MILDRED DRESSELHAUS AWARD AND RECIPIENTS

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Universität Hamburg
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CUI THE HAMBURG CENTRE FOR ULTRAFAST IMAGING

EDITORIAL

Dear reader,

Presenting the Mildred Dresselhaus Award is always a very special experience: to see what outstanding female scientists we can bring to Hamburg thanks to the award. Experts who have already achieved a very good international reputation and who will now be there for us as collaborators, source of ideas, and discussion partners. But also excellent role models and advisors for young researchers who are still at the beginning of their career.

In addition, the prize is awarded each year to a promising junior female researcher. It is exhilarating to see the potential these scientists have and how much they can profit from the time spent with us. Therefore it is always a great pleasure to select the recipients and to present the award.

Mildred Dresselhaus said, "It is important for us to get these things going, to show that we can do it, too." We are printing this quote on our certificate as it describes in few words what is important for the career of a female scientist: To show herself and to be confident of her professional skills.

All her professional life the professor of physics and electrical engineering at the Massachusetts Institute of Technology (MIT) engaged herself in improving the opportunities for women in the natural sciences. She herself had experienced how difficult it can be for women to follow their vocation. In spite of her successes as a student, the doors were not open for her. In fact, she was advised to become a teacher, a secretary, or a nurse. Mildred Dresselhaus, however, had an outstanding mentor, who inspired her to graduate in natural sciences. So she became a highly decorated expert in physics, who until her death at 86 never got tired of engaging herself for a good cause.

Be inspired by the awardees we were allowed to honor in the name of Mildred Dresselhaus.

Your CUI board of directors

Women have always been interested in natural sciences and worked successfully in research. All her professional life Mildred Dresselhaus, shown here as a postdoc at Columbia University, engaged herself in improving the opportunities for women in the natural sciences

GREETING

SUPPORT FROM AND FOR WOMEN

Few months before Mildred Dresselhaus died at age 86, she sent us a greeting written for the 20th Women in Physics Conference of the German Physical Society, which was organized by CUI together with the Physics Department at Universität Hamburg in 2016.

Prof. Mildred Dresselhaus started her career as a faculty member at MIT as the Abby Rockefeller Mauzé Professor in 1967, funded by a female member of the Rockefeller family

I am delighted to have an opportunity to write a few words to express my appreciation of the establishment in my honor of the Mildred Dresselhaus Guest Professorship at the Hamburg Center for Ultrafast Imaging. I am also very happy for the woman in physics receiving this professorship to have an opportunity to speak at the annual meeting of the German Physical Society about her recent research. Women have become increasingly important in physics internationally since the start of my independent career, when only two percent of PhDs in physics in the U.S. were awarded to women. Support by women was important to giving me a start as a faculty member at MIT as the Abby Rockefeller Mauzé Professor in 1967, funded by a female member of the Rockefeller family. This highly visionary chair also provided a small research grant for creative work on any topic of personal interest. This small amount of unrestricted funding allowed me to do my most creative research, and over the years similar small unrestricted grants have provided opportunities for highly creative research involving high-risk experiments with limited probability for success, but that resulted in the contributions to physics that I am known for.

When I started my independent career at MIT in the 1960s, women undergraduate students at MIT made up only four percent of the entering class, compared to about 50 percent nowadays. I have for a long time worked hard to increase the participation of women students' careers in physics. Fellowships for women have been and remain helpful in encouraging women to persist in their careers in physics, and I personally have spent much time in running seminars to promote this cause. Women do the same science as men, and society needs more physicists. I have found that women physicists promote more collaborative research and are dedicated mentors. In my own late career, I still love my work and remain highly active in research and student training, and I still enjoy lectures by women doing interesting physics research.

Yours Mildred Dresselhaus, October 2016

THE MILDRED DRESSELHAUS GUEST PROFESSORSHIP PROGRAM

INTERNATIONALLY-RECOGNIZED AWARD

Broadening one's horizons, initiating collaborations, creating role models. Within the Mildred Dresselhaus Guestprofessorship Program, CUI has established an award for successful senior scientists as well as junior scientists with high potential - to the benefit of the recipients but also of the local scientific community.

