological conflicts and problems. ■

*Eliana Sdenka Asunta Vasquez Berazaín was born in Potosí on 31 December 1980. Her girlhood passion for literature and the arts led her to study Community Development at the Universidad Mayor de San Andrés. After graduation, she was able to combine her two passions: culture and journalism.

Mayana Zatz
Brazil

> “...Women are more intuitive, which [...] is an important characteristic for science”

Interview by Lucia Mendonça Previato*

Dr. Mayana Zatz, after receiving the 2008 Mexico Science Prize for Science and Technology

Mayana Zatz was born in Israel and is a naturalized Brazilian, having lived in Brazil since the age of 7. Full Professor of Genetics, Director of the Human Genome Research Center, Institute of Biosciences, University of São Paulo.

Study area

Human and Medical Genetics. Neuromuscular disorders and stem cells - with the aim of developing cell therapy and as a tool to investigate gene expression that causes genetic diseases.

Results and achievements in science of which you are most proud:

Identification of new genes responsible for neuromuscular disorders, and more recently, results of pre-clinical research with stem cells in animal models

Honors and Prizes received

- Dr. Honoris Causa, University National Autonomous of Mexico (UNAM), Mexico, 2011
- G. Conte Award for social work in support of dystrophy, Mediterranean Society of Biology, Italy, 2011
- Mexico Prize of Science and Technology, 2008
- Bertha Lutz Prize, Federal Senate, March 11, 2008
- Scopus Award, Editora Elsevier-Capes for Scientific Production, 2007
- Order of Ipiranga, Grand Cross Award, Government of the State of São Paulo, 2006
- "Making a Difference" Award, Category: Science and Life, O GLOBO Newspaper, 2006
- Hospital Award 2005, Personality of the Year in the Area of Health
- TWAS (The Academy of Sciences for the Developing World) Prize in Basic Medical Sciences, 2004
- UNESCO-L'OREAL Award "Women in Science", Best women scientist in Latin America in 2001
- Medal of Scientific and Technological Merit from the State of São Paulo (2000) for participation in the XYLELLA GENOME Project.
- Grand Cross of the National Order of Scientific Merit for contributions in the areas of science and technology (July 21st, 2000) Brazil

Mayana Zatz

- Highly Cited Brazilian Articles of the 1990s, ISI WEB OF SCIENCE, Prize offered to the authors of the 27 most cited Brazilian papers in the decade of 1990, March 2000
- Muscular Dystrophy Association Award (1986) for the paper: Growth hormone deficiency and Duchenne muscular dystrophy

What made you decide to enter a Scientific, Engineering or Mathematics career?

Since I was a child I have liked science. As a young girl, I wanted to become a doctor in order to "heal" sick people. But later I fell in love with genetics and decided that that was what I wanted to study. I never imagined at the time, that this would be the "science of the future".

Mayana and her children: "Her best work is in genetic engineering."

Why is it important for a woman to be in the world of science?

I believe women can offer important contributions to science. They are more intuitive, which I personally believe to be a characteristic important for science. I also think women have a different way of thinking than men, and therefore the two sexes complement each other. In my opinion, dealing with a specific problem from different angles can be very constructive.

Who or what is your inspiration to do science?

Since I was a child I loved to read biographies of famous scientists such as Pasteur or Madame Curie. But today, the scientist I admire the most in the whole world is the Italian Rita Levy Montalcini, the 1986 Nobel Prize winner in Medicine for her discovery of the nerve growth factor. Rita died December 30, 2012 at the age of 103.

Which were the main barriers you experienced, and how did you overcome them?

I have never felt discriminated in Brazil for being a woman in a scientific career, in contrast with the United States, where I did my post-doctorate. There, I had to work very hard to show that even though I was a woman and a South American, I could also think. In Brazil, currently the main barriers are the difficulties in importing materials or research animals, and the excess of bureaucracy. We lose a lot of time when starting up a research project, or putting an idea into practice. This is quite a drawback in such a competitive world.

Do you have a family?

I only have an older sister, who has two daughters and three grandchildren. My parents, who have both passed away, were very special. I owe A LOT to them. Besides encouraging us

to study hard, my parents had extremely strict ethical principles and were a great example to me. My father taught me to never be envious and to fight for what I wanted and what I believed in. I have a son and a daughter, both adults and wonderful people. They are my best work of "genetic engineering". I was married for 30 years, but slowly our interests drew apart and I ended up getting a divorce. Presently my ex-husband and I are close friends.

Mayana with her student at the Center for Human Genome Research

Her most significant achievements and results are the identification of new genes responsible for neuromuscular disorders, and more recently, results of pre-clinical research with stem cells in animal models

Mayana with her students in the laboratory

What do you like to do in your free time?

Reading (although presently I read scientific papers almost exclusively), going to the movies, to the theatre, to restaurants with my children and friends, traveling and getting to know new places. I also like to jog every morning before I go to work. Besides making me feel well physically, it is during these moments that I think the best. I have solved several problems during my morning jog.

What would be your advice to other scientific women?

To fight for what they believe, to question, not to be afraid of getting a no as an answer, not to give up on an idea before testing it. And not to relinquish motherhood for the sake of a scientific career. To be a mother is a fabulous experience and even though for a few years life will be more difficult due to maternity, it is possible to reconcile a career with being a mother. ■

*Lucia Mendonça Previato is profesor at the Biophysics Institute at the Universidade Federal do Rio de Janeiro, Glycobiologist UNESCO L'Oréal Laureate 2001 and Brazil Focal Point of the IANAS Women for Science Working Group.

Marla B. Sokolowski

Canada

> “My parents made me feel I could achieve whatever I wanted; the sky was the limit”

Interview by Frances Henry*

Marla Sokolwoski at the University of Toronto, Canada

Professor and Canada Research Chair in Genetics and Neurology, Academic Director of the Institute for Human Development, Department of Ecology and Evolutionary Biology, University of Toronto.

Main research interests at this time

Main research interest is in genes and behaviour. She wants to understand how and why individuals behave differently. Her first research was on genetic analysis of behaviour in the fruit fly Drosophila. By watching the movement patterns of fruit fly larvae on and off their food she discovered the rover and sitter behavioural polymorphism which her group mapped to a single gene called foraging. When her group cloned the foraging gene they found it to be a signalling molecule called cGMP dependent protein kinase or PKG which

is found in most organisms including humans. This was the first time that a molecular basis for normal individual differences in behaviour was uncovered in any organism. The foraging gene in Drosophila has multiple functions affecting food related behaviours, metabolism, response to stress and learning and memory. Her group and others have shown that the foraging gene affects food related behaviours and metabolism in a wide range of species including nematode worms, honey bees and ants. She was a pioneer in the field of behaviour genetics at a time most biologists did not think that genes could actually affect normal individual differences in behaviour. Her current research interests include studies of gene-environment interactions on behaviour from neuro, molecular and evolutionary perspectives. She studies flies, rats and humans to address these questions.

Accomplishments and achievements she is most proud of

- Students and post-doctoral fellows who she has trained who hold positions around the world.
- Starting a new subfield of behaviour genetics on normal individual differences.
- Work with the Canadian Institutes for Advanced Research on the importance of early life and how experience gets embedded into our biology.
- Her 37-year marriage and her two wonderful children.

Honors and awards

- Fellow of the Royal Society of Canada
- Canada Research Chair in Genetics and Neurology, University of Toronto
- Co-Director, Brain and Biological Development Group of the Canadian Institutes for Advanced Research
- University Professorship
- Academic Director of the Institute for Human Development at the University of Toronto

Why she decided to enter a science career

As a young child, Marla loved to collect things and she loved playing school. Later, in high school, she was very good at math and physics. The environment for women studying physics and math was not very good in the early 70's when she was in school so she started taking biology courses and was made to feel more welcome. In her first course in genetics and animal behaviour, she actually enjoyed reading the text book. She says "It didn't put me to sleep". She decided to take more courses and when she was an undergraduate student she had an especially encouraging professor whose lab she worked in. He thought she was smart enough to go to graduate school so she applied and was accepted. Marla also noted that she came from a very supportive family. Her parents, although they had little formal education nevertheless worked very hard to enable her and her siblings to attend university.

Why is it important for women to be in science?

It's important not to lose the brain power of half of the population! Think of how many more mysteries would be solved if the pool of potential minds working on a problem almost doubled and included both men and women. On average women may approach science differently than men and their labs may be more welcoming to woman. Women scientists can act as role models and mentors to other young women so that these young women can see that it can actually be done. The style of my lab is very nurturing and interactive. Women's labs have different characteristics than men's - which is not to say that some men's labs are not nurturing - because they are. When I first started out, most of my students were women - about 5 or 6 to 1 man - but now it is about even - 50/50. I have graduated more women Master's students but more Ph.D's are men. Post-docs also seem to be about 50/50. In the 1980s, I was the only practising woman scientist in my department. Women came to talk to me and wanted to come into my lab because they felt welcome. Part of this had to do with me being female.

Who or what is your inspiration for doing science?

There are a few things which inspired me. I have two brothers and as a young girl, I was made to feel by my parents that I could do whatever I wanted. My mother taught young children and my father who was an immigrant had very little formal education. He sold shoes for a living. They both felt "the sky's the limit for me". I was also attracted in part to science because it was thought to be hard.

Once I started to read the scientific literature, I was influenced by several other scientists. As a student, I was interested in normal individual differences not those caused by mutant effects. My early perspective was evolutionary rather than mechanistic. One of my main influences was Richard Lewontin, the eminent evolutionary biologist, who was writing about how to perform rigorous evolutionary experiments. He said that there were three important attributes before a behavioral trait could be called adaptive. The trait had showed phenotypic variation, that this variation could be inherited, and third, that these heritable behavioural differences had adaptive consequences. This approach influenced my early research. Douglas Wahlsten's notions that gene-by-environment interactions and genetic background were neglected by those in the field also influenced me. So I was encouraged but it was a difficult field in the 70s, 80s and 90s - behaviour and genetics - and people didn't believe it was possible for genes to influence behaviour. It was an uphill battle until about 10 years ago.

Her first research project involved the genetic analysis of the behavior of the fruit fly

The food-seeking gene in the Drosophila contains numerous functions that a ect behavior related to food, metabolism, stress response, learning and memory

What were the main barriers you experienced, and how have you overcome them?

The first main barrier Marla experienced was the recognition of her field of study. She was a pioneer in that field of study and there were many skeptics. Geneticists didn't believe that one could find genes that influenced behaviour and when she identified a single gene and cloned it, the evolutionary biologists said it was an exception. Everywhere she went, she says, "they said it was cute, it's neat" but there was no serious acknowledgement of her work. This made her dig in harder. In the nineties this area of research became very mainstream partly because of her work. Now the top journal want to publish papers in the area of genes and behaviour. Marla followed the questions that interested her. She overcame this barrier by continuing her line of research and accumulated so much evidence in favour of it that its significance could not be refuted.

Marla says that when she was a student, she never felt any discrimination as a woman. It was when she applied for her first job - a tenure track position at a major university - she became aware of discrimination during the job interview. She was applying to a department which did contain two women but both were elderly and no other women had been hired. During the interview she was asked such questions as "When you get pregnant, are you actually going to come back to us to work?" The chair asked "When you work so late at night, doesn't your husband expect dinner

on the table?" There were other comments like that and some "I wouldn't really tell you because they were even more inappropriate". What she did, even before she got the job, was to annotate everything inappropriate that was said to her. She presented her notes to the then President of the university and to the woman who was the head of the Status of Women Office on campus. She said "This is what happened to me in this department which was, in face, welcoming to women and interviewing women candidates for the position. And I don't want this to happen to anyone else." At that time, during the mid-eighties, a series of guidelines were written including questions that were acceptable and appropriate to ask women who were being interviewed. A committee was also set up to look at the status of graduate student women on campus. In addition to these changes, the department and the administration of the university apologized to her. She was pleased that some action was taken as a result of her difficult experience. She was very surprised about what happened to her at this interview because up to that point she had felt that she was treated equally. Only men were on the search committee for this position and later, she heard that there were many arguments among them as to whether she should be hired and that she was "barely chosen" even though her accomplishments were superior to those of the other candidates. She notes that experiences like hers were very common in earlier times. She was disturbed by her experience and felt that she had to do something about it, especially as she thought that the interview committee didn`t apparently see anything wrong with their language or their questions.

Marla did receive this appointment and stayed at this university for many years before moving to her present position. Many other women were subsequently hired in the department where she held her first appointment and several of them were visibly pregnant when they interviewed for their jobs.

Do you have a family?

Marla has been married for thirty-seven years to her high school sweet heart and they have two children, a boy and a girl, who are now 16 and 20 years old. Both children are interested in science and both are also musical. Her husband is a dentist who practiced professionally until recently when he started to teach in the dental clinic at the University of Toronto's School of Dentistry. He has always been very supportive of her career and assumed half or more of the child rearing responsibilities in the family. She says that she has a very balanced life between her professional career and her family life.

What do you like to do in your leisure time?

Her life is divided into work and family. Her children are older now and leisure time

is spent doing things with them and her husband including sports and travel. She also enjoys going to classical music concerts with friends. Her friends often question her as to why she does not have a major hobby. She says that she decided very much earlier in her life that "If I wanted to do very well as a scientist and a Mom, that's the way my life would be organized... and I'm happy with that... one has to make choices in life".

What is your advice to other women scientists?

She believes that they need to do what they love and women should not worry about whether there are jobs in this area or that area because there are always different trends in hiring practices at universities. Women scientists (and men, too, of course) should do what they are really most interested in and do it well so that they can be proud of themselves and their achievements. Women need especially to realize that leading a balanced life between family and academic work is possible - in fact, probably more so than in other professions. If one is fortunate to have supportive people around such as students and post-docs like she did, one can always stay home if necessary if your child is ill. If one wants to attend field trips with your children, that too is possible because the work hours provide a lot of flexibility for women scientists. Her children feel that she has a flexible career because she can be at home and although she is most often on the computer, she is always available to them when they need her. All told, Professor Marla B. Sokolowski leads a very productive and successful professional life as one of Canada's leading scientists but she also maintains a happy and healthy family life. ■

*Frances Henry. Anthropology professor and expert on racism and anti-racism, author of several books, member of the Royal Society of Canada and liaison center for Canada for Women for Science.

Grace Sirju Charran

Caribbean

“Being a scientist does not conflict with feminine values; you can be a mother, a housewife and glamorous!”

Interview Neela Badrie*

Grace Sirju Charran

Grace Sirju Charran is senior lecturer in Plant Biochemistry, Former Head, Department of Life Sciences, Former Head, Institute for Gender and Development Studies, University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies

Main Research Interests

The initial doctoral research of Dr. Grace Sirju-Charran was on "*Enzyme Genesis in Fresh and Aged Sweet Potato Tuber Tissue*". This research provided the basis for further examination of the role of light in tuberisation of roots and stems of sweet potato and cassava. She was instrumental in the re-introduction of pachyrhizus sp. (jicama or yam bean). Her research also included gender and the natural environment and perspectives and contributions of women scientists in the Caribbean. Other current interests are on the influence of light on the expression of genes involved in the storage organ formation in cassava and sweet potato using RT-PCR microarrays and a comparison of secondary and nutritional metabolites of root and stem tubers in sweet potato and cassava.

Accomplishments and Achievements she is most proud of

Dr. Sirju-Charran has spent thirty-seven years at the University of the West Indies (UWI), St. Augustine campus, Trinidad and Tobago. She has coordinated the Women and Development Studies Group at the St. Augustine Campus during the period 1988-1992 and held several seminars on *Women in Science* and *Gender Issues in Agriculture* which culminated in the institutionalization of Women and Development Studies as an academic discipline at the University of

Grace Sirju Charran with members of the UNESCO National Commission on 17 August 2011

the West Indies in 1995. One of her major achievements in this area was the introduction of 4-credit courses on 'Gender and Science' and 'Gender Issues in Agriculture'. She was instrumental in the development of new courses in Bioethics, Molecular Biology, Plant Biotechnology and Comparative Biochemistry and has successfully supervised 2 PhD, 5 M.Phil, several MSc. theses and hundreds of undergraduate students' research projects

Honors and Awards

In 2012, Dr. Sirju-Charran was awarded the Vice-Chancellor's Award for Excellence in Teaching and in 2010 the UWI/Guardian Life Premium Award for Excellence in teaching. She received a gold medal for her contribution to plant science awarded by the National Institute of Higher Education, Research, Science and Technology. Her biography was included in a publication on '*Caribbean Women in Science and their Careers*'. Other recognitions include the Centre for Gender and Development 10th Anniversary Award, Naparima Girls' High School Alumnae Award, the Association of Commonwealth University Shell Fellowship in biotechnology, Senior Fulbright Award, the UWI/Cable and Wireless Fellowship in Distance Education; UWI/IDB Fellowship and UWI/ISS staff Development Fellowship. She was awarded a gold medal for placing first in the General Certificate of Examination (GCE) ordinary level examination at Naparima Girls'

High School and a National House Scholarship to pursue GCE advance levels at Naparima College. She won a National scholarship to pursue the BSc. in Natural Sciences at the University of the West Indies (UWI) in St Augustine and as an undergraduate student was awarded the Year 1 Faculty of Natural Sciences Prize, and the Faculty's nominee for the BWIA Student of the Year Award. She graduated with the BSc. General double first class honours in chemistry and botany and was awarded the Esso research scholarship to pursue Graduate Studies.