Prof. Mildred Dresselhaus came to Hamburg in the year 2012 just before the Cluster of Excellence was founded. Everybody was extremely pleased, when she agreed to give her name to the program. The guest professorship program invites women researchers to work within CUI for a period of up to six months. Excellent research conditions are provided to international outstanding scientists, who can focus on a research topic of their choice, give lectures or engage themselves in a variety of activities within the research community. The award includes a certificate and a personal prize money. It is presented within the festive frame of CUI's New Year's Reception by representatives from the scientific and political community of Hamburg.

Within a short period of time, the award became an internationally visible honor for young and senior women scientists in the broad CUI research field of photon and nanoscience. The number of self-applications and recommendations from Germany and abroad has always been high, which put the selection committee in the happy but difficult situation of having to choose the recipients from many extraordinary applicants and recommended women. In the past years worldwide leading women scientists came to Hamburg; new collaborations developed, existing contacts were strengthened.

In recognition of its success, the German Research Foundation (DFG) included the program in its toolbox. At the same time, a lot of people are needed to realize such a program. It was a great reward, when the organizing team received Universität Hamburg's Equal Opportunity Prize 2018. Now this team has organized the Mildred Dresselhaus Guest Professorship Conference from 4-6 April 2019, bringing together the outstanding Mildred Dresselhaus Guest Professors as well as experts on equal opportunity, diversity, and scientific careers.

The organizing team of the Mildred Dresselhaus Guest Professorship Program was awarded Universität Hamburg's Equal Opportunity Prize 2018. To the right: Vice President Prof. Jetta Frost

Mildred Dresselhaus Guest Professors 2013-2017

- Prof. Dr. Anna Krylov, University of Southern California, USA (2017)
- Prof. Dr. Tanya Zelevinsky, Columbia University, New York, USA (2017)
- Prof. Dr. Cristiane Morais Smith, Universiteit Utrecht, the Netherlands (2016)
- Dr. Friederike Ernst, Stanford University, USA (2016)
- Prof. Elspeth Garman, University of Oxford, UK (2015)
- Dr. Liesbeth Janssen, Heinrich-Heine-Universität, Düsseldorf, Germany (2015)
- Prof. Roseanne Sension, University of Michigan, Ann Arbor, USA (2014)
- Dr. Anouk Rijs, Radboud Universiteit, Nijmegen, the Netherlands (2014)
- Prof. Dr. Tamar Seideman, Northwestern University, Chicago, USA (2013)
- Prof. Dr. Rosario González-Férez, Universidad de Granada, Spain (2013)

ABOUT MILDRED DRESSELHAUS

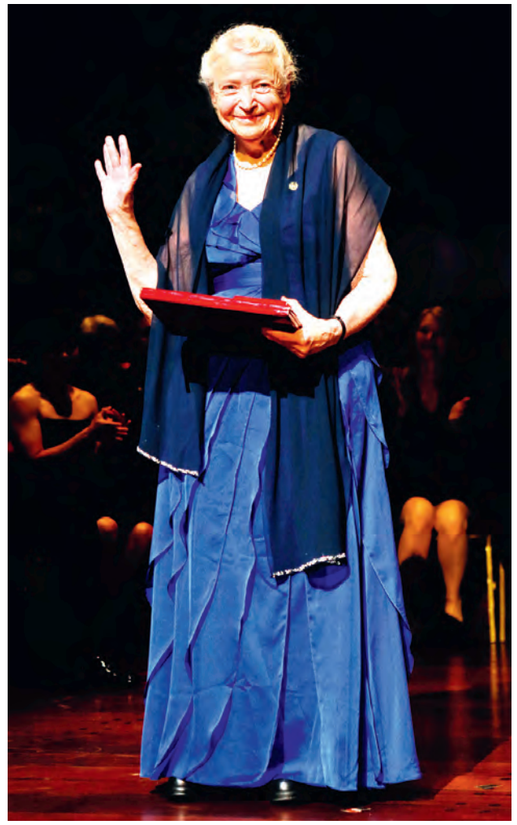
QUEEN OF CARBON, PIONEER AND ROLE MODEL

Mildred Dresselhaus, Professor of Physics, Professor of Electrical Engineering and Institute Professor at the Massachusetts Institute of Technology (MIT), was a pioneer in promoting opportunities for women in science and technology and a worldwide role model for junior scientists.