Why did she decide to enter a science career?

Grace believes that 'almost everyone born on this planet has a natural curiosity about Nature; however this does not automatically translate into becoming a scientist.' She was placed in the science stream at high school based on good academic performance but was inspired by a young female chemistry teacher, Ms. Dewar. The overriding pursuit of her desire for knowledge was to improve the well-being of society. Her choice of research topics had implications for improving agricultural productivity and for a greater understanding of gender studies. The research aspect of her university career took a plunge when it was felt as if the main reason for research was to publish papers necessary for promotion. She believes that emphasis must be given to the teaching of principles and concepts rather than facts and to satisfy intellectual and emotional needs rather than training to get a degree as a passport for a job with a higher salary. Her publication portfolio consists of over 100 scientific papers which includes 3 book chapters, 14 articles in refereed international journals, 33 published conference proceedings, and 53 conference presentations and contributions to several, technical reports and video presentations.

Why is it important for women to be in science?

It would be unthinkable to have a discipline devoid of the influence and perspective of the female population. Science must address problems of those issues relevant to both sexes in an equitable way and this is more likely to happen when both sexes participate on an equal basis. Women in science can change the culture of science from an individualistic enterprise to one that is more cooperative and humane. They also function as role models and may provide a different kind of mentorship to female students. Women should be able to follow a career path of their choice without having to carry the baggage of being seen as deviant or a-stereotypical. The same must hold for males who would like to follow careers seen as stereotypically feminine. Equal participation in science by women is not just a 'gender' issue, but an economic one resulting in benefits to the whole society.

Grace Sirju-Charran's research focused on the "Origin of Enzymes in Fresh Tuber and Yam Tissue." This research provided the bases for a more extensive examination of the role of light in the tuberization of potato and yucca roots and stalks.

Who or what is your inspiration for doing science?

Although in the 1960s, science was often seen a subject to be pursued by males, her father instilled in her that she had the capacity to do whatever she desired. There were no gender barriers in education in her family. Her mother was extremely liberal and supported her children in whatever they chose to pursue. Grace grew up in a rural village setting which allowed her the opportunity to 'see' nature at work. In high school it was the norm and expectation that the better performing students would follow the science subjects. However, her preference was to pursue French at the tertiary level. She opted to pursue botany and chemistry as a national scholarship was available to pursue science. The powerful theories of evolution, genetics and gravity based on Darwin's observation of different species and Mendel's simple experiments crossing pea plants; Newton's observation of a falling apple and Fleming's discovery of penicillin have been truly inspirational. She was reminded of such serendipity in science when during her PhD research, an error in orienting the sweet potato tuber during planting led to the observation that sweet potato stems can form tubers. This could easily have been dismissed as an anomaly not worthy of further investigation.

What were the main barriers you experienced and how have you overcome them

Grace faced major challenges in science when she joined the faculty to become the only

female faculty in the Department of Botany, while still a PhD candidate and having as her colleagues, professors who taught her as an undergraduate student. Breaking the student/professor barrier and gaining the recognition of being equal at a time when "gender studies' were unheard of, proved to be most difficult. This was exacerbated when she had to take maternity leave on three occasions. When she joined the Women and Development Studies Group in the late 1980s, she was able to understand and deal with being a lone junior female faculty in the department, which was slowly getting more female faculty. However she could not help noticing that opinions and suggestions voiced at meetings by females were given scant regard, and although those same ideas became accepted in the end, the female was not given the recognition she deserved. Females are required to speak confidently and sometimes aggressively in order to be 'heard "Achieving a balance between motherhood and career was only possible with the assistance of a supportive spouse and mother who looked after the children while she travelled to attend the many conferences.

Do you have a family?

Grace was married to the late Dr. Dale B. Charran (MBBS MRCOG; FRCOG; FACOG) for 34 years and is the proud mother of three wonderful children: Krista (Electrical and Computer Engineer); Amanda (Musculoskeletal Radiology Fellow (MBBS, MRCP, FRCR) and Timothy (Counseling Psychologist). She is the grandmother of Luke and Caitlin with whom she spends a lot of time since her recent retirement.

What do you like to do in your leisure time?

Grace enjoys reading novels and biographies and travelling to different countries in order to get a better appreciation of world history and culture. She also likes interacting with pre-schoolers and youths with the hope of imparting some life lessons. She relaxes by going to theatre plays and recitals and the movies.

What is your advice to other women scientists?

Her advice is not be deterred by 'gender' issues but rather confront and deal with them, not at a personal level, but in a professional and academic manner and to build a network for support. Follow your instincts (heart?)- pursue activities which at first seem to have no relevance to your professional career. They bring rewards in ways you never envisaged. Be aware that there may be periods when progress is slow- having a cohort of enthusiastic graduate students is a great support. Becoming a scientist does not translate into denying your feminine values- you can still have the choice to be a mother, home maker and be glamorous!

Public Service

Dr Sirju-Charran has served as a member in the Board of Governors of the National Institute of Higher Education, the Board of Management of the National Stadium, and Trinidad and Tobago National Commission for UNESCO since 2007 and was Chair of the Science sub-sector Committee. She is a founding member and is the current treasurer of the Bioethics Society of the English Speaking Caribbean. She continues to serve as assistant chief examiner for CSEC Biology and chairs the panel for the revision of the CSEC Biology syllabus. She holds membership in the History of Science Society, Philosophy of Science Association, Women's Caucus and Organization of Women Scientists in the Developing World (formerly TWOWS). ■

*Dr. Neela Badrie was born in Trinidad and Tobago, West Indies, She is representing the Caribbean Academy of Sciences. She is a senior lecturer/researcher in microbiology, food safety and quality assurance and tropical food processing. She is the author/co-author of 71 refereed journal papers, 8 chapters in books, 29 articles/publications and has 87 presentations (including several on women in science and technology) She is responsible for the development of recent M.Phil /Ph.D programmes in Food Safety and Quality.

María Teresa Ruiz
Chile

> “It is quite awe-inspiring to gaze at that wonderful dark sky, but even better to actually know what you are looking at...”

Interview by Richard García*

María Teresa Ruiz clearly fell in love with stars at first sight. The Chilean astronomer has earned international renown for having discovered the first brown dwarf, a type of star unable to burn and of a similar size to extrasolar superplanets. She is also a pioneer among Chilean female astronomers, having graduated forty years ago, and was the first to be awarded a doctorate from Princeton in the United States. Her prestige was confirmed by the fact that she was the first Chilean woman to receive the country's National Science Prize in 1997.

What was your first real contact with the cosmos?

It happened in my first year at college in 1966, during an engineering summer course. We spent a lot of time in machining workshops making metal pieces, and that was when I realized that it did not suit me. The atmosphere was actually rather unpleasant and oppressive, so I began to look for something different and found the practical astronomy summer course that was being taught at Cerro Calán (a hill in the east of Santiago, where the Astronomy department of the University of Chile is located). There I gained some basic knowledge of astronomy. But the best part was when they took us to the Cerro Tololo Inter-American Observatory (AURA and NSF), 500 kilometers north of Santiago. It was spectacular. They gave one of my classmates and me a small 16-inch telescope to measure variable stars. It was my first contact and I fell in love with the subject. I decided that I wanted to become an astronomer.

Why was astronomy so appealing to you?

We did our observations with a telescope that was tiny but actually relatively good for the time. I worked with that professional telescope for about a week and it was a revelation for me, because, strangely enough, though I had always been interested in Nature, I preferred myths and natural phenomena such as rock formation and climate to stars. For some reason I had never felt curious about the sky. But after visiting Tololo and doing observations with absolutely minimal knowledge - they had given us a week-long crash course in astronomy - everything changed. It was awe-inspiring to gaze up at that wonderful dark sky, but this time I actually knew what I was looking at.

After that practical course, how did you pursue your interest in astronomy?

I was fortunate in that year the University of Chile had introduced a degree course in astronomy. It worked perfectly: I was in the first class, and the first student to graduate in astronomy in 1971, before any of my male classmates.

María Teresa Ruiz at the Paranal Observatory with the presidents of Colombia, Mexico and Chile on the occasion of the signing of the Pacific Alliance

Were you the only woman?

Yes, there were very few students, and I was the only woman. The astronomy teachers were physicists: Claudio Anguita, Hugo Moreno, and Adelina Gutiérrez. She had just obtained a doctorate in astronomy from the University of Indiana in the United States. We were also exceptionally lucky because the director of the Cerro Tololo Observatory

The two Magellanic Clouds, satellite galaxies of the Milky Way, light up the Paranal Observatory (European Southern Laboratory) located in the south of Antofagasta

helped us. He was a Puerto Rican called Victor Blanco and he was very keen for astronomy to develop in Chile. He would come to give us classes on the solar system because there were no Chilean experts on the subject. He would drive every Friday from La Serena, which would take him about seven or eight hours as the road was in a dreadful condition. He would teach us for several hours, then give us homework and reading and return to Tololo. He was a first-rate teacher. Then, since the European Austral Observatory (ESO) was based in Santiago (Vitacura), I was taught by European astronomers. So we had brilliant astronomy teachers and that degree gave us a really good foundation. My thesis was supervised by Dr. Johann Graham, one of the most important astronomers at the Tololo Observatory at the time.

At that time, there were no computers so how did you work?

We used Sriden machines that cost a lot more than a computer does today. They could work out a square root and do calculations with numbers with many decimal places, but they were terrible. I asked to borrow one of those machines to write my thesis, and took it home. I had a tiny flat back then as I had just gotten married, and I worked all day on my thesis. I had just been accepted at Princeton and I had to finish it before leaving. The neighbors complained about the dreadful racket it made, so I had to take it back to the office. I easily had time to make myself a cup of coffee as it was working away calculating a square root.

Was it like a typewriter?

It was like a giant typewriter but it did calculations, the kind you can solve in a second nowadays. To calculate logarithms we used these giant log tables, but they were only available in few places, such as libraries. Conditions have changed so much, so fast.

As regards the observations themselves, were they with the naked eye?

Not exactly with the naked eye. We used photographic plates with emulsions like in photographic film, but designed for astronomy. We also had a photometer, a device that measures how much light from a star reached us. You could insert various filters to see the luminosity of a star in different colors. We had red, visual, blue and ultraviolet ones. We would use these to measure the distribution of energy in the star and how much the flow varied, because in that case I was observing a variable star. At the beginning of each observation you had to check that the light was going into the photometer properly, then keep it there. It was difficult work and also cold, because the telescope dome was open and gusts of wind would come through.

So you had to wear mountain climbing gear. You absolutely needed a thermos with coffee and a red flashlight, which was the least distracting kind. You had to use as little light as possible, so you would spend all night there in the cold darkness. Nowadays it is entirely different: you have your coffee, microwave, music, light. You can even put the heating or air conditioning on, as well as use computers.

So today astronomers see everything on a screen, they do not work with the naked eye?

Yes, exactly. They actually work as far away from the telescope as possible, because it has been found that objects around it create heat and turbulence inside the dome itself, and that hinders the observations. Nowadays all modern telescopes are as far away as possible from the control rooms. After my son was born I had to go to do observations. That was very upsetting because I would sometimes be away for three weeks and there was no means of communication. There was no telephone line. My only option was calling the receptionist at the Tololo office on the radio, to ask her to call my husband at his office to make sure that the baby was all right.

When did all of this change?

It changed rapidly. It all happened in the 1980s, when the first computers arrived. In 1982 I went to Arizona to do observations at the Kitt Peak Observatory, and a Chilean friend who was working there invited me to his home. His son was around five and had an Apple computer, one of the first that came out. He was learning to read by using one of the computer games. I got home very depressed and told my husband that Chile would be left seriously behind because children in the States were using computers, while even researchers in Chile did not have such sophisticated equipment. I think that the '80s began to change that. The first one to arrive in Tololo took up a whole wall; it was like the ones in the movies, covered in lights. One worked using special keys and the data was stored on enormous magnetic tapes. I am sure that it was less powerful than those little pocket calculators to calculate the currency exchange rate when you travel. I spent a lot of my time at the Tololo offices in La Serena because we had to calibrate the data that we had obtained before analyzing it, and there were no computers at the university for that purpose.

When did brown dwarf stars appear in your life?

One of the things that I realized upon returning in 1979 was that, though Chile had those large telescopes, the situation was still very different to today and we were far away from all the centers of astronomical

In Moon Valley, near San Pedro de Atacama, María Teresa with her husband Fernando Lund (right), her son Camilo Lund and her daughter in law Francisco Varela (center)

knowledge. We always ended up working on marginal projects, while scientists at first-world institutions such as Harvard and the Max Planck Institute received the most interesting ones. José Maza and I realized that one way to get around this was to do our own surveys, find our own interesting objects and observe them. We avoided observing the same ones as other scientists, as they had already creamed off all the interesting projects before their articles had even been published, and we were only left with minor ones. I devoted myself to looking for nearby dead stars, the white dwarves in the solar neighborhood, which are carcasses of stars or what is left after they have exhausted their fuel. They are very hot and bright at first, but then they cool down and become weaker and fainter, and you can hardly see them. When they die they are about the size of the Earth.

With Fernando and Camilo at ALMA (Atacama Large Millimeter Array)

I wanted to know how much they contributed to dark matter in the galaxy. It was a very relevant topic at the time and I thought that there were perhaps many of these cold white dwarf stars and nobody could see them.

It was during an observation with the La Silla telescope that we noticed a very weak object, which I thought was a very cold, old white dwarf. But its distribution of energy did not match our expectations for a star with those characteristics. I had already had significant experience with all kinds of stars and knew how to recognize them. I had never seen that distribution of energy before. First I thought that there must be something wrong, that I had not focused on the object correctly. I asked the technician to measure it again because something was not right. The same results appeared, and I then realized that it could be a brown dwarf, which I had heard about years before. For decades there had been uncertainty regarding objects with a lower weight than that required for a star, which is around 70 times the weight of Jupiter. A lower weight meant that there could not be nuclear

reactions in the center. They could not reach the necessary temperature and therefore did not have their own light. They are like giant planets, not stars. It was not yet known if there were many of these in the universe or in our galaxy in particular. Nobody had found any reason why they should not exist. Therefore there were many astronomers searching for them and numerous projects on them. They were thought to be very red. I also heard that they were supposed to have lithium in their atmosphere. Lithium is an element that formed soon after the Big Bang, which is destroyed by the heat of nuclear reactions in stars, but as the brown stars do not have nuclear reactions then they must have Lithium. The energy distribution clearly showed the presence of lithium.

Were you the first person to observe them o□cially?

Until that moment they had only been a hypothesis, and the one I discovered, Kelu, was the first "free floating Brown Dwarf", which was just there alone in space and not part of a system. In that respect it was like a star. I named it Kelu, which means red in Mapudungun. I published a paper on it with Sandy Leggett, a British colleague who worked with infrared and France Allard, a French Canadian expert on brown dwarf models. A few years ago, Sandy sent me a mail from Hawaii, where she works. She told me that the night before she had seen Kelu with the Kek telescope and new laser beam technology. It turns out that Kelu is not one but two brown dwarfs revolving around one other. This was lucky, because as they could observe the orbit they also managed to calculate the mass of each one very precisely. A year later, an English astronomer discovered that one of the two brown dwarfs is itself a double, very close together. So Kelu is actually a family of three brown dwarfs, which I had seen as one.

Can you describe brown dwarfs?

The coldest ones have an atmosphere very similar to that of Jupiter.

Have they been photographed from closer up to find out if they have spots or lines, like those planets do?

Not yet, but we will soon. We do know more and more about the composition of their atmospheres. Some are hot, others cold and we have found some as freezing cold as Jupiter.

We have also discovered that there is no clear division between an extrasolar planet located around other stars and a brown dwarf. It is a kind of continuum. The largest extrasolar planets could be brown dwarfs. Extrasolar planets have been found that have 20 to 30 times the mass of Jupiter, and brown dwarfs that are 15 times the weight of Jupiter, or even

less. There is overlap there. The difference could be the way they form. The brown dwarf that is alone in space probably formed in the same manner as a star: a cloud of gas that collapsed in on itself as a result of its own gravitational attraction. Planets, on the other hand, always form through the coalescence of debris. A disc of debris forms around the star, and the collisions between the debris produces larger and larger bodies that become planet.

Could they contain life?

We have not ruled out the possibility. All of this is such a challenge. The planets, which are formed in a protoplanetary disc through the coalescence of planetesimals (debris), tend to be more enriched in the basic chemical elements that permit life than the brown dwarfs, which form through the collapse of a gas cloud that is probably less enriched or contaminated by dead star matter. It is an entertaining topic for discussion, and one we are working on.

And are you still working on this topic?

I still publish on white and brown dwarfs. My post-doctoral students and I are trying to obtain a sample that is broad and large enough to make statistics and also to locate brown dwarfs that partners of other stars (in a binary system in which they both formed at the same time from the same material). By studying the partners we can measure their age and metallicity.

How far away are they?

Kelu is 49 light years away from the Sun.

What were the circumstances of the National Science Prize - were you expecting it so soon?

Not at all. I was actually in the Calán office and suddenly José Maza, Leonardo Bronfman and Guido Gara gathered in the office. They were photocopying things, going in and out, and I watched them discreetly. A long time ago I learned that the less you know, the better, so I did not even ask. Otherwise they often ask you to do some boring task. Then one day they called me and told me that I was a candidate for the National Science Prize. They did not want me to hear from the press, so they told me a week or two before. They had already spoken to my ex-students and people who had sent letters to support my application. I was really surprised but also satisfied, in particular in a country where colleagues do not tend to support each other.

I did not know what chance I had of winning, but simply having been proposed was a prize in itself.

I did not imagine that they could give it to me. I had booked a holiday with my husband, my son

Outside the Magellan telescope, observing the daytime sky and hoping for a clear night, with no wind or humidity, a perfect night

and a nephew. We were going to the Caribbean, to the Riviera Maya. We had packed our suitcases and were waiting for the taxi to the airport. At that moment the minister called to tell me to come immediately because I was about to receive the National Prize. I could not believe it.

My husband told me to take a taxi to the ministry, and that meanwhile they would go to the airport. I went there alone, in my travelling clothes. I hailed the first taxi that went by, but the driver did not know where the ministry was. I was so nervous that I could not remember either, and had to call my husband to ask for directions. The press was already there. It is all still a little dream-like because it was so strange. Afterwards, they sent me to the airport in the ministry car, with the lights flashing to avoid the traffic. I arrived just before they closed the boarding gate. I always ask for the window seat because I sleep on flights, but that time I could not. My husband, my son and my nephew were asleep, but I kept staring at my reflection in the window in disbelief. It all felt like a dream. When I arrived in Akumal, which is quite a remote place, somehow people had found a fax machine and I received heaps of congratulations. The hotel manager was waiting and already knew. It was all absolutely magic.

Did winning the prize change your life?

Yes it did, because suddenly people were taking ideas seriously that they had previously considered nonsense. It also changed me because people began to wonder, "Now that she has won the prize, what is she going to do in the time she has left?" I had always worked thinking that life was infinite, and had never given myself an expiry date. But suddenly I realized that I would need at least two decades to finish my research, and that paralyzed me until I realized that living that way was not enjoyable. I had to live as though life were infinite because if it ended, that would be that. I hope that when I get to that stage I will be enjoying myself.

Have you ever suffered any discrimination for being a woman?

Rather than being discriminated against, I feel that I was not included. I was the only woman studying astronomy at Princeton. They had begun to accept women there not long before, and there were not yet any female astrophysicists. So the college was not used to dealing with women. Being a foreigner as well as a woman, I had to make twice the effort to feel part of the group. But in the end everything went fine and I had no problems.

I do not remember any blatant, severe incidents of discrimination. I myself have managed to survive because I have not focused on that issue too much. If others do not include me I simply carry on with my work. Historically there has been terrible discrimination against women, but men also suffer from discrimination for other reasons. Being a woman has also been of some benefit to me, because sometimes people will treat you better or give you some kind of advantage. I think the two things have cancelled each other out.

Unless you have a specific personality then discrimination can paralyze you. Many women do not have that personality. It is tough if a woman is very shy, because they overlook you. Women like myself, who have reached decision-making levels, have a mission: we keep on our toes to prevent these things from happening.

Do you feel that you have become a symbol in Chile in the sphere of female scientists?

When I became the first woman to receive the National Science Prize, that was a significant moment, partly as women could see that a barrier had been removed. overcome. I also believe that astronomy is a subject that can reach people easily, both children and the general public. The topics can be appealing and entertaining, and this has given me an advantage. It may be why I am better known than other women who may be more entitled to that recognition.

As regards your personal life, does being married to a scientist make your life di□erent from that of your colleagues?

Female scientists do not have many alternatives. It has made it easier for me because working in scientific subjects gives you specific priorities. When I have had to speak at conferences abroad it has helped to have a partner who understands my priorities and is willing to accept the consequences. Sometimes this meant he had to take care of our son and take him to nursery school. I have a few astronomer colleagues who are married to businessmen, and this has been difficult for them. Their husbands do not understand the priorities implied by their scientific work.

Has your son chosen to study science?

He is an industrial civil engineer at the University of Chile, so he is involved in the business and financial aspects. I think that is great; having two scientists in the family is quite enough. Someone needs to deal with the financial aspects. ■

*Richard García has worked for *El Mercurio* Newspaper in Chile since 1988. His relationship with science started when he published in *Revista del Domingo* a story about the Abalon´s Hatcheries in Chile. During 1993 he won an scholarship for the International Institute of Journalism in Berlin. He wrote stories about biodiversity, climate change, energy and also started to write about astronomy, archaeology and paleonthology. In 2001 he started to write to the new section Ciencia y Tecnología. In 2004 he was selected to participate in the Jack Ealy Workshop on science journalism at Instituto de las Americas in San Diego, California.

Ángela Restrepo Moreno

Colombia

“It is worth trying to change the world through your work”

Interview by Andrea Linares*

Ángela Restrepo, 'Microbe Hunter'

Summary

Dr. Restrepo is Colombia's most highly renowned microbiologist. Now 80, she holds a doctorate in microbiology and medical mycology from the University of Tulane, New Orleans (United States). Her achievements range from developing a line of research on the diseases caused by fungi to contributing to national policies on education and research.

Restrepo has always been fascinated by the tiniest yet powerful forms life forms: microorganisms. She saw them for the first time as a child, through her grandfather's microscope, and her studies began with the book *Microbe Hunters* by Paul de Kruiff.

Among this vast microbe universe, she chose to focus her study on fungi, particularly those that cause diseases in humans. Her work produced concrete results, as she established a line of research on a disease produced specifically by fungi, which has only been diagnosed in Latin America and was discovered over a hundred years ago in Brazil: paracoccidioidomicosis. It is a severe infection caused by a fungus, the Paracoccidiodimicobrasiliensis, affecting the entire organism and considered an endemic disease in Brazil and other Latin American countries. The fungus is inhaled, causing a pulmonary clinical profile that can subsequently affect the skin and oral, nasal and gastrointestinal mucus. The spleen and liver may also be affected.

A research group created decades ago by Dr. Restrepo is currently following two key lines of work. Firstly, understanding in detail the relationship between patient, fungi and environment, to develop modern (molecular) diagnostic methods to define the diseases caused by fungi and treat them appropriately. Secondly, knowing in depth how fungi cells work in order to deal with them and prevent them from multiplying in an infected person.

Restrepo's scientific career began formally when she was accepted at the University of Tulane in 1960. There she realized the crucial role of scientific research and decided to devote herself to it.

She was attracted by research and teaching and keen to advance scientific knowledge, to "give humans a better appreciation of the wonders and mysteries of Nature."

Who or what inspired her to work in science?

"Pasteur and his disciples were definitely my first source of inspiration," she replies. She also mentions the teachers at the university

Academics Santiago Díaz, Michel Hermelin and Ángela Restrepo, during the swearing-in ceremony of Michel Hermelin as a member of the Colombian Academy of Sciences, Bogotá, 11 April 2007.

where she completed her graduate degree and the advice and work of renowned researchers such as Burnet, Medawar, Monod, Palov and Rostand.

Dr. Restrepo, a co-founder of the Corporation for Biological Research (CIB), a private, non-profit institution devoted to scientific research to which is she currently attached, has always been known for her scientific rigor and commitment to her profession.

She admits to having very little spare time, as she is constantly writing reports and articles or checking theses. However, she enjoys classical music and reading historical novels.

"I am immensely proud of having given many patients the benefit of accurate diagnoses, always with all due respect," she says. She also took part in developing new antifungal drugs used regularly throughout the world.

Her other achievements

Angela Restrepo is one of several female scientists in Colombia, but the one with the longest career, her many achievements spanning almost fifty years. In 2007 she received the SCOPUS Prize (Elsevier) awarded to Colombian scientists with the greatest number of publications and citations. She also established the first diagnostic laboratory in her home city, Medellín, devoted to research on medical mycology and in particular fungi pathogenic for humans.

She has also earned numerous prizes, recognitions and honorary doctorates throughout her career, and made major contributions to developing clear policies on education and research in Colombia. There is even a school located in the municipality of San Antonio de Prado (Antioquia) named after her.

Dr. Restrepo has also demonstrated that 5% of Colombian university students are suited to scientific research, following systematic studies of their personality and abilities.

Indeed, she states that "the greatest satisfaction of my scientific career has been training numerous young Colombians, both male and female."

She therefore does not believe that there are differences between men and women as regards their ability to pursue a scientific career. Nonetheless, she explains that, "Women have a particular sensitivity that allows them to focus in greater depth on biological problems."

Restrepo has had to overcome barriers to achieving her dreams, as some of her relatives (although not her parents) objected to her becoming a professional. It was also difficult for her to find a university that taught the subject in which she was interested: microbiology. However resolve, persistence - which she calls stubbornness - and faith allowed her to achieve her dreams.

She stresses the fact that many female scientists display qualities such as patience and persistence, essential traits for research.

"Women's ability in science is beyond question, as demonstrated by the many women to receive the Nobel Prize and those holding prominent positions in universities, institutes and research and development centers," she explains.

Her research group is currently pursuing two lines of work; the development of modern diagnostic methods and the study of mushroom cells, in order to deal with them and prevent their multiplication in an infected person.

"My greatest satisfaction is to have trained a certain number of young Colombian men and women in the discipline of scientific research"

"One of the things I am proud of is to have served many patients, with the respect they deserved, thanks to accurate diagnoses"

She also offers women the following advice:"If they are already scientists, they should never lose their optimism or their desire to open new roads for future scientists."

It is worth trying to change the world through their work, she says, and they should always be enthusiastic and willing to pursue ambitious objectives. Her own career has been an endorsement of these principles. ■

*Andrea Linares is a journalist in the Vida de Hoy section of *El Tiempo* newspaper, specializing in education with 13 years' professional experience in the written media

María G. Guzmán
Cuba

> “I dreamed of becoming an astronomer or astronaut, under the influence of the novels of Jules Verne...”

Interview by Iramis Alonso*

Gustavo, her inspiration, and Pedrito, their son, who has also chosen to study medicine. (Photograph: courtesy of Dr. Guzmán).

Enterprising by nature

The scientist María Guadalupe Guzmán Tirado cannot picture her life without the dengue virus she has fought so bravely. In her opinion, a good virologist must be persistent, passionate and methodical.

As persistent and tireless as a miner pursing an elusive gold seam, Doctor of Science and Professor María Guadalupe Guzmán Tirado has been studying the dengue virus for over three decades - half her life.

Lupe, as she is known by colleagues and friends, has directed the virology department at the Pedro Kouri Tropical Medicine Institute (IPK) since 1987, as well as the Collaborative Center of the Pan-American Health Organization-WHO for the study of dengue and its vector.

In both organizations she has worked assiduously to characterize the various dengue epidemics in Cuba, identify the risk factors of the hemorrhagic form and create an advanced work group for research into this disease, with the aim of obtaining a potential preventive vaccine.

Her contributions to the knowledge of this virus include participating in the complete clinical description of hemorrhagic dengue in adults and in children with a different genetic origin to those of South East Asia and the Pacific.

Before she directed this research, not all the scientific community accepted the hypothesis that a second infection by another dengue serotype was a risk factor for developing the hemorrhagic form of the disease. IPK confirmed this, removing all doubts.

Another mistaken idea was that the danger of hemorrhagic dengue invariably only lasted for four or five years after the initial event. Guzmán and her team demonstrated that the eventuality exists even 24 years after the first infection. This finding was crucial for the development of any potential vaccine, as it forced researchers to provide protective immunity for a long period.

As a result of these contributions she was designated by Science magazine as one of the 12 most influential figures in science worldwide, who were asked to write their scientific biographies as part of its 125th anniversary celebrations.

In the 1980s Dr. Guzmán's career was marked by an unprecedented unfortunate event. An epidemic of the hemorrhagic form of the disease, the first on the American continent, struck the Cuban archipelago. In four months it caused sickness in 300,000 persons, including 10,000 serious cases, and claimed the lives of 158 people, 101 of whom were under 15 years old.

The memories of this disaster were tangible during our conversation, which lasted an hour despite the doctor's obvious tiredness. After 12 hours in the laboratory she could be excused for calling off the interview, but she willingly proffered her memories, declaring that "there are events that are lessons for later generations of scientists."

"It may seem paradoxical, but I have both suffered and learned a great deal. I was afraid, because I was young and was confronted with an event in which I had so much responsibility. Any epidemic is harmful, but we only knew about this one from books and publications of cases in South East Asia and in the Pacific. The most distressing aspect was that children were the most severely affected group. They quickly became very ill and died.

"I can remember one day in particular, late at night, when the cases were only just beginning and we were in the diagnostic phase. I was

creating a serological technique to detect the antibody titer, and they produced such large amounts that I thought that I had made a mistake. I repeated the tests three times until the presence of secondary dengue was beyond question.

"Finally, the work group, around ten people, directed by Dr. Gustavo Kouri - my late husband and the director of the IPK - managed to finish the diagnosis, classify the strain (of the serotype 2) and establish a laboratory monitoring system, which we have been perfecting to the present. Within four months, transmission of the disease had stopped, quite a feat and only possible by combining research, epidemiological work, control of the vector, decisive political will and popular participation, because the mosquito *Aedes* had a high infection rate while there was a perception that the risk was low.

"The truth is that those dramatic moments, during which it was difficult to predict what would happen and how the epidemic would evolve, were ultimately a crucial lesson, which motivated and reinforced my career as a scientist."

However, her vocation for virology was a matter of chance.

"My family was not inclined towards the sciences, though my stepfather was an obstetrician, an excellent doctor at the time, and my mother insisted that I study and become independent. So I dreamed of being an astronaut or a cosmonaut, influenced by Jules Verne novels and the science fiction movies that were so popular in the late 1960s.

"That interest then evolved towards mathematics. But a month after starting my mathematics degree, in October 1969, I felt a twinge of anxiety - or perhaps intuition - that this was not the way to achieve my professional ambitions.

"After leaving the mathematics degree I did not want to waste that academic year, so after applying for ocean sciences and even language courses, I discovered that the only specialization with open enrolment was medicine. So I immediately applied there. I had never been interested in health care management, and was fortunate that certain new courses designed to identify students interested in science opened up, and I was one of the first to sign up. So I did my internship in basic science at the National Scientific Research Center, where many leading Cuban scientists were trained. There I had my first contact with virology, then in 1980 I moved to the IPK, where I have been ever since.

Why are you so interested in that specific specialization?

Because it is the world that one does not see at first sight.

Her studies focus on the characterization of the various dengue epidemics in Cuba, the identification of the risk factors of the hemorrhagic variant and the creation of a cutting-edge work group for research on this disease, in order to obtain a possible preventive vaccine.

At only 14 years old, graduating from a piano course. (Photograph: courtesy of Dr. Guzmán)

What are the qualities of a good virologist?

They must enjoy science, be curious and not tire of studying, because the information changes so rapidly that it is almost impossible to keep up to date. They must be disciplined and constantly write and publish. I cannot conceive of a scientist not publishing her results. Publishing is a measure of one's impact, and allows one to advance knowledge.

What were the circumstances for the collaboration with the Pan-American Health Organization?

After 1981 there was a reinforcement of the national dengue monitoring system, in regard to case management, vector control and diagnosis. A significant amount of Cuban research and results were published while the disease was spreading in the American continent, and it was not yet known how to manage it. From that moment a systematic link was created between researchers from different countries. Some requested our direct collaboration while others did so through the Pan-American Health Association (PAHO), which benefitted from Cuba's focus on dengue.

How did the project to develop a vaccine against dengue in Cuba emerge, and at what stage is it now?

The project emerged between 1992 and 1993, as a result of the IPK's experience with dengue and the Genetic Engineering and Biotechnology Center of Cuba's experience with biotechnology and vaccine production. We knew that it was difficult but today we have one of the most advanced candidates in the world. The preclinical tests are encouraging and the process has increased our knowledge and trained many researchers.

What does it involve to be an Academic of Merit at the Cuban Science Academy?

It is a great recognition and an opportunity to promote the best scientific results and share our views on the development of research in Cuba.

Your work group is mainly composed of women. Is there any particular reason for this?