The daughter of poor Polish immigrants, she was born in the Bronx, New York, in 1930. At the age of four she started playing the violin and received a scholarship to attend a music school where she made contact with children attending much better schools than her own. Being a talented girl, she appreciated the difference and thus got inspired to push for the same opportunities. At the age of 13 she won a place at Hunter College High School for girls. Although successful as a student, she was advised that the only jobs open to her were schoolteacher, secretary or nurse. However, Mildred Dresselhaus had a good role model: inspired by her physics teacher, early mentor and future Nobel Laureate Rosalyn Yalow, she graduated in 1951 with a science degree from Hunter College – with the highest honors possible.

After working stays in Cambridge, Great Britain, and Cambridge, USA, Mildred Dresselhaus obtained her Ph.D. at the University of Chicago in 1958. In the same year she married physicist Gene Dresselhaus and had four children in quick succession. Some of her superiors were not eager to support her in juggling work and childcare commitments; however, due to a professorship funded by a female member of the Rockefeller family she had already made her mark on the MIT campus: in 1968 she became the first female tenured professor in MIT's engineering school, in 1977 she became head of the Center for Materials Science and Engineering, a Physics Professor in 1983 and Institute Professor in 1985.

The scientist, who has been called the "Queen of Carbon", has received numerous awards for her research. On top of her scientific success Mildred Dresselhaus has kept an artistic side of herself. In an interview with the MIT Faculty Newsletter (FNL) in 2006 she described her daily routine and explained why she was the first professor in the office in the morning:



Prof. Mildred Dresselhaus has been awarded 36 honorary doctorates, the Fermi Award, and the Presidential Medal of Freedom – among others

"My schedule is a little bit unusual for an MIT professor. I'm an amateur musician; I play violin, mostly, but also viola as a pinch hitter. And most evenings I have a musical event going on that's usually at my house. And if you have a musical commitment at night you have to leave the lab around 5:30 to get it all in. And then I also have to get some work done, and after 9:00 a.m. this place is crazy and there are few opportunities for serious work. So I have to add some time, like three hours before 9:00 a.m., to get some of my own things done. So, that's how I have the schedule that I do."

PROF. ROSARIO GONZÁLEZ-FÉREZ, JUNIOR AWARDEE 2013

POSITIVE IMPACT ON SCIENTIFIC CAREER

When asked about role models, Rosario González-Férez quickly hints at Marie Curie; in fact, however, physics has always interested her independently of anybody – in particular the question of how things work in detail. At the beginning of the 90s, it was not possible to study physics at the comparatively small university of her hometown Murcia in Spain. Thus Rosario González-Férez convinced her parents to let her move to Granada. Her first idea was to study astrophysics – but then she ended up with quantum and molecular physics.

In the course of researching, she became quite familiar with Germany: Prior to her guest professorship, Rosario González-Férez had already spent five years in Germany – among others as Alexander von Humboldt scholar and "Plan Propio de la Universidad de Granada" scholar at Universität Heidelberg. There she did research as a Postdoc in Professor Peter Schmelcher's group and laid the foundation for a permanent collaboration: Being in Hamburg she again collaborated with Schmelcher who in the meantime had become the director of the CUI graduate school and professor at Universität Hamburg. Together with his research group she investigated ultralong-range triatomic Rydberg molecules which are formed by a Rydberg atom and a ground state polar diatomic molecule. The features of these exotic molecular species open unprecedented opportunities for their control by means of weak electric fields.