No. There were simply more applications from female scientists. I would rather not get involved in that debate on the advantages or disadvantages of being a woman. I believe that we are neither better nor worse than men. We are perhaps more perseverant. But in general, we are a good group and get on with each other, and each member has her own opinion. We view that positively, because what is the use of everyone agreeing with you? They help me keep learning.

There are many women working in science but not many running research centers.

That is an important subject, as gender perception is a very relevant issue today. I do not believe that ability has anything to do with it, as I have many very capable female colleagues, but in the social sphere men and women have still not reached complete equality.

In her o ce, lively, talkative and always wearing a touch of purple. (Photograph: Luis Pérez/JT)

How did you manage to combine maternity, work and marriage?

Being happy in all aspects of one's life depends on family support, and the type of family. My mother moved in with me when my son Pedrito was young. My husband was very understanding. He recognized that I needed to work and did not mind if I came home late. That may have been because we were both scientists working on dengue... Though not all scientist husbands are like that.

Did Professor Kouri, being a researcher as well, have any influence on your career?

Gustavo did have a lot of influence on me. I remember my first trip as an advisor, to help the Nicaraguan laboratory diagnose dengue, to prevent the virus from spreading to that country. I was terrified. I was young and did not feel prepared. But Gustavo gave me confidence. I became less shy and learnt to speak in public and at congresses. When he did not agree with my ideas he would tell me so, but without losing that sense of collaboration.

"He was actually just as kind to everyone, in particular young people, despite his serious demeanor that commanded a great deal of respect. He had a long-term vision; he insisted on training and on engaging in debate with colleagues to keep learning and detect knowledge gaps and errors. He encouraged us to listen to others' good experiences, whether to incorporate or discard them. He believed that developing science and scientific exchange was crucial to resolving everyday problems.

Are you aware of the links between your work and that of Carlos J. Finlay, the only Cuban to be nominated for the Nobel Prize?

About eight years ago I was asked to prepare the Finlay Address, a kind of eulogy that is dedicated every year to the man who discovered the transmitting agent of yellow fever. I examined his studies and realized that he was, if not the first, then one of the first to study the arbovirus, the virus transmitted by arthropods. The yellow fever one is the prototype virus of the *flaviviridae* family, to which dengue belongs. Dengue is also transmitted by the *Aedes aegypti* mosquito. So there is indeed continuity, and the method he proposed to control that disease is still valid. All the hygienic methods he recommended are being employed in response to current health challenges.

How do you manage to participate in so many projects?

By working methodically. I get up before 6 AM, have breakfast then an hour later another hectic day begins, and I work for approximately twelve hours. I work until around 8 PM, though sometimes later as the night is my best moment for writing and thinking. It is when I am alone in the laboratory and there are no telephone calls. At home I chat to my son for a while, and then watch whichever soap opera is on. It is the hour and a half when I have a break and just switch off. During the weekend I work a lot on the computer, and that is it really: a little music on the way to and from work, an occasional meal out and a quick catch up on the news. The thing is I have so much to read for work!

With some members of her research team. The IPK has proposed a comprehensive hypothesis on dengue, which demonstrates that in addition to the risk factor of secondary infection, susceptibility depends on the individual. Indeed, in equal conditions, one person can have a form of hemorrhagic dengue and even die, while another will display no symptoms. (Photograph: courtesy of Dr. Guzmán).

Academic profile

María Guadalupe Guzmán is a Doctor of Science, virologist, Tenured Professor and Merit Researcher. She has been the Head of the Virology Department at the "*Pedro Kouri*" Tropical Medicine Institute in Havana, Cuba since 1987 and the Director of the Collaborative Center of the Pan-American Health Organization-WHO, for the study of dengue and its vector. She is an Academician of Merit at the Cuban Science Academy. She directs the Cuban Microbiology and Parasitology Society and is the Coordinator

of the National Reference Laboratory for Dengue in the Americas, NRLDA/PAHO. She is a member of the Dengue Prevention Board of the Americas, the Dengue Work Group (GT/Dengue) of PAHO and the Advisory Group of the WHO Tropical Disease Program.

She has participated in over 90 congresses and other scientific meetings with over 200 works, conferences and posters. She has delivered keynote addresses at prominent scientific institutions in Cuba, Europe, the United States, South East Asia, Latin America and the Caribbean.

She has written over 300 publications and short reports in scientific journals, principally on the subject of dengue and its hemorrhagic form. She has co-authored books and written chapters in books published in the Dominican Republic, Colombia, Cuba, Brazil, Germany, the United Kingdom and the United States and TDR-WHO. She is the author of four patents and a chapter in the Public Health Encyclopedia and the WHO Dengue Guides, 2010.

Guadalupe Guzmán was one of 12 figures chosen by the North American journal *Science* to write her scientific biography for its 125th Anniversary celebrations.

Distinctions and prizes

Dr. Guzmán has received many prizes and decorations, including several prizes from the Cuban Health Department and the Cuban National Science and Technology Forum, the Medal at the 30th Anniversary of the Cuban Science Academy and the "*Carlos J. Finlay*" National Order of the State Council of the Republic of Cuba, for her contributions to Cuban science in 2003. She became a fellow of the *Academy of Science for the Developing World*, (TWAS). ■

*Iramis Alonso Porro is director of Cuban Journal Juventud Técnica, Executive Secretary of the Scientific Journalism Department in Havana International Institute "José Martí" and Professor of scientific journalism in Havana University. Iramis worked as reporter specialized in environmental and scientific issues in Bohemia Magazine from 1999 to 2007. Iramis Porro obtained the most important Cuban Prize for scientific journalism "Gilberto Caballero" and she has written extensively on topics related to science, technology and environmental issues. Coauthor of the book "A mal tiempo, periodismo. Cobertura de huracanes en Cuba", published by UNESCO. 2010.

Idelisa Bonnelly
Dominican Republic

"...science is about data, perseverance, discipline and often about love, and women know a lot about all this"

Interview by Odalis Mejía Perdomo*

Idelisa Bonnelly de Calventi, president of Fundemar

Idelisa with her grand-daughter Isabella and her daughter Laura Calaventi (blue blouse), her son Vinicio Calventi and his wife Cinthia Camarena

Idelisa Bonnelly: a sea enthusiast

Idelisa Bonnelly speaks slowly but is a spirited defender of the causes she has defended and researched for many years. She is notably a pioneer in her country in the protection of marine ecosystems and is particularly renowned for her battle against dolphin centers. She believes that women's great talent, discipline, perseverance, ability and compassion means that they have a great deal to contribute to research.

Bonnelly, a retired professor, was born in the Dominican Republic. She is currently the president of the Dominican Marine Studies Foundation (FUNDEMAR).

Her main field of research is marine biology and the preservation of her country's coastal resources.

She is extremely proud of having pioneered marine sciences in the Dominican Republic from the 1960s onwards, by creating the first university for the study of marine biology, the Marine Biology Research Center (CIBIMA) of the Autonomous University of Santo Domingo (USDA), in 1962. She later promoted the School of Biology at UASD, where the country's biologists are trained. Bonnelly has published widely on the country's marine resources, works that

Idelisa holding her grandson Jaime Vinicio, next to her her son-in-law Bela Bartok with Isabella and on the other side her grand-daughter Gabriela, behind are her daughter Laura and her son Vinicio with his wife, Cinthia

From left to right: Cecilia León, Idelisa's assistant; Patricia Lancho; Idelisa Bonnelly; Rita Inés Sellares, director of the Center of Marine Studies in Bayahibe; and Toby Bloom, Wildlife Director of Humane Society International.

have been instrumental in decisions on their management and preservation and in the creation of protected areas such as the Banco de la Plata Humpbacked Whale Sanctuary (1986), now the Banco de la Plata and la Navidad Sanctuary, the first of the Atlantic Ocean and one of the first in the world.

After retiring from the university in 1987, she created the Dominican Marine Studies Foundation, FUNDEMAR, in 1991. A non-profit organization, it has allowed her to continue her research and educational work for the benefit of the Dominican Republic's marine mammals and resources. Since 1991 FUNDEMAR has undertaken numerous preservation projects throughout the country, in particular in Bayahibe in the Eastern National Park in the south-east of the country. There FUNDEMAR carried out the first dolphin study in the Dominican Republic and today Bonnelly works alongside an excellent research team on adaptation to climate change in coral reefs and coordinates the Marine Mammal Sanctuary Management Plan.

Bayahibe is located in the Eastern tourist hub, where FUNDEMAR has promoted responsible tourism and community development by designing ecological marine excursions

and reaching agreements with the tourism industry. This project involves permanent training programs for the staff to guarantee that they work effectively.

Distinctions and prizes received

- Medal of Merit for a Woman in Science, from the Government of the Dominican Republic, 1986.
- Distinguished Professor of the Autonomous University of Santo Domingo, 1987.
- Incorporated into the United Nations Environment Program's Global 500 Hall of Fame (UNEP) for the preservation of the environment, 1988.
- Global 500 Prize, from the United Nations Environment Program in 1995, for her contributions to preserving the environment.
- Founder of the Dominican Republic Academy of Science (1974), from which she received an Academic Tribute in 2009
- Member of the Organization of Women in Science in the Developing World (OWSD) and representative at its First General Assembly in 1991.
- National Ecology Prize Corripio Foundation, 2008.
- Madame Curie Medal at the 50th Anniversary of UNESCO, 2009.
- Prize for Distinguished Service in Biology (SCB), from the Society for the Conservation of Biology, Victoria, Canada, 2010.
- Order of Duarte, Sánchez and Mella, with the grade of Commander, 11 September 2011.

Bonnelly's choice of a scientific career can be attributed to her lifelong passion for the sea. As a child she lived very close to the Santo Domingo Jetty and from her early years was curious to fathom the mysteries of the vast sea.

She recounts that she had to travel to the United States to study, and her professors there encouraged her to continue her postgraduate training in Biology. The time that she spent working at the New York Aquarium, working alongside Doctors Ross Nigrelli and Sophie Jakowska, was a decisive moment in her training as a researcher.

There she worked in the laboratory that monitored the health of the species in the aquarium, including penguins, invertebrates and even walruses. "Many problems arose and we had to be dedicated, creative and study constantly."

Along with her academic training this experience provided the impetus for her most ambitious project back in the Dominican Republic, a study on the rational use of marine resources in the country.

Regarding the importance of women working in science, Bonnelly believes that despite the scientific world being generally dominated by men, women have great talent, discipline and ability, and can therefore make a significant contribution as researchers.

Her keenness to work in science was reinforced once she returned to the country at the end of

Idelisa has researched and fought for many years for the conservation and protection of marine ecosystems.

Idelisa Bonnelly works in the field of adaptation to climate change in coral reefs in the region

Rafael Leónidas Trujillo's dictatorship (1930-1961). She observed serious deficiencies in scientific teaching and research, yet among the population there was a desire for change and for the university to help create a new society based on freedom, democracy, equality and criticality. "Science is a means to create knowledge to preserve marine resources and serve society," she declares.

At the time, there was little knowledge about the seas and their resources, but it was evident that many coastal areas had deteriorated and numerous species has decreased in number, fish in particular and there were only limited specific regulations. Consequently, CIBIMA conducted taxonomic studies on coastal species, studies to establish closed seasons for species such as lobsters, crabs, shrimp and oysters, and biochemical research to control the quality of marine food. There were also innovative studies to find bioactive components of marine origin (algae, mollusks, sea squirts, etc) for potential pharmaceutical use.

Bonnelly encouraged professors and students from other fields to support their research by adapting methodologies to the marine field. Thus was formed a small research team devoted to marine science.

The close ties with a variety of institutions such as the Fishing Department drove not only the research but also the organization of educational courses, workshops and discussions to promote interest in marine science.

Among the main obstacles that Bonnelly has had to overcome is the equipment in the early years of her career, often scarce or in a state of disrepair, and the need to use other laboratories for chemical and microbiological analyses while CIBIMA was being established. She has presented projects to international institutions such as the Organization of American States (OAS), and forged alliances with other universities in the Caribbean such as the Marine Science Department of the University of Puerto Rico and with national organizations. She has also established a marine station on Güibia beach in Santo Domingo, which is now the Professors' Club of the USDA.

In 1979 Hurricane David destroyed CIBIMA's installations, equipment and collections. In three hours the swell destroyed the product of 17 years' work. "This was a very difficult event to overcome", she recalls.

However, despite the heavy blow, with the help of professors, students, employees and friends its activities were resumed and soon after the aquaculture station was opened on the Engombe estate at the USDA, where research continued as before and new, successful lines of work began. The institution promoted freshwater aquaculture.

Family environment

The support of Professor Bonnelly's family has been crucial to her life and achievements. Her parents decided to send her to study in the United States, and her colleague and husband Dr Vinicio Calventi, an eminent doctor and researcher, understood and shared her vision and love for science. Finally, her children Laura and Vinicio and grandchildren Gabriela, Jaime Vinicio and Isabella have been a source of affection and support.

Bonnelly is good-natured and permanently active. In her free time she enjoys reading, listening to good music and going to the cinema. Family reunions are another great source of happiness. The "chocolate" celebration she has held for over 30 years with her relatives and close friends has become a tradition.

Motivation

As advice to young persons wanting to study science, Bonnelly says that it is a fascinating subject that once begun is hard to abandon. There are numerous opportunities for young persons with talent.

Indeed, despite the vast quantity of information and high-technology research being carried out, there is still much to be discovered in all branches of science - natural, exact and

Her research has permitted the conservation of marine resources such as the Humpback Whale Sanctuary in Banco de la Plata. She also conducted the first study on dolphins in the Dominican Republic.

even social. "The early 21st century is the perfect time to achieve this, if we wish humanity to survive and develop peacefully."

As regards the inclusion of women in a sphere normally dominated by men, and the different criteria that may be imposed on men and women, Bonnelly argues that the scientific world demonstrates women's successful integration into such spheres. "Scientific information and opportunities are there for both women and men, and women are very capable of the data management, perseverance, discipline and compassion required by science."

Institutions

Bonnelly believes that the most significant obstacles of the Dominican Republic in regard to science are the lack of a clear scientific re-

search strategy and the insufficient incentives for research and innovation from the state and private sectors. Despite the existence of a Higher Education, Science and Technology Department and the financing of research projects, there is no clear, precise definition of the country's research needs, and insufficient training of university staff and young persons interested in becoming researchers. "We must improve school education - that is where the roots are," she says.

Yet in her opinion the government of the Dominican Republic does recognize the work of the Science Academy and frequently seeks its advice on many topics. Among these is the preservation of the environment. The Academy is currently an advisor to Congress. The Women in Science program has been successful thanks to the solidarity of the Education and Women Departments. It is not only run by women but also men with strong, progressive views.

Bonnelly says that collaboration between the academy and government authorities varies depending on the subject.

Regarding the reception of her projects by the authorities, as founder of the Academy she worked for several years as Coordinator of the Biology Commission, now the Natural Sciences Commission. There she organized a series of biology conferences, which had a significant impact on the national environment. The government also assisted the publication of the Academy's journals.

Among many successful projects are the establishment of the Marine Mammal Sanctuary, the first research on dolphins in the country, campaigns to protect dolphins in captivity and currently, the Marine Mammals Sanctuary Management Plan.

Bonnelly believes that there is an institutional vacuum, as a result of which the government depends more on individual people than the Ministry or technical teams.

Though there have been significant advances in strengthening environmental legislation, there are still many gaps and legal instruments must be improved, such as the Sectoral Law on Protected Areas (2002-2004), which lacks a subsystem of protected marine areas, despite this being crucial for their management. ■

*Odalis Mejía Perdomo, a science journalist, was born in Santo Domingo, graduated in Social Communication Sciences from the Universidad Autónoma de Santo Domingo and received a Teaching Certificate from the Salomé Ureña Advanced Teacher Training Institute in 2004. She has worked as a journalist for *Hoy* newspaper since 1998. She has also taught Spanish and Natural Sciences to young persons and adults at the Guyana Public School since 2004.

Eugenia M. del Pino

Ecuador

“We are all o□ered a range of choices in life; you have to choose a path and focus on it in order to be successful...”

Interview Winston Oswaldo Báez*

Senior Lecturer in Biological Sciences, School of Biological Sciences, Pontifical Catholic University of Ecuador (PUCE), Quito since 1972. Head of the Department of Biological Science, PUCE (1972 to 1974). Eugenia del Pino Veintimilla is a distinguished Ecuadorian biologist of international renown. An in-depth conversation about her career in biological research and various personal subjects provided an insight into her character. Eugenia answered the questions with her characteristic friendliness. A summary of this interesting conversation is given below.

Current main research interests

In her laboratory at PUCE, Dr. del Pino undertakes comparative studies on the early embryonic development of Ecuadorian frogs with the Xenopus laevis developmental model frog. Her main areas of research are oogenesis strategies and the early development of marsupial frogs, particularly the marsupial frog Gastrotheca riobambae (Hemiphractidae), the development strategies of frogs with terrestrial eggs, Epipedobates machalilla and other frogs from the Dendrobatidae family and Engystomops randi (Leiuperidae) frogs with foam nests, compared to the early embryonic development of the Xenopus laevis developmental model frog. This comparative analysis began 40 years ago, when developmental biologists concentrated exclusively on studying model organisms such as the Drosophila melanogaster fruit fly and the X. laevis frog. There is currently interest in comparative studies on early development, since adaptations of various organisms to their environment are natural experiments that increase our knowledge of embryonic development.

The comparative studies by Dr. del Pino and her colleagues are therefore of great interest to the international scientific community.

The achievements that constitute her greatest source of pride

Rather than proud, I would describe myself as content with my life in general and with the choices I have made.

Studying Biological Sciences was an excellent decision, as it has allowed me to develop my intellectual abilities, learn methodologies and contribute to science at a national and international level.

Working in science in Ecuador rather than abroad has allowed me to develop personally, as well as contribute to society and scientific progress.

In this way I have been a pioneer in training students and scientific research in Biological Sciences at PUCE. The wonderful biodiversity of Ecuador has provided the specific themes of my research on embryonic development in Ecuadorian frogs.

Eugenia M. del Pino with students in the PUCE laboratory in Quito (photo by Micheline Pelletier, L'Oréal)
Photo on page 107: Highlands of Island Santa Cruz, Galápagos. Where the *Scalesia* provide another example of the radiation evolution. In arid regions the plants are srubs whereas in the highlands, where it is wet the Scalesia evolved into trees. Photo by Eugenia M. del Pino

I have also had a productive relationship with the Charles Darwin Foundation for the Galapagos Islands, through which I helped to train Ecuadorian scientists devoted to preserving those islands as well as Ecuador and Latin America. This kind of partnership is extremely unusual for a female scientist working in a laboratory on developmental biology. My involvement in education on the conservation of the Galapagos stems from being a scientist based in Ecuador. I have learnt a great deal about biology and the problems associated with conserving the Galapagos Islands. I have become interested in Ecuador's enormous biological diversity.

Honors and Recognitions

International scholarships:

- Grant from the Latin American Scholarship Program of American Universities (LASPAU), 1967-1971 for a Masters' degree at Vassar College (Poughkeepsie, NY) and a doctorate at Emory University (Atlanta, Ga), United States.
- International Scholarship, awarded by the "American Association of University Women," 1971-1972, to complete her doctoral studies in the United States.
- Scholarship from the Alexander von Humboldt Foundation to carry out research at the German Cancer Research Center in Heidelberg, Germany during a sabbatical year. (July 1984 to July 1985).
- Fulbright Fellow and Visiting Professor at the Washington Carnegie Institution, Embryology Department, Baltimore, United States, during a six-month sabbatical (March to September 1990).
- Activities supporting science and conservation
- Member of the Charles Darwin Foundation for the Galapagos Islands since 1976.
- Founding member of the Ecuadorian Biology Society since 1976.
- Member of the Board of the Charles Darwin Foundation for the Galapagos Islands (1986 to 1992).
- Vice President for Ecuador of the Charles Darwin Foundation for the Galapagos Islands (1992 to 1996).
- Vice President of the General Assembly of the Charles Darwin Foundation for the Galapagos Islands (1998 to 2001).
- Member of the Board of the Third World Academy of Science (TWAS) (2004 to 2009).

Prizes and distinctions:

- Elected Member of the Biological and Natural Sciences Section of the Ecuadorian Cultural Center (May 1978).
- Diploma for her work on Education for the Conservation of the Galapagos Islands, awarded by the World Wildlife Fund, Gland, Switzerland (March 21st, 1986).
- Honorary Overseas Member of the American Society of Ichthyologists and Herpetologists (a permanent post awarded in 1996).
- Merit Medal for the Conservation of the Galapagos Islands, awarded by the Charles Darwin Foundation for the Galapagos Islands on the 40th Anniversary of its founding (Quito, 1999).
- L'Oréal-UNESCO Women in Science Award (Paris, France, 2000).
- Sheth Prize for Distinguished Graduates of Emory University (Atlanta, GA, 2003).
- "Feather of Dignity," prize awarded by the National Union of Ecuadorian Journalists (Quito, 2003).
- Medal from the Academy of Sciences of the Developing World (Alexandria, Egypt, 2005).
- "Eugenio Espejo" Medal for Science, awarded by the Council and Mayor of Quito Metropolitan District (Quito, 2005).

The three main areas of her research refer to the strategies of oogenesis and the early development of marsupial frogs, particularly the *Gastrotheca riobambae* marsupial frog. Photo by Eugenia M. del Pino

Eugenia M. del Pino

- Diploma awarded by the National Women's Council (CONAMU) (Quito, 2006).
- "Eugenio Espejo" Prize for Science, awarded by the Government of Ecuador (Quito, 2012).

Academies that have elected her as a member:

- Member of the Latin America Science Academy (ACAL) since 1987.
- Member of the Academy of Sciences of the Developing World since 1989.
- Foreign Honorary Member of the American Academy of Arts and Science, since 2006.
- Foreign Associate of the United States National Academy of Sciences, since 2006.

Why did you decide to study science?

My career in Biological Sciences began when some opportunities appeared while I was studying at PUCE. My parents fostered the intellectual abilities that I demonstrated as a child. They were not university-educated, but one great goal of their generation was to support their children in the university studies that would lead to a career that would allow them to earn a living. I am the youngest of three children and my two siblings played an important part in my youth, as they were adamant that I should study at the university. My problem was that I did not have a clear idea of which discipline. I enjoyed literature as much as mathematics and biology and was particularly interested in German and other foreign languages. I studied in the Education Sciences Faculty at PUCE and graduated in Education Sciences, as a secondary school Biology teacher.

However, my Biology teachers at PUCE encouraged me to apply for a scholarship to study in the United States. Once I had decided on Biological Sciences, I committed myself to them. I immensely enjoyed my time studying in the United States. When I returned to Ecuador, af-

ter joining the teaching staff at PUCE I began research in the area I had studied, Embryology and Developmental Science.

We are all offered numerous options in life. One has to choose a path and focus on it to succeed. I devoted myself to Biological Sciences, and in particular Developmental Biology, and ignored my other academic interests.

Why is it important for women to work in Science?

All human beings have the social responsibility of using our abilities for the benefit of society. Women also have a responsibility towards themselves, to develop an independent, worthwhile life. I have many female colleagues and students at PUCE. The School of Biological Sciences awards Bachelors' and Masters' degrees, but we do not yet have a doctoral program. I have supervised many of my students' Bachelor's theses. Several scientific projects on which we have worked together have been published in national and international journals. I supervised the Masters' degree thesis of the first person - a young woman - to obtain a Masters' Degree in Conservation Biology from PUCE, in 2012.

A number of my thesis students have studied successfully at universities in Latin America, North America and Europe. Some have returned to Ecuador and some are even part of the Biological Sciences teaching staff at PUCE.

Who or what inspired you to work in science?

My two siblings provided support for my academic abilities during my childhood and youth. I chose to study Biology because I was offered a scholarship to study in the United States. The LASPAU scholarship aimed to enhance the abilities of the teaching staff at Latin American universities. Consequently I felt a moral obligation to return to Ecuador after my training. I should stress that Ecuador is the country with whose culture I identify myself most. However, when I joined the Department of Biological Sciences at PUCE I was struck by how limited the research facilities were in comparison with those I had used abroad. I set myself the professional goal of finding a research topic that satisfied my scientific interests and would allow me to make scientific contributions of international significance in Quito. I reasoned that if I gave up scientific research then I would soon lose all that I had learnt, as science progresses at breakneck speed.

I needed a frog to study embryonic development, as I did not have enough money to buy the Xenopus laevis frog, the model organism on which my experience was based. In the PUCE gardens I found a marsupial frog (Gastrotheca riobambae), and as I knew nothing of its biology I wrote to my thesis supervisor at Emory University, Dr. A. A. Humphries, Jr. who very kindly researched it in the library. I can clearly remember his

letter, in which he told me that the embryonic development of marsupial frogs was unknown and that the field of study was therefore completely open.

This freed me from the pressure to publish and compete with other researchers, and I progressed slowly but surely, studying the reproduction and embryonic development of marsupial frogs. I strived to produce articles of international quality and publish them in specialized journals. So I discovered a "niche" in the study of the biology and development of marsupial and other Ecuadorian frogs, and one which no other researcher had access to. This is a result of the rich diversity of the embryonic development of Ecuadorian frogs.

The international scientific community was interested in our research results and has always supported me. I was a visiting researcher at major research centers during my sabbatical year: the German Cancer Research Center in Heidelberg, Germany and the Embryology Department at the Washington Carnegie Institute in Baltimore, United States, where I was assisted by Professor Michael Trendelenburg and Dr. Joseph Gall, respectively. At those centers I could employ the most advanced methodologies available to analyze the embryonic development of marsupial frogs. Other researchers have supported me, not only by donating reagents and equipment, but also by guiding my analysis to define my lines of research. I am grateful to my international colleagues who have offered to discuss our research, because that discussion is crucial for scientific progress and critical thinking.

The marvelous biology of marsupial and other frogs has always motivated me in my scientific career.

What are the main obstacles you have come across, and how have you overcome them?

I cannot say that there have been specific obstacles in my life and academic career. Everyday large and small problems appear, which we solve, and then carry on. If I can foresee a problem occurring I take a proactive attitude to prevent it from happening.

As a student I did not suffer any discrimination in Ecuador or the United States. On the contrary I was accepted by both students and professors. Neither has there been any discrimination in my workplace at PUCE. Biology was a new career and male and female graduates obtained posts at the university and other academic centers in Ecuador.

I suppose that the various responsibilities imposed by academic life and society are a form of obstacle. One has to learn to manage time appropriately and allocate specific periods to scientific work.

Do you have any family?

I have not raised a family. I was very close to my mother, who supported me personally and professionally. Over time social roles have changed, and parents evolve from providing support to requiring support from their children. A child's development is different, as it gradually acquires a sense of self and is less dependent on its parents. On the other hand our parents' ageing process is sad, as they increasingly need help from their children and loved ones. In my mother's last years, she needed a professional care-giver. My academic and personal commitments, in addition to my lack of medical training, made it impossible for me to provide her with the care she required. Thankfully a doctor and one of my siblings advised me that caring for my mother was beyond my abilities and that she needed professional help.

What do you like to do in your spare time?

I do not have a great deal of spare time and I am not an athletic person and so I do not have a hobby as such. My home has a very peaceful effect on me, and I listen to classical music and appreciate the colorful flowers in my garden, as my mother did. However, the weeds grow far too rapidly me for me to eliminate them. I am interested in German and study it when I am in the mood.

Frog embryos developing

What message would you give to other female scientists?

I would share the recommendations that I was given early on in life. The teachers at "La Providencia" Elementary and High School in Quito taught us to develop our intellectual abilities as much as possible to help society. I have never forgotten that lesson, and that commitment to society. Alongside that message is another that I received from my family. Parents can only support their children for a limited period of time, and the children must use that support to become independent in the future.

Every man and woman owes it to society to develop his or her intellectual abilities and choose a meaningful career.

Scientific research is fascinating as it allows us to question our environment. Scientific careers are very suitable for women. They must find a research "niche" to progress at their own speed, and ideally they should not be competing fiercely with other laboratories. This would spare scientists the unpleasant experience of realizing that another center is doing research similar to theirs. On the other hand, no laboratory possesses everything. Therefore each one should identify their strengths and use them in the best way.

Eugenia del Pino is a tireless researcher who has worked for four decades with scientific and methodical rigor and has thus made important contributions to science. She is candid and modest about her achievements in research and numerous publications and recognitions. When she recently received an award, she declared "Calm is the only possible habitat for science" and "a prize increases one's responsibility to society." This responsibility entails creating and recreating good science and disseminating it in the way Eugenia has done, with a brilliance that has done credit to her university. ■

*Oswaldo Báez Tobar is a biologist and science writer, Biological and Environmental Science Professor at the Central University of Ecuador, founding member of the Ecuadorean Society of Biology and Assembly Member of the Charles Darwin Foundation for the Galápagos Islands.

Elfriede de Pöll
Guatemala

"My father taught me from an early age which plants it was forbidden to cut, which were toxic and which areas were protected. This is how I learned about them and I loved them"

Interview by Lucy Calderón*

Elfriede de Pöll

Remarkable vitality

Dynamic, cheerful and enterprising, with enviable stamina, Doctor in Botany Elfriede de Pöll is still active in teaching and research on the ethno botanic wealth of Guatemala at the age of ninety.

De Pöll's eyes light up when she talks about her projects or the trips with her students to discover new plants and the various uses to which they are put in communities. Her work in this line of research has contributed to the preservation of the country's cultural, social and ecological heritage.

The projects she has undertaken on cardamom, nettle and ornamental plants have

had an impact at the economic and nutritional level by improving the production of locally consumed and export crops.

In the area of ecology and conservation, she has classified the biological diversity of various basins and ecosystems and provided input for making political decisions on the issue.

The immediate, long-term implications of de Pöll's research earned her a recently-established agreement with the new Center for Studies on Biotechnology at the University of the Valley of Guatemala (UVG) to develop further applications of her work.

Vast Trajectory

Dr. de Pöll is a tenured researcher at the Academy of Physical, Natural and Medical Sciences of Guatemala, where she was the first woman to be admitted. She continues to collaborate with the academy through the Science at School Program, in an attempt to make classroom science teaching fun.

The knowledge produced by de Pöll has been disseminated through conferences, scientific articles, books and teaching at various universities in the country and abroad.

She also remains in close contact with European botanic gardens and is a member of the following networks: The Latin American Botany Network; the National Environmental Teaching and Research Network and the Network of Herbariums of Mesoamerica and the Caribbean.

Her services to the community include the identification of plants for the public, academic and private sectors, consultancy for botanic gardens, educational tasks and consultancy for the government.

Her knowledge of medicinal plants and their uses have made her a "folk healer" among her colleagues, students and friends.

What led to your love for plants?

It was thanks to my father who used to take my brothers and sisters and me to the countryside in the summer holidays when we were small. During our walks, he taught us which plants it was forbidden to pick, which ones were toxic, which areas were protected. So I learnt all about plants and I loved it.

There, when I was at junior high school, I had the idea of researching plants to cure cancer. At that time, people knew nothing about this and I wanted to find something new.

In 1945, once the war was over and Austria regained her independence, I went to the university and obtained a doctorate in plant physiology and a masters in natural sciences in Vienna and a doctorate in Botany in Guatemala in 1960 when I enrolled in the San Carlos University of Guatemala.

How did you develop the discipline required to achieve your goals, as you did?

I learned about discipline as a child, at home, with my parents, but through affection rather than impositions. My parents advised me and never forced me to do anything. They taught me that I should be the one to decide what to do.

What are the qualities of a good botanist?

Being interested in plants and treating them as living beings, because although they do not walk or shout, they have similar reactions to us. They must be treated well.

Do you talk to plants?

I realize that some people believe that you have to talk to plants to make them feel good, but I don't do so myself. All I know is that when you treat plants properly they respond. Giving them the water, light and fertilizer they need is important. You have to study their reactions and understand them.

What species do you like best?

I don't have any favorites although my favorite plants are the most difficult ones to identify, plants that pose challenges such as mistletoe, for example.

You have been a university professor for decades. What keeps you motivated?

As a scientist, I work, but I have to pass that knowledge on to others. I do not work or study just for myself, it is important for others to learn.

What is the key to motivating students to be interested in this topic?

You have to comment on the details of the plant, not just have students memorize them. In addition to the common and scientific names of plants, they must also know that a species has uses: as food, a medicinal plant, an ornament and so on. You have to tell them why that plant is important, they must feel that their studies have a point.

What do you think about using plants to fight disease?

"Ninety per cent of medicines have been found when studying plants and their extracts; there are doctors who have great faith in plants and recommend their use. I do too, but under certain conditions," says Pöll.

"You have to realize that medicinal plants have an active substance and other compounds that boost the former. The plant's age determines the amount of active substances it has and

Rhyncholaelia digbyana is a native of Mexico, Belize, Guatemala, Honduras and Costa Rica, where it grows as a epiphyte, often in conditions of long periods of drought.

In Guatemala, it is popularly known as "Candelaria"

Orchid species of Guatemala

although they have a slower effect, they are also more effective. Conversely, chemicals get rid of symptoms quickly but do not cure them and also have side effects," notes the specialist.

Do you take communities' traditional knowledge and use of plants into account?

Yes, I listen to them and understand them, but you have to ignore superstition.

During your long career, what has given you the greatest satisfaction?

Studying and sharing my knowledge, and receiving students whom I sometimes do not recognize because they have changed so much. But when they come to visit me, they always mention something they learned in my classes. That is very satisfying.

Can a woman, a mother and a professional achieve everything she sets her mind to without neglecting her family?

She can do everything provided she is organized.

How do you keep yourself so active and in such good physical and emotional shape?