Professor Jochen Küpper (Universität Hamburg, DESY) was her second collaborative partner during her time with CUI. Motivated by the experimental results from his group, Rosario González-Férez investigated the non-adiabatic dynamics of linear molecules in combined electric and laser fields. These theoretical studies led to the interpretation and understanding of experimental observations of non-adiabatic alignment and field-free orientation of linear molecules.

„I am very happy about the output. Due to my CUI stays, my scientific collaborations have been gradually growing in strength and diversity. And I hope they will continue in the future," Rosario González-Férez emphasizes. "In addition, there have been excellent results, which gave rise to several publications in prestigious scientific journals." Furthermore, the Mildred Dresselhaus Award meant a recognition for her scientific trajectory and motivates her to continue working in the same direction.

Rosario González-Férez is associate professor at the Departamento de Fisica Atómica, Molecular y Nuclear and at the Instituto „Carlos I" de Física Teórica y Computacional in Granada.

The Mildred Dresselhaus Award has been crucially important for Rosario González-Férez as it means a recognition for her scientific trajectory

SEVEN QUESTIONS ASKED OF ...

... PROF. GONZÁLEZ-FÉREZ

When do you have the most brilliant ideas?
In a relaxed and quiet environment. Some times when I am not at the University, and I am doing a completely different task such as hiking or a relax activity I get my best ideas. Maybe it is because being relaxed, I can concentrate on the problem without disturbance.

Which of your scientific works makes you especially proud?
I feel proud of many of my scientific works, but lately I am especially pleased with my collaborations with the experimental groups. My second work with them was really special for me. In the first one, we learnt that the adiabatic approximation used so far to describe the mixed-field orientation of molecules could not explain the experimental measurements. I realized that this approximation was not correct, and that a time-dependent analysis was required to understand the experimental observations. This theoretical study showed that the mixed-field orientation is in general non-adiabatic and we could predict the experimental conditions to reach an adiabatic dynamics. Since then, we had a fruitful collaboration.

Who or what has pushed your career the most?
My supervisors, both from my PhD and postdoc, and several colleagues have helped me on my career.

When you need an advice, who do you talk to?
I normally talk to a very good friend and my sister, both of them are also scientists.

How do you network? Do you use social media?
I normally don't use social media. I network still with the "old fashion methods" either with emails, phone calls or personal meetings.

Your tip for young scientists how to climb up the career ladder?
They should enjoy their work and never give up. For young women, they should keep trying because the scientific community needs them and should not get distressed by the quota discussion that sooner or later might affect them.

What would you be in another life?
An archaeologist or a writer of travel books, doing research in situ.

PROF. TAMAR SEIDEMAN, SENIOR AWARDEE 2013

GLOBAL CITIZEN WITH HIGH APPRECIATION FOR DIVERSTIY

Tamar Seideman very much appreciates being invited to speak to young female scientists

I love being able to make a contribution to society by using science," says Tamar Seideman. There are two aspects she has in mind: on the one hand, her research at the interface of physics, chemistry, and materials science, in particular in the field of nanotechnology; on the other hand, her ambition to serve as a role model for young women who want to go into science.

The scientist from Israel herself could not rely on any role model. She grew up in Israel, first in a kibbutz, later close to Tel Aviv. The year she spent at a boarding school in England was to give her life a significant direction, Tamar Seideman says, "I hardly spoke any English, but the natural sciences were easy to learn." So she played close attention to the natural sciences. During her year in England, her parents moved to Munich, so that Tamar Seideman did not return to Israel immediately but instead relocated to an international school in Munich. Since this rather small school couldn't offer an A-level course in history, she chose chemistry again. When thinking about a field for academic study, she considered mathematics, philosophy, music and chemistry – and again chemistry got the upper hand. "Chemistry offered diversity," Tamar Seideman says today," but I only realized years later that diversity is more generally an important criterion."

In the following years she got her master's and her PhD degrees at the Weizmann Institute in Israel, spent two postdoc-years in Berkeley and one more year as a Principal Investigator at the NASA Ames Research Center (USA) – until forced to leave the US for visa issues. From 1993 until 2003 Tamar Seideman lived in Canada and worked in the National Research Council of Canada in Ottawa. She then returned to the US and became Professor at Northwestern University in Evanston.