For the past 15 years, I have done everything

Elfriede de Pöll in her greenhouse

at home. I get up early and do a lot of walking. Although my husband and one of my two daughters died several years ago, it is still difficult... there are days when I do not feel very good emotionally but I get up and refuse to give in.

Proof of the vitality and passion that characterize Dr. Pöll is the fact that she improved the UVG botanic garden. She began that task with her collaborates in the middle of 2011 and the garden now has a wide variety of plant species that have been classified, documented and labeled. She even taught her collaborators to obtain coffee from some plants in the garden and they are all delighted to have drunk the first cups of their own organic coffee.

Academic profile

- Dr. in Botany Elfriede de Pöll graduated from the University of Vienna in 1947.
- She obtained an M.Sc. in Natural Sciences from the University of Vienna in 1965.
- She obtained a doctorate in botany from the University of San Carlos in Guatemala in 1960.
- She speaks German, Dutch, English and Spanish and translates from the Latin and Greek.
- Since 2003, she has taught Botany 1 and 2 at the UVG.
- Since 1988, she has been the director of the Herbarium of the UVG Institute of Research.
- From 1980 to 1988, she was the director and honorary researcher of the Herbarium at the Center for Conservation Studies at the Faculty of Chemical Sciences and Pharmacy at the University of San Carlos in Guatemala, USAC.
- She has given various workshops and conferences both locally and internationally to both scientists specializing in issues in her field and to elementary and junior high school teachers. She has also collaborated with the Ministry of Education in

Lycaste Skinneri, better known as "White Nun," is the national flower of Guatemala. Currently extinct in its natural habitat, it continues to be grown in nurseries and by collectors.

Wild flower species native to Central America

Guatemala, through the Academy of Sciences and the University of the Valley of Guatemala.

Publications

- Recent publications include: Los muérdagos de Guatemala (Loranthaceae, Viscaceae y Eremolepidaceae): Diversidad, Distribución e importancia económica. In Ec. Cano, Biodiversidad de Guatemala, Vol. I, UVG, 2006.
- Doce plantas tóxicas de Guatemala. Revista de la Universidad del Valle de Guatemala, No. 15, 2006.
- Etnobotánica Garífuna, Livingston, Izabal. Pöll, E. C. Mejía, M. Szejner. 2005

Distinctions and awards

- She received a tribute from the Permanent Civic Program of the Industrial Bank in 2007.
- She was given the Presidential Medal of the Environment, awarded by the Ministry of the Environment and Natural Resources of Guatemala, 2006.
- She received an award for excellence in teaching from the Board of Directors of the University of the Valley of Guatemala, UVG, 2001.
- She was honored for her dedication and contribution to the training of biologists in Guatemala, UVG, 1998.
- She obtained the Austrian Cross of Sciences and Arts, First Class, from the government of Austria, 1997. ■

*Lucy Calderón Pineda is a journalist who obtained a degree in Communication Sciences from the University of San Carlos in Guatemala in 1999. In June 2011, she was elected member of the World Federation of Scientific Journalists and in 2008, she was the only Latin American scientific journalist chosen to sail the Arctic Ocean on the Canadian Coast Guard Icebreaker Amundsen and report on the Circumpolar Flaw Lead System Study carried out in the polar region.

Silvia Torres de Peimbert

Mexico

> “...the excitement I felt about astronomy has not ended and on the contrary has multiplied”

Interview by Judith Zubieta*

Emeritus professor, Instituto de Astronomía, Universidad Nacional Autónoma de México.

Main research interests at this time

"I am an astronomer and work on gaseous nebulae".

Accomplishments and achievements she is most proud of

"My work has centered on the determination of the physical conditions and chemical composition of planetary nebulae and HII regions. The first type of objects correspond to the final phases of evolution of intermediate mass star; they have a hot central star and a gaseous envelope that shines. The H II regions are the combination of young, hot massive stars and gas illuminated by them. Both type of objects allow us to determine the physical conditions and composition of the gas.

In the study of planetary nebulae my work has given important clues on the conditions of formation of the progenitor star, and on the internal processes of the star. It has provided important restrictions to the understanding of chemical evolution of the Galaxy and other galaxies. My studies on this type of objects cover many other aspects: like halo planetary nebulae, and very young planetary nebulae, among others.

Silvia Torres de Peimbert

In the study of HII regions my work has provided significant indications to understand star formation processes in the Galaxy and other galaxias; these results are important for the understanding of the Universe as a whole. Again many aspects of this field have been

Silvia Torres de Peimbert with her family

advanced with my contributions: like the seminal work on the Large Magellanic Cloud proposing to determine the primordial helium abundance with which the universe started its expansion, on this topic my approaches have been different: initiating the study of the low density interstellar medium in the Galaxy; proposing the relation of metallicity of the gaseous content of galaxies with total mass; measuring gradients of chemical composition in galaxias, etc.

My activities encompass many additional aspects besides research, namely fostering a scientific journal, promoting institutional development, stimulating graduate studies in astronomy, and investing a great effort in popularization of science”

Honors and awards

- G. Budé Medal, College de France, 1974
- Academic Medal, Sociedad Mexicana de Física, 1983
- Science Prize, Universidad Nacional Autónoma de México, 1996
- Emeritus Professor, Universidad Nacional Autónoma de México, 2000
- Emeritus researcher, Sistema Nacional de Investigadores, 2007
- National Science Prize, Mexican government, 2007

Gaseous pillars in the Eagle nebula

Silvia Torres de Peimbert's work focuses on the study of gaseous nebulae

- Heberto Castillo Prize, Government of Federal District, Mexico, 2007
- TWAS Medal and Lecture, Academy of Sciences of the Developing World, 2010
- L'Oréal-UNESCO Award for Women in Science for Latin America, 2011

Why did you decide to enter a science career

"As a child I was very interested in mathematics, which I found engaging. Later I became acquainted with chemistry and physics; finally, in college I encountered astronomy. In graduate school it became clear that I indeed wanted to become an astronomer. I was dazzled by the scientific activity and the many areas of research that were being developed at the time. The excitement about astronomy has not worn out, on the contrary, it has multiplied"

Why is it important for women to be in science?

"I am convinced that it is important for women to participate in all human activities

The Milky Way seen from the Earth

Silivia Torres de Piembert, Mexican astronomer

and not to be excluded from them. For example in my discipline there were women that made significant contributions, and were only able to do so by assisting their husband or brothers, since they were not allowed to carry out their work freely. Only a few of them were recognized, and this was done belatedly. I consider that those women that are interested in scientific research should have similar opportunities as men"

Who or what is your inspiration for doing science?

"Three scientists have inspired me: Guillermo Haro, Louis Henyey and George Wallerstein.

In Mexico, Guillermo Haro for his passion for astronomical discovery and for his commitment to the development of science in our country. While I was a graduate student in California, Louis Henyey impressed me for his generosity and self discipline in his research method, as well as George Wallerstein for his great interest in knowledge and for the support he gave young students to carry out research at an early stage"

What were the main barriers you experienced, and how have you overcome them?

"Although my family was very supportive of my interests, they raised me in a very traditional fashion. At the time I studied, women in my country were not expected to have a career. Therefore my own expectations of the role of women in society were the main challenges to overcome. At several stages in my life I had to stop and reflect on my real interests, in order to prioritize my activities. Of course, raising my children coupled to pursuing my scientific interests was quite a challenge. Looking back, I am very glad to have been so defensive of my career"

Do you have a family?

"I have been married for 49 years to Manuel Peimbert, who is also an astronomer, and with whom I have collaborated in my research activities. I have a son and a daughter, both wonderful and hardworking; my son is an astronomer, and my daughter is a biochemist. They both work in Mexico City. In addition I have a 3 year old granddaughter whose company I enjoy immensely"

What do you like to do in your leisure time?

"What I enjoy most is being with my family, as well as with my friends. I read a lot, like to attend concerts and movies, and I also love sewing and knitting"

What is your advice to other women scientists?

"I am convinced that women scientists have a great responsibility in the different aspects or everyday life.

Within our own family: We should educate our own families with the same opportunities for both men and women. We should be aware that whatever we teach at home will be what our children will imitate in their future life.

Our role as educators: Let´s support education for men and women. My country has a low level of education, we require to encourage more opportunities of development to access scientific careers.

In the professional arena: we should make sure to treat men and women, students and colleagues with the same respect and attention.

In the popularization field: We should accept the challenge of making public appearances when required, since there is no better way of showing the way to young women, than showing ourselves.

In the personal aspects: We should not set limits to our goals. We should aim for the highest levels of achievement” ■

*Judith Zubieta has a PhD in Social Systems Sciences from the University of Pennsylvania, Professor at UNAM, with several publications on science and communication, Coordinator of the UNAM Long Distance Education Program and Mexican Focal Point of IANAS WfS-WG.

Mayra Luz Pérez Díaz

Nicaragua

"Women have had the privilege of gaining access to the world of knowledge. They have had to test their sensitivity in search of a new social ethics based on truth, equity and harmony between human beings"

Introduction by Jorge A. Huete-Pérez and interview by Vera Amanda*

Honorary Doctorate, University of Fairfield, United States May 2010

Dr. Mayra Luz Pérez Díaz's academic career illustrates the weight of Nicaraguan intellectuals in the brief history of science in Central America. During the time I spent as director of research, I witnessed firsthand the tremendous impetus given to scientific research under her leadership. This drive principally took two forms.

Dr. Pérez Díaz - more than any of her predecessors - has made scientific research the center and driving force of university activity, which has contributed to the development of modern science in Nicaragua. Dr. Pérez Díaz, the successor of Rector Eduardo Valdes, stands out as the first female rector, along with great Jesuit heads such as Dr. Xavier Go-

rostiaga, who fought for the modernization of higher education in Nicaragua. During Dr. Pérez Díaz's tenure as Rector of the Central American University (UCA),the illustrious Jesuit university, has also established social commitment as the main purpose of scientific and intellectual work. In a country suffering from significant socio-economic difficulties, this required the creation of a research agenda that gave priority to human and social development and to the vast obstacles to fundamental human rights in poor nations. Another of Dr. Perez's achievements has been her support for the creation of the Nicaraguan Science Academy as an institution promoting national scientific development. Together with Jaime Morales Carazo, the then Vice President of Nicaragua, Dr. Pérez Díaz assisted with the organization of the Academy, which aims to become the voice of Nicaraguan scientists. Dr. Pérez Diaz played a decisive role in women's achievements in a period in which national scientific institutions were consolidated. This was crucial for the development of a national scientific culture.

As a Nicaraguan intellectual, Dr. Pérez Díaz's professional and personal experience is a source of inspiration for the young female professionals wishing to overcome many obstacles, be they work, social, cultural, educational, psychological or research-related.

Dr. Mayra Luz Pérez Díaz was born in Managua, Nicaragua. She is the first woman to be appointed as Rector of the Central American University (UCA) of Nicaragua, founded in 1960 and the first private university in Central America.

Awards prize to the Ambassador of the European Union, Mr. Mendel Goldstein. November 2011

Inauguration of "Carmelo Palma" Arbor, together with the Ambassador of the European Union

Under her leadership, UCA was ranked as the top Nicaraguan university and one of the ten best in the Central American region by the world university ranking by the Superior Higher Scientific Research Council (CSIC) of Spain, attached to the Ministry of Science and Technology. This recognition can be attributed to the Rector's commitment to extensive university reform designed to make UCA a successful university of the modern era.

During her academic training, Dr. Pérez Díaz obtained a doctorate in Philosophy and Literature from the Universidad Complutense of Madrid, Spain, and a Diploma in Cinematography from the University of Valladolid.

The achievements that represent her greatest source of pride

Dr. Pérez Díaz has worked at UCA for 35 years and played an important part in its management. Indeed, the various high positions she has occupied have significantly strengthened the academic processes, in particular the development of research. The Rector considers research a fundamental contribution to society, since it produces new scientific, technological and humanistic knowledge and progress.

Dr. Pérez Díaz has promoted the institutionalization of scientific activity at UCA and in Nicaraguan society. She is convinced that it renders human development more dynamic, by creating a new culture favorable to equality in all forms. In this regard, she considers gender equality a fundamental challenge for human beings and an institutional responsibility to recreate a world based on new ideals and values.

Consequently, under her leadership, the UCA has created a research agenda that supports the economic, social and democratic processes in Nicaragua, to overcome the prevailing poverty and inequality. This has been a two-fold effort for the university: its responsibility to the nation requires it to conduct activities that respond to their difficulties, many of which are of an urgent nature. On an internal level, the university seeks a systemic vision, to consolidate a culture of research and innovation that provides coherent responses to national and regional demands.

To date, though Dr. Pérez Díaz feels satisfied with the progress of research activity, which has brought the university prestige and recognition in recent years, she still has many challenges before her. This is the reason for her support for the Nicaraguan Science Academy, as a means to project the shared scientific spirit that lives and breathes thanks to research.

Honors and prizes

Throughout her professional life Dr. Pérez Díaz has received national and international recognitions, including the following:

Unveiling of the Father León Pallais S.J. plaque, together with Vice-president Jaime Morales Carazo, 31 August 2010

- Honorary doctorate from the University of Fairfield, United States;
- Diploma of Recognition for her contributions to research from the Encuentro Journal published by the Central American University;
- A recognition for her contribution as a benefactor of the Nicaraguan Science Academy;
- Merit Diploma for her professional experience, awarded by the Rotary Club of Managua, Nicaragua.

Why is it important for a woman to work in the scientific world?

As a woman, Dr. Pérez Díaz is proud of the greater female presence in the university and scientific sphere, and mentions that women have contributed to science for centuries, permitting numerous advances. Indeed, primitive women's discoveries and experiments provided their families with better living conditions, which were subsequently handed down to later generations.

What are the main obstacles you have encountered and how have you overcome them?

Despite the cultural barriers that require a greater effort from women to participate in a competitive, predominantly male environment, there is more recognition of their contribution to social development. Women nowadays must be aware of how important their participation is from a progressive point of view, as it promotes their autonomy and independence. This is a counterpoint to the traditional dynamics that still prevail in Nicaraguan society and legitimize inequality between men and women to the detriment of the latter's human and professional growth.

Mayra considers research a fundamental contribution to society, since it produces new scientific, technological and humanistic knowledge and progress.

Do you have any family?

I have been married for 28 years to Dr. Rafael Lucio Gil, an academic who has worked extensively on educational theory and scientific philosophy. We have two sons, Rafael and René Alejandro, both of whom are engineers.

What do you like to do in your spare time?

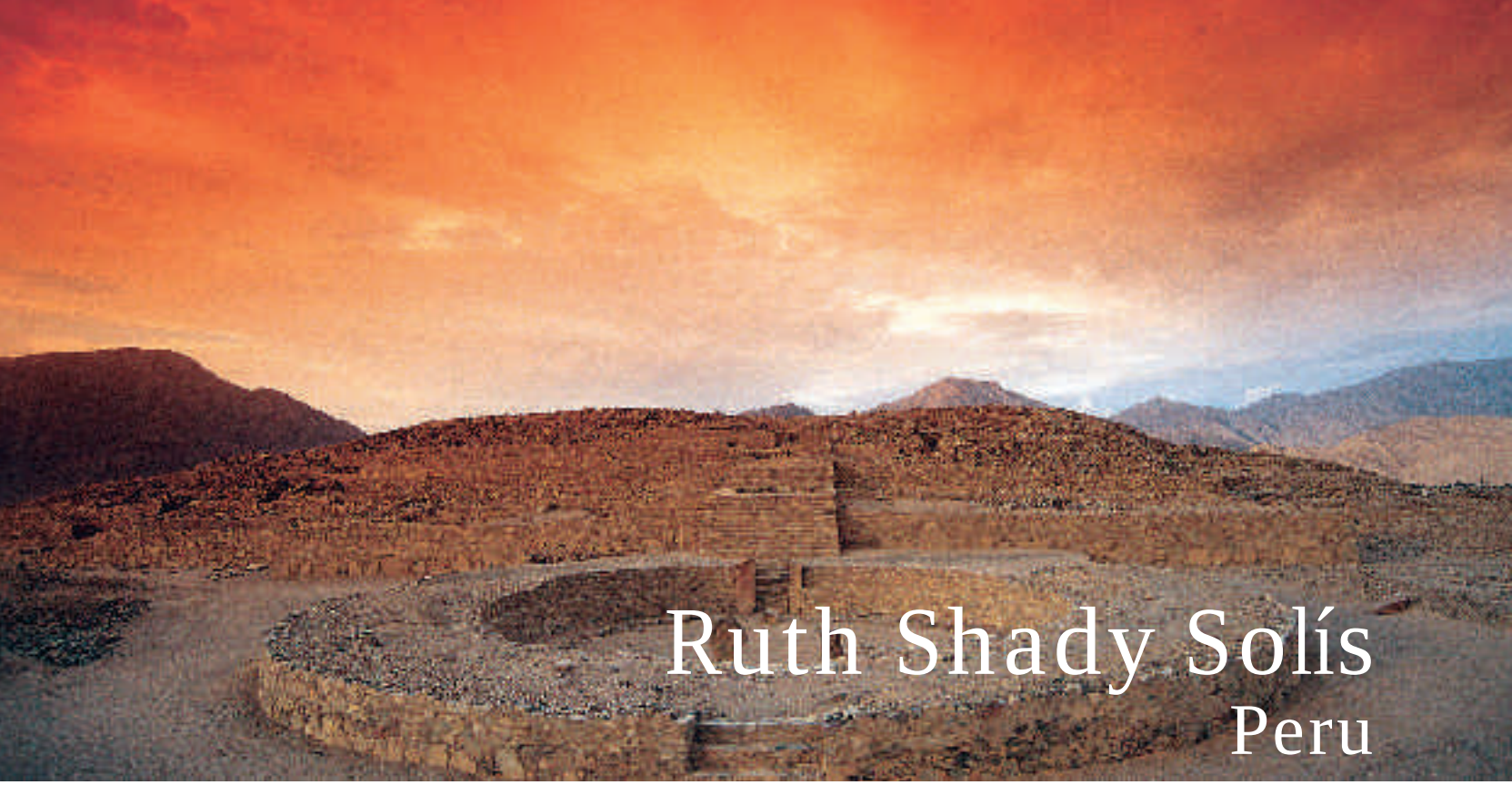
I like to spend time with my family and a small circle of friends. I also enjoy reading and going to the cinema.

What advice would you give to female scientists?

In the years to come, women must work with great commitment and solidarity to gradually build a new history in which women play a strong role in all spheres of society. They must claim their right to education, and be aware that unlike in earlier, more restrictive eras, women's situation has benefited from new spaces for training and action.

Women who have gained access to the world of knowledge must employ their sensitivity to create a new social code of ethics based on truth, equality and harmony between human beings in both economic and social processes. ■

*Dr. Jorge A. Huete-Pérez is the founder and director of the Molecular Biology Center at the University of Central America (MBC-UCA), President of the Academy of Science of Nicaragua and President of the National Coordinating Committee for the GEF Program on Biosafety and a member of the National Committee for Risk Analysis under the Ministry of Agriculture. His current research includes molecular parasitology, forensic DNA typing and bioprospecting for industrial enzymes.
*Vera Amada Solís. Professor at the Central American University UCA-Nicaragua. Specialist in Food Technology. She is currently UCA Secretary General.



Ruth Shady Solís

Peru

“Build a house, which is my family; plant a tree, which is my children’s development and write a book, which is my occupation, to feel that it was worth having lived”

Interview by Claudia Cisneros Méndez*

Ruth Shady Solís

Dr. Shady holds a Doctorate in Archaeology and Anthropology and a Bachelors' degree in Pedagogy and has been the Senior Archaeology Professor at UNMSM (National University of San Marcos), director of the multidisciplinary research work on Caral, the oldest civilization in America and director of the "Caral Archaeological Zone" Executive Unit 003 of the Department of Culture. She holds Honorary Doctorates from four universities, and received the Medal of Honor from the Congress of Peru.

Shattering assumptions

They did not believe her. When Ruth Shady announced to her archaeologist colleagues the results of her research in the Valle de Supe, Peru, they thought that she was exaggerating. It was a new interpretation and therefore shattered the prevailing paradigms. Until that moment, the Chavín de Huántar culture was known as the oldest civilization of Peru, and Dr Shady's findings invalidated that assumption in one fell swoop. Not only had she found the

oldest Peruvian civilization, but also the first civilization of the entire American continent. Dating back 5,000 years, Caral was revealed as preceding the 1,800 year-old Olmec culture, and even the 3,000 year-old Maya cultures. "We took the results to the National Cultural Institute (INC) but they did not even consider them. They thought that I was exaggerating." But Ruth was not daunted and continued to seek funds to develop what she sensed would be the most significant research of her life. "I was immensely motivated because I knew that I was dealing with a historic event that would revolutionize knowledge about the first American civilizations."

Persevering in the face of obstacles

The first months of research were very difficult. There was virtually no road. The team camped on the uncultivated terraces close to the mountain range, with no water, drainage system or electricity. Dr. Shady and four of her former students and colleagues took turns to cook food on a gas cooker. "The work between 1994 and 2001 was very tough. One night I was chatting to a local farmer when I heard a loud noise. An enormous bull had just sat down on my tent, in which I had just been resting. Moments earlier I would have been crushed." However, she refused to turn back. "We realized that Caral was a very special site, extremely ancient. It was pre-ceramic but had an extensive, complex series of buildings with monumental architecture. We did not expect this in such ancient settlements." She transmitted her motivation and professionalism to the others. The mayor of the district provided some logistical support, INC occasionally lent her a vehicle and she obtained a grant from National Geographic for the first excavations.

Empathy for the underprivileged

But she did not focus merely on research and the conservation of monumental architecture. "I decided that this was not sufficient, and that I also must improve the living conditions of the local populations." Ruth wanted them to feel proud of their heritage, benefit from it and have a better quality of life. "We wanted these people to identify with the heritage and accept it as theirs, as a source of identity and cohesion." If Caral could improve their lives, this would bring responsibility as well as pride, to transmit to future generations. To this end, she organized "participative workshops" with a group of academics, and involved the local politicians and population in the creation of a Master Plan to promote integral, sustainable development. This program was approved by the Peruvian Congress in 2006. However, six years later and due to constant changes in State policies and bureaucracy, the authorities have not implemented it. "I am persistent, and continue to work on this issue. There must be a way to implement the integral development plan for the population." Dr. Shady thus demonstrated her concern for people as well as science. From an early age she was determined to study for two degrees

simultaneously: Archaeology - Anthropology and Pedagogy. (She laughs at the recollection). "It was a challenge: I would study Archaeology and Anthropology in the morning, English in the afternoon and Pedagogy in the evening. But I was very happy, as I loved to learn. I am fascinated by science but I also wanted to help society."

"I dreamt of discovering ancient cities..."

Dr. Shady was only eight or nine when her vocation became clear to her. Her father was her first source of inspiration. An immigrant from Prague, he admired the ancient Peruvian culture. "He would take us to archaeological sites, but also show us the contrasts between rural and urban areas. For each of our birthdays my father would give us a collection of history books. We eventually had the whole set. I would dream of discovering ancient cities, and write about them... I would fantasize about being a great explorer..." She also had excellent teachers at university: the expert on Andean geography Javier Pulgar Vidal, philosopher Augusto Salazar Bondy, the famously studious Ella Dumbar Temple ("she would teach us about 16th to 18th century chronicles and I would imagine those societies"), archaeologist and art historian Jorge Muelle and social archaeologist Luis Lumbreras. Many relatives and friends told her that in that profession she would die of hunger and it would be even harder because she was a woman. "Following my vocation was of the utmost importance for me, not listening to other people. We archaeologists have to be disciplined and persistent, not be daunted by problems, find a solution and always seek to achieve our objectives, while never losing respect for others."

It is our task to preserve culture, not that of the officials, yet when we achieve something they come and change it. We cannot be constantly starting afresh.

Against gender and knowledge based prejudice

Throughout her life, Dr. Shady has faced many obstacles, both as a professional and a woman. "Certain male colleagues tried to undermine my scientific work, saying that I was not physically strong enough. But I did not feel diminished. I have made them admit that they were wrong, and they now respect my work." She has also come across bureaucratic obstacles, often caused by a lack of interest in culture. "My country needs to implement short-, medium- and long-term State policies that regard archaeological heritage as a resource. In that way the change in government and officials would not disrupt the continuity of the programs. We spent years lobbying for a budget to be allocated to specific projects, but when we obtained it the leadership changed and we had to start again from scratch." Nonetheless, she persists with her work and multidisciplinary team. "As regards research, we excavated contextualized materials in 11 Caral settlements then

At one of the 11 research sites, Caral (Valle de Supe, Peru), which measures 67 hectares

Ruth Shady Solís

processed them with professionals from various disciplines (biologists, ichthyologists, physicians, chemists, geologists, among others) from our university or through agreements with other Peruvian or foreign institutions. We thus deduced the necessary information and made sound interpretations of the social system of the Caral civilization, the changes over its thousand years of existence and the reason why its remarkable urban centers were abandoned."

A visit from the president

One morning in 2001, while Dr. Shady was in the Sacred City of Caral, she was informed that

Peruvian President, Dr. Valentín Paniagua and his ministers, who had recently heard about Caral, were planning a visit. "I considered it a significant event. He was the only president in 18 years to express interest in our archaeological heritage. They arrived in a helicopter at 9 am, and I took them on a tour around the city until 4 pm, showing them the impressive architecture (which was not immediately evident to a non-archaeologist at that moment) and sharing the knowledge we were acquiring. He congratulated us and asked each of his ministers how their respective sector or ministry could assist the research in such an important Peruvian historical site."

A few days later she was called to the Government Palace to explain the details of the project's austere budget. "As I was leaving, the president looked at me and said: "'Doctor, we have a van here. Please take it, you need it more than I do.'" I also asked him to implement a museum exhibition on Caral at the Palace, to begin sharing its cultural value. One of our most important achievements was the Supreme Decree declaring Caral a site of national interest, with a budget allocation to accelerate and value the research. "That was the first recognition that we received. However we subsequently had to fight for a second decree to make the amount allocated from the budget of the National University of San Marcos independent, so that we could use it.

A woman, a message, an objective

Dr. Shady is convinced that the Peruvian archaeological heritage is a resource that can promote development and, unlike petrol or mining, does not harm the environment and is one of the most profitable industries. "Not only does it have a touristic and economic value, but it is also important to obtain historical knowledge, and to know how the territory was managed, how society was organized and why it was so successful for thousands of years." Ruth is keen for Peruvians to know that Caral was not only the first civilization on the continent (before Egypt built the first pyramid at Saqqara and later ones at Giza), but moreover, unlike other civilizations it was not a warlike society (there are indeed no traces of either weapons or defensive walls), in which the State worked in cooperation with civil society representatives and employed knowledge, science and technology to improve living conditions. One example is its seismic constructions, recognized by contemporary Japanese scientists. Caral also has a significance as regards women's role. "Those first American civilizations maintained gender equality. Women had access to power." She also believes that in any era "women must have the same options, to take part in whichever activity benefits them and society." She is aware that, though there has been considerable progress in various fields of knowledge, we are still a long way from sharing these benefits indiscriminately between human beings, and from

preserving living conditions throughout the world. “Maybe the obstacles stem from the culture of individualism and of exclusive use of economic production. Those who study the message of ancestral societies such as Caral know that common wellbeing should guide our work. We should aim to generate benefits that extend to the rest of society.”

The woman, the mother and the dedicated scientist

Archaeologist, anthropologist, teacher, a woman to be reckoned with and alongside all of this, a mother. It has not been easy, as archaeological work is always on-site. “I have always tried to combine my career with the upbringing and education of my two children. Thankfully, my mother helped me. But undoubtedly my work would often take me away from them.” She mentions that she tried to foster an interest in archaeology in them. “But to no avail. I think that they were over-exposed (she laughs) They are both economists, specializing in development and social service. I have instilled values in them and am pleased to have created the conditions for them to develop successfully.” This is her greatest source of personal satisfaction. As a professional she feels very satisfied with the multidisciplinary team, which has contributed to knowledge of the social system of the Caral civilization. “The worldwide response to the values of the Caral civilization has encouraged us. So has our ability to convey to current and future society the importance of peaceful social interaction between people with different cultures and languages, who exchanged resources, products, experiences and knowledge produced in the Andean territory, which is itself immensely varied. This intercultural relationship favored by Caral’s social system enabled it to develop very early in the north-central area of Peru. This is a valuable message for modern society, as nowadays military action and behavior are still ubiquitous, which is entirely counterproductive to the millions of years of human evolution and the six thousand years of establishing complex civilizations. We have failed to strengthen our human identity and preserve living conditions on Earth. We need to reflect on this, to avoid exterminating ourselves. And of course, I am also thrilled to be able to improve the quality of life of the populations around Caral and train archaeologists with a different vision, who can appreciate the diverse social reality of Peru.”

We take our leave from Dr. Shady, the undaunted archaeologist, devoted mother and tireless defender and researcher of the civilization that changed the history of the continent. She continues to energetically emphasize its social and cultural values, social and political complexity, organized collective, monumental architecture and interest in

Ruth Shady with President Valentín Paniagua (to her right) and former United Nations Secretary General, Javier Pérez de Cuéllar (at the front) in Caral, 2001. Source: Caral Archaeological Zone.

knowledge and its inhabitant's quality of life. Two of her eleven dogs also bid us farewell. "I love animals. All of our dogs have been rescued strays." This is how she spends her free time, in addition to reading, seeing her family, Yoga and walking.

She knows that blazing a trail for archaeology will be a hard task, but as her father once told her, "Build a house, that is your family; plant a tree, that is your children's development; write a book, that is your profession, to feel that it was worth having lived."

Undoubtedly, this will not be the last time we come across Ruth. Her story is now part of ours, and of yours. We are all part of this great history that Ruth Shady revealed to us. ■

Claudia Cisneros Méndez is an independent TV, radio and Internet journalist and the director of the scientific and humanistic portal www.sophimania.pe. She is a producer in Lima of Fuji TV-Japan, a CNni-USA collaborator in Peru and an opinion columnist in the *La República* newspaper in Peru.

Eugenia Kalnay
United States of America

"The most important thing is to devote yourself to what you like best, regardless of the pay or recognition, because this will come if you do your work with passion"

Interview by Anneke Levelt Sengers*

Eugenia Kalnay

Meteorologist. Distinguished University Professor, Department of Atmospheric and Oceanic Science, University of Maryland, USA.

Main research interests at this time

I am an expert on numerical weather prediction, which is the science of developing computer models of the atmosphere, and combining them with atmospheric observations, in order to predict the weather. My book "Atmospheric Modeling, Data Assimilation and Predictability" (Cambridge University Press, 2003) is widely used as a graduate course text. I have worked on the impact of land use on climate change, and currently I am also working on developing models that couple models of the earth system (atmosphere, ocean, land, etc.) with models of the human system (population, economy, etc.) in order to study the feedbacks between population and climate change.

Accomplishments and achievements she is most proud of

- The substantial improvement of the weather forecasts due to our research during the ten years (1987-1997) I was the Director of the Environmental Modeling Center (EMC) of the National Centers for Environmental Prediction (NCEP) at the National Weather Service.
- The NCEP-NCAR (National Center for Atmospheric Research) 50 years Reanalysis of the atmosphere I directed. The NCEP-NCAR Reanalysis gives the state of the atmosphere every 6 hours, and is a very widely used data set (the paper describing it has over 7000 citations, a record in geophysical sciences), because it makes easily available to any interested researcher information that was previously only available at large centers of weather research and forecasting.
- Being the PhD advisor of about 15 brilliant women and men from all over the world.

Eugenia Kalnay and her family

Honors and awards

In 2009 I received perhaps the most prestigious prize in Meteorology, the IMO Prize of the World Meteorological Organization, only the second woman to be so honored. I have been elected Fellow of the American Association for the Advancement of Science (AAAS), the American Geophysical Union (AGU) and the American Meteorological Society (AMS). I have received a gold medal from NASA, and two gold medals from the Department of Commerce, where the National Oceanic and Atmospheric Administration (NOAA) and the National Weather Service reside.

I am a member of the National Academy of Engineering (US), a foreign member of the Academia Europaea, and a corresponding member of the Academy of Sciences in Argentina.

Why she decided to enter a science career

When I was a girl, I always wanted to study medicine. However, as I was finishing the girls-only high school I attended in Buenos Aires, a brilliant fellow student whom I respected

very much, said to me: "you are very good in math, you should study physics instead of medicine" and I immediately decided to enroll in the School of Exact and Natural Sciences at the University of Buenos Aires.

That was a wonderful decision: I experienced for the first time in my life the joy of science. I can still remember the emotion I felt when I understood the meaning of Newton's third law (action and reaction) or how to program the Turing machine.

The education I have received at the University of Buenos Aires' School of Science was not only free of charge but also of such superb level that compared to it, graduate school at MIT was easy to me. I had other cultural surprises when I arrived at MIT in 1967. In Argentina about 40% of the science students were women, so I assumed that in the US, being much more developed than Argentina, surely the number of women students would be closer to 50%. I almost had a heart attack when I found I was the only woman in the Department of Meteorology. Then I became the first student to become pregnant, the first woman to get a PhD in the Department, and the first woman to become a Professor. I was promoted later from Assistant to Associate Professor, but without tenure, so I decided to move to NASA Goddard in 1979. I note that since that time, MIT and the US in general made profound changes for the better that started with the women's liberation movement in the 70s and 80s.

When I tutor undergraduate women in science they tell me that they feel women have the same opportunities as men. This is truly an amazing change that has taken place in the US!

Why is it important for women to be in science?

I know from my experience at the University of Buenos Aires that, if not discouraged by society, about half of the science students and professionals are women. With this experience (and a similar one at the University of Uruguay where I worked after I got my PhD), this question seems almost silly. Of course, women should be in science! Why would one even think of wasting the brains of half of the scientifically inclined population?