Today Tamar Seideman perceives herself as a "citizen of the world" who highly values diversity. Scientists from Russia, China, India, England, and Germany work closely together in her research group.

Diversity, however, also applies to gender, "We can't afford loosing half of the population as potential scientists. It is therefore very important to encourage young women – without discriminating against men, of course," Tamar Seideman states. She very much appreciates being invited to speak to young female scientists – a task which is part of the Mildred Dresselhaus Program.

Tamar Seideman is professor of chemistry and professor of physics at Northwestern University in Evanston, USA.

SEVEN QUESTIONS ASKED OF ...

... PROF. SEIDEMAN

When do you have the most brilliant ideas?
Usually late in the evening, often when I do a physical activity such as walking or gymnastics.

Which of your scientific works makes you especially proud??
It is difficult to single out one work – I like all my group's projects – but I am especially proud of our work on the problem of strong field coherent control, in particular the work on the subfield of strong field nonadiabatic alignment – the alignment of molecules to the polarization vector(s) of a moderately-intense short-pulse laser field, which has led to growing interest of other groups.

How do you network? Do you use social media?
Mostly conferences. I don't use social media.

Who or what has pushed your career the most?
Nobody pushed my career, unfortunately. It was probably curiosity and a drive to understand phenomena in physics and chemistry.

Your tip for young scientists how to climb up the career ladder?
Consider both fundamental and application driven-research and follow your curiosity. On long timescales curiosity-driven research will likely win.

When you need an advice, who do you talk to?
I would talk with a colleague, but depending on the nature of the advice this would be a different person.

What would you be in another life?
Probably I would follow the same career path, which is nevertheless very demanding.

DR. ANOUK RIJS, JUNIOR AWARDEE 2014

RAISING PEOPLE'S AWARENESS OF CAREER STEPS

When Anouk Rijs studied chemistry at the Free University of Amsterdam, it was normal to have a male world, "That's how it was. But there was one female professor as well. So I thought everybody can do what suits him or her most." After receiving her master's degree, she checked advertisements in industry and academia, realizing the interesting jobs all required a PhD. So she did her PhD at the Free University of Amsterdam and the University of Amsterdam, thus combining the two different fields of ultrafast spectroscopy and electron detection to study atmospheric questions and reaction dynamics.

Anouk Rijs, shown here in her lab in Nijmegen, had a close look at the career paths of other scientists in her research field, to find out about the key turning points in a career

At an early stage in her career, her supervisor, who was like a mentor, recommended her to find her own funding. So Anouk Rijs obtained a postdoc position within a European Network Program at the University of Santa Barbara in California. She loved learning a lot about new techniques and when she returned to the Netherlands after three years she was a pioneer in the field of bringing large molecules into the gas phase.

Today as an assistant professor she sees herself more and more as a role model. When asked, she recommends students to find someone they trust, maybe even from other disciplines, to make them aware of the steps they are taking. Anouk Rijs herself checked the career paths of scientists in her field to find out what is important at which point in a career. Rijs, "And don't think you're the only one who doubts. Discuss your doubts with your mentor and then – if you really want it – do it."

Anouk Rijs' aim is to become a full professor, perform great research, to teach more students and thereby to fill the same role as her professors did for her. "I never had any doubts that it is possible as a female scientist to become a professor. And I think it is really good for students to see that a career in academia is possible," she says.

During her guest professorship with CUI, Anouk Rijs continued the experiments she had already started together with Dr. Melanie Schnell (Max Planck Institute for the Structure and Dynamics of Matter). In collaboration with Prof. Arwen Pearson (Universität Hamburg) and Prof. Henry Chapman (Universität Hamburg, DESY) she experienced further new techniques. "In my research in Nijmegen we zoom into the heart of the proteins to see how things interact, how molecular recognition is established," she explains. Her aim in Hamburg was to connect the local, zoomed in picture to the functioning and global scale to understand how for example binding and conversion of ATP, our energy molecule, affect the structure of the entire protein.

Anouk Rijs is assistant professor of advanced spectroscopy and physical chemistry at Radboud Universiteit, Nijmegen, the Netherlands.

SEVEN QUESTIONS ASKED OF ...

... DR. RIJS

When do you have the most brilliant ideas?
On my bike from home-to-work or from work-to-home, when I am by myself. Sometimes late at night just sitting on the sofa, but certainly not on a very busy day!

Which of your scientific works makes you especially proud?
- Having built a very successful lab equipped with a set-up to study large biomolecules with unprecedented detail. This set-up is interfaced with the Free Electron Laser FELIX, which allows us to measure mass and structure specific infrared spectra to fully characterize structure and structural changes of all kinds of molecules.
- Pursuing a direction, by combining my methods to a new spectral region for my type of research, the far-infrared and terahertz regime, while advised otherwise. It is a huge success and we learn so much on peptides and how they adopt their structure, but also on the type of scientific questions we can answer. We develop new analysis methods etc. Exciting!
- The graduation of a PhD student in my group!

Who or what has pushed your career the most?
Who? Me! And the support of home, my friends, previous supervisors, colleagues all of the world. But very important are my collaborators, they bring new insights, challenges, friendships and also feedback, point out opportunities as for example to Mildred Dresselhaus guest professor position. What? The FOm/f grant I received (female physics grant), which made my first permanent position possible, and which allowed me to start my own (mini)-group.

When you need an advice, who do you talk to?
Many different people! My supervisor from my postdoc to discuss steps in my career. The same holds for an international colleague and friend. Of course also with Edwin, my husband, who is my sounding board for many things. But also my friends from my rowing team. Although, we all have different jobs with completely different backgrounds, we noticed that we have to make similar choices, follow similar steps in our career parts, experience similar difficulties. It is very helpful to have their "outside view".

How do you network? Do you use social media?
I talk a lot! Attending conferences, where I meet the peers in my field. The best place to start new collaborations, get ideas for your own research, to learn about the latest progress and state-of-the-art in my field. Furthermore, I use twitter to read about the latest news in my favorite journals and occasionally tweet about my work. I use linked-in to collect and manage my network. Of course, I use this social media, as well as putting announcements at the website of my faculty, for great break-throughs or special accomplishments.

Your tip for young scientists how to climb up the career ladder?
Let people know what you want! It might seem obvious for you, but until you say what you want, it is not always obvious for the people around you (also not for your supervisors).

What would you be in another life?
Professional rower! I love to be on the water! Or a pilot, I like the combination of learning complicated equipment (an airplane), combining technical knowledge with meteorology and traveling.

PROF. ROSEANNE SENSION, SENIOR AWARDEE 2014

CUTTING EDGE RESEARCH IN A FRIENDLY AND SUPPORTIVE CLIMATE

Roseanne Sension grew up in Minnesota, USA, in a family where higher education was much valued at a time when the natural sciences where not yet a wide spread option for young women. "It was expected for us to go to college and nobody ever said to me that I couldn't do science," Roseanne Sension remembers. So she went to Bethel College, a small College in St. Paul, first with the idea of entering medical school, then she got interested in mathematics and physical science. In 1986 she received her Ph.D. in physical chemistry at the University of Berkley in California. "What fascinated me was the power of being able to bring physics and chemistry together to find out how things work, why they work and how they influence biological systems". And she loved both theoretical and experimental work, "I was always fascinated by building up complicated machinery." Finally, she realized that she really liked research and that she wanted to be a professor.

Roseanne Sension then spent three years each at the University of Oregon, experimenting with molecular spectroscopy, and at the University of Pennsylvania, using ultrafast spectroscopy. In 1992 she moved to the University of Michigan, where her professional aims came true. She became the second tenured female professor in her department in 1999 and was promoted to full professor in 2007.

"Things have been changing dramatically since I have been in the business," she recalls. Today approximately 25 percent of the professors in her department are female due to a general change in education and in expectations during the last 50 years. The University of Michigan has taken deliberate efforts to become open to a diverse range of prospective faculty. "Legally we can't give preference to any group, so we tried very hard to make the climate friendly and supportive for everybody," she explains. Furthermore, regularizing the way young scientists are mentored had an impact. Today everybody gets mentoring through formal group and individual arrangements. This makes the playing field level for everybody.

Prof. Roseanne Sension's work fits perfectly into CUI. For many years she has used femtosecond laser pulses to analyze the ring-opening reactions of vitamin D. In Hamburg she cooperates with the group of Prof. R. J. Dwayne Miller from the Max Planck Institute for Structure and Dynamics of Matter. The focus is on direct information about the structure of a molecule while it is reacting. "In the end we will pull all this together – from our experiments in Michigan, at the LCLS in California, and here in Hamburg – and see whether we can confirm or whether we disprove our ideas about the way the reaction happens."

Roseanne Sension is professor of chemistry and professor of physics at the University of Michigan, Ann Arbor, USA.

Roseanne Sension was always fascinated by building up complicated machinery

SEVEN QUESTIONS ASKED OF ...

... PROF. SENSION

When do you have the most brilliant ideas?
The best ideas tend to come when I have the opportunity to dig deeply into a problem with minimal distractions. Often this is in the evenings, on weekends, and over the summer months.

Which of your scientific works makes you especially proud?
This is the hardest question here. I am satisfied with most of my work. I would say that it is the ongoing study of cobalamins that I find most satisfying. But I believe the best is yet to come.

Who or what has pushed your career the most?
My career has primarily been "pushed" by my own interests and ambition. The ability to be involved in something new – solving problems and learning something new all the time is an amazing opportunity. The opportunity to teach and improve upon teaching for our students is also satisfying.

When you need an advice, who do you talk to?
I usually talk to senior colleagues or peers – more often peers today.

How do you network? Do you use social media?
Most of my networking comes through conferences and other face-to-face meetings. I use social media, but not for work-related activities and contacts. I don't find it a useful way to make contacts in the first place.

Your tip for young scientists how to climb up the career ladder?
I'd tell young scientists to work hard, listen to advice from multiple sources, and to expect bumps and detours along the way. Be persistent and imaginative, you might find a satisfying career path you hadn't anticipated.

What would you be in another life?
I have always been interested in ancient history, archaeology. If I could start over I might choose to pursue research in the scientific side of archaeology. On the other hand, I have had amazing opportunities in chemistry and physics. There are no regrets here.

STEPPING OUT OF THE COMFORT ZONE

What is important for a successful scientific career? Liesbeth Janssen recalls her development as a mixture of enthusiasm, active engagement, and support.

Born in a village near Venlo in the Netherlands, Dr. Liesbeth Janssen studied chemistry at the University of Nijmegen, spent three postdoctoral years at Columbia University in New York and will continue her research at Heinrich Heine Universität in Düsseldorf until April 2017. "New York was great but the university in Düsseldorf is also a great institution. There is a very collaborative atmosphere and many great people work there," says Liesbeth Janssen, whose enthusiasm quickly spread to Hamburg as well: As CUI's Junior Mildred Dresselhaus Awardee she has the chance to work with the experimental groups at Campus Bahrenfeld. "This is really exciting because I will get new data for my research and at the same time I can follow the output of my theoretical work," Liesbeth Janssen says.

It almost comes as a surprise that Janssen has not always been as convinced about her career. "It took me a while to figure out what I want to do." Although initially interested in psychology, she started studying biochemistry. Once a student at university, however, she quickly realized how good she was in physics – something she would never have thought possible at school. "It really helps if somebody guides you in the right direction," she claims. Nether of her parents had the opportunity to study at a university, but they were very supportive of their four children. In addition, Janssen describes her mother as an "incredible strong woman" who succeeded in combining motherhood with a career for herself. So she is still the perfect role model for her - besides Marie Curie. Later on in her career, Janssen very much appreciated the American attitude that "you can make it happen" in combination with her postdoctoral advisor saying, "You have to do your best and try to bring out all your potential."

This environment pushed her to step out of her comfort