Who or what is your inspiration for doing science?

My mother, who raised my younger sister and me after my father died when I was 14, pushed me to go to the university. I remember her saying when I first started dating: "Don't even think of getting married before getting a PhD" (I disobeyed her). Then, after I enrolled in physics, she discovered that there was a competition for scholarships of meteorology

students sponsored by the National Weather Service in Argentina. My mother signed me up and changed my major in the application forms from physics to meteorology, a science that until then I had never heard about. After I started studying meteorology I was extremely grateful to my mother for this change, since it is the physics of the atmosphere (and now more like the physics and biochemistry of the full earth system). It can also be considered as environmental engineering. I enjoy working with students and colleagues on improving weather forecasts and studying climate change, and feel like our work benefits humankind.

Eugenia Kalnay and her international colleagues Kang, Miyoshi, Greybush and Ruiz.

What were the main barriers you experienced, and how have you overcome them?

To be honest, except for the loneliness of frequently being the only woman in meetings, I did not experience formal barriers. I did feel psychological barriers at NASA when my boss, Milt Halem, was promoted and I reluctantly replaced him as Branch Head at the Goddard Space Flight Center. My predecessor was very successful with a rather confrontational management style accepted by the very bright Branch scientists, and I could not possibly follow his style. I decided instead to follow the style of a Quaker woman who chaired a group on Human Rights in Boston. When we first met, she said we would follow the Quaker approach of working by consensus, and to my big surprise, after a couple of sessions, it worked well even though the group was very heterogeneous. I was also very surprised when the consensus approach plus gentle nudging worked also extremely well in my Branch of aggressive scientists, all men except for one woman and me. One of the problems I had (before becoming Branch Head) was that the men had a tendency to interrupt me when I started talking. I solved that problem by speaking more forcefully and interrupting back. However, I once had to tell one of the scientists after a Branch meeting: “Have you ever noticed that every time she (the only other woman in the Branch) starts talking,

you interrupt her?". My colleague was very surprised and denied that he ever did that, but afterwards he stopped interrupting her. Another annoying problem that I was never able to solve was that some men would never look at me when talking, instead they would look at the man on my left and then at the man on my right (even though I was their boss). Just looking hard at the speaker did not work. Fortunately, younger men almost never do that anymore.

What made you decide to do your PhD work in the US, and how did you go about finding a graduate program that was willing to accept you?

I attended the School of Sciences of the University of Buenos Aires, which, under the brilliant direction of the Dean, Dr. Rolando Garcia, became one of the very best in the world. After I graduated in 1965 I continued working as a teaching assistant. The military overthrew in June 1966 the elected government of Arturo Illia, and on July 29 1966 attacked the School of Sciences, savagely beating with long police batons, and then detaining, more than 400 professors and students that had taken over the building (an episode known as "La Noche de los Bastones Largos", or "the Night of the Long Batons"). As a result thousands of faculty and assistants (including me) resigned in protest from the university, and many of them left the country, leading to a tremendous brain drain for Argentina.

Eugenia Kalnay, meteorologist and professor at the Department of Atmospheric and Ocean Sciences of the University of Maryland, USA.

Dr. Garcia, who is a meteorologist, still active in his 90s, contacted Prof. Jule Charney at MIT and several other universities to secure a possibility to do a doctorate for the many students that had been left jobless. Prof. Charney kindly offered me a Research

Eugenia Kalnay has conducted studies on the impact of land use on climate change. She is currently collaborating in the development of models that connect to land system models.

Eugenia Kalnay and her husband

Assistantship, and the Ford Foundation paid for my travel from Buenos Aires to MIT in January 1967.

Do you have a family?

My first husband, Alberto Rivas, came with me to the US in 1967, where he later got a PhD in linguistics at MIT with Prof. Noam Chomsky. Our son, Jorge Rivas, was born when I was a still a student, in 1970. I remember thinking that if I failed to get a doctorate, I would at least have a good excuse. I told the department chair, Prof. Norman Phillips, that I was pregnant, worrying that he would get angry, but he stopped for a moment and then said: "Now you are going to be creative in two different ways!"

Alberto died very young of cancer, and I was married in 1981 to Malise Dick, a transport economist who worked at the World Bank.

Malise was an incredibly supportive husband who encouraged me to take the challenging jobs that I was offered, first as Branch Head at NASA Goddard, and then as Director of the Environmental Modeling Center (NCEP/NWS/NOAA), even though I was very scared about accepting such responsibilities. Jorge Rivas, who is a political scientist, helped me when Malise died in 2007, and has given me immense happiness because of his principled commitment to social justice, and for his guidance in our collaboration on the development of a coupled model on population and climate change.

What do you like to do in your leisure time?

I love to bicycle, and I biked to work almost every day until I got slightly hit by a truck in May 2011. Fortunately I only broke my tibia. I really hope that I'll be able to bike again! I am very passionate about progressive politics, and about the future of mankind and the future that we are leaving to our children and grandchildren.

What is your advice to other women scientists?

The most important advice is to work on what you like to do, without worrying about money or recognition, which will come if you put passion in your work.

Learn to speak clearly, briefly and forcefully, and don't allow others to interrupt you! ■

*Anneke Levelt Sengers, physicist, member of the NAE and the NAS, scientist emeritus at the National Institute of Standards & Technology (NIST), author of articles and books in the field of thermodynamics and critical phenomena of fluids, L'Oréal Prize Awardee. Co-Chair and USA Focal Point of the Women for Science Program of IANAS.

Deanna Marcano

Venezuela

“Science is not to be kept but rather to be spread”

Interview by María Teresa Arbeláez*

Deanna Marcano is far stronger than she first appears. Among her family and friends she is known as the Iron Lady, though she claims that her temperament has become weaker.

At 74, and having lost her partner of 40 years, she remains committed to science. Though she no longer works in the laboratory, she is fully abreast of the latest publications in her field, can discuss recent advances in natural products and is still an authority on their production.

A chemist by profession, she has a doctorate from the University of Oxford and is far more professionally active than she admits. Indeed, she disseminates knowledge by assessing books to be published and writing her own, 14 at the last count, "dedicated to my students." She writes prolifically, believing that "science is not to be kept jealously but shared."

As Venezuelan as her surname

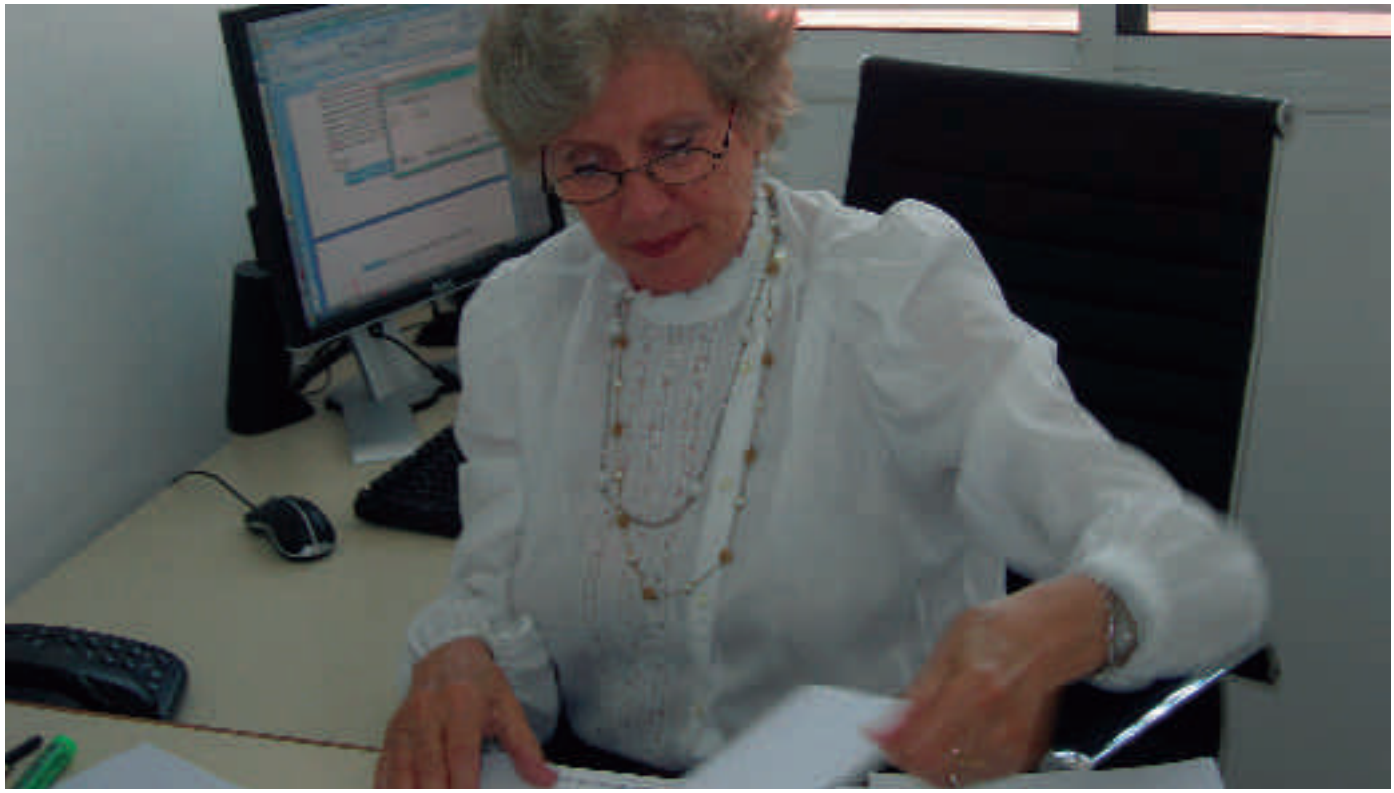
Deanna Della Casa was born in Modena, Italy and moved to Caracas with her parents when she was nine. She attended one of the most renowned high schools in the city, the Andrés Bello High School, from which she graduated as the best student in her final year. She always wanted to be a chemist. Why? I do not really know, she replies, "but I must have some chemical gene because my great grandmother was a healer back in Modena. She would make brews from plant extracts, with which she cured people."

She graduated in Chemistry from the recently established School of Chemistry at the Central University of Venezuela (UCV), where she met her future husband Melquíades Marcano on the first day of term. They were married two years after her degree, and had two children. From that moment she adopted the surname Marcano, from the east of Venezuela, and this, together with her distinctive Caracas accent and frequent use of Venezuelan expressions identified her as a "Latina" in England, despite her blue eyes, blonde hair and European demeanor.

A woman who makes her presence felt is a real woman. Have you ever felt marginalized for being a woman studying a subject regarded as very "masculine" at the time?

When I started university in 1956 there were 81 male and only 8 female students in the course, so we accounted for a mere 9 per cent. 35 of us graduated, of which six were women. We were therefore much more persistent than the men, despite the fact that four of us got married.

In Venezuela I never perceived any difference, even in my workplace. I did however feel a contrast in England. I was married with two



Deanna Marcano, academia is the world. Photo by Alexis Mendoza-León, family archives

young children, as well as a "Latina." Nobody believed that I could study.

I felt resistance at the beginning but once I asserted myself it vanished. The difference between men and women is that women do not know how to assert themselves. I finished my doctorate in three years, having also produced seven publications.

Has being a scientist helped you to deal with loneliness, for example?

I have disciplined myself to constantly look for innovations in my field, which is useful when I sit down with groups of young researchers to discuss topics. With biologists, chemists and physicians.

That is why her colleagues and friends joke that a simple lunch with Deanna can easily turn into a seminar on food science.

Science as entertainment

Dr. Marcano began her career doing chemical research on natural products and studied the structure of alkaloids, an area on which she wrote her first publication, a short article in Nature. This made her the first Venezuelan person to be published in the prestigious English journal.

In her doctoral thesis Deanna Marcano developed the structure of the Taxol aglicone, which she isolated from the Taxus baccata (European Yew). Years later, in another laboratory and backed by pharmaceutical companies, she obtained this composite from the Pacific Yew, identified its complete structure and described its physiological characteristics. It then became a powerful agent for chemotherapy to treat cancer.

When she returned to Venezuela, she observed that Yew was scarce and consequently worked with modified steroids, influenced by an English colleague who also came to Venezuela. By that time she had already set up a Natural Products group in the School of Chemistry, setting an example for other universities. "She organized the studies in that area in Venezuela, as well as developing its teaching," states Bernardo Méndez, one of her first students and currently Administrative Vice-Rector at the Central University of Venezuela. He also recalls that Marcano and another professor, Luis Cortes, published the first university-level book on Organic Chemistry in Venezuela.

Deanna Marcano

"Disciplined and able, she is a fighter, pioneer and the real founder of natural products studies in this country, as she has documented in her books," in the words of Jeanette Méndez. "I was her student, instructor, colleague, and today we still socialize."

Dr. Marcano's productivity is evident in her 70 publications in specialized journals, 15 other publications, 83 presentations and lectures at

Deanna Marcano developed the aglycon structure of Taxol, which isolated Taxus baccata, a compound that years later, became a powerful chemotherapy agent against cancer.

Deanna Marcano with her students

congresses, 15 reports and memos and the 31 Bachelor theses, two doctoral theses and eight theses under co-tutorship she has supervised. She retired from her post as tenured professor of Organic Chemistry in the Science Faculty at the UCV in 1986, where she was designated as having an "academic activity." Alongside her career as a research professor she was intensely active, being a member of various research and library committees, an international advisor, an assessor of public policy organisms, a representative of Venezuela in international organizations, an organizer of congresses and other events, a member of award panels, a project assessor and a reviewer of national and international publications. She is currently an academic advisor on the Scientific and Humanistic Development Council at UCV and a member of the Academy of Physical, Mathematical and Natural Sciences, where she is a member of the Women in Science group.

Industry with academia

"After retiring, Dr. Marcano became an assessor of a company producing food additives, which opened a new world for her. She was also a patent assessor for several firms, which changed her perception of the academic and industrial spheres.

The new government policies in Venezuela encourage scientists to immediately make themselves useful to society. What is your opinion of this?

That is a false premise. It is like the relation between art and craftsmanship, in which neither of the two activities is compromised. Science is an art, whereas the solution to immediate problems is craftsmanship. Although it is immensely important for scientists to solve problems, they must not devote themselves exclusively to that task. Had I not had my basic training, I would not have been able to solve problems in industry. When I was working with students on their theses in the lab, I may have thought of the usefulness of those results, but not in the immediate future. Here is an example. The last doctoral thesis I supervised focused on a plant, nightshade. Solanum nigrum L, which is traditionally used to relieve the pain of herpes zoster, a viral infection known in Venezuela as shingles. We proved clinically that the isolated product is a virustatic - it halts the growth of the virus - and is effective against herpes

zoster. However, even though the final project earned a prize, we were unable to continue as we lacked funds and the industry was not interested. This was partly because acyclovir, a synthetic composite targeting that viral condition, had just appeared on the market.

Which of your achievements are your greatest source of pride?

I am proud of my books designed for students. Science should not be kept jealously but shared.

Indeed, on four occasions (1984, 1994, 2000 and 2002) Deanna Marcano obtained the Biennial Prize for the Best University Book.

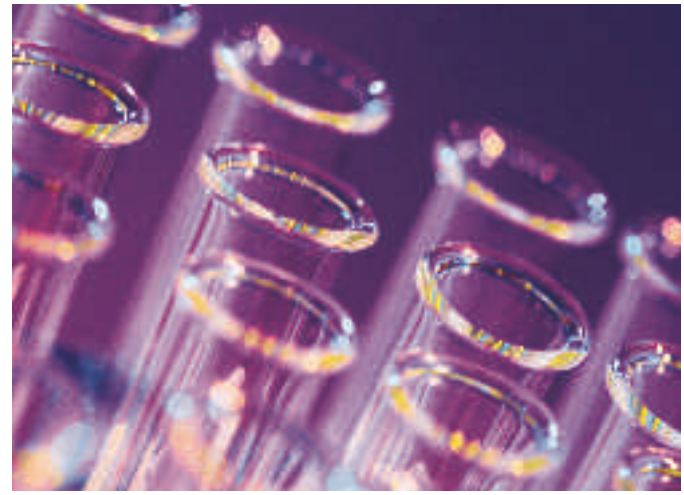
Today, after 26 years of retirement from her alma mater, her thoughts are permanently occupied with science. It has become her hobby.

She lives in the world of academia, says her son Alfredo Marcano, a physicist and a researcher and professor at the UCV. How would he describe her?

My Mom? She is the best! ■

María Teresa Arbeláez is Director of Public Relations (DPA) editor of the daily electronic bulletin *USB en Breve*, the monthly bulletin *El Papel de Bolívar* and the news *blog* http://usbnoticias.info and editor of *Datos y Cifras*.

A disciplined, capable fighter and pioneer, and the founder of studies on natural products in the country, which she has documented through her books



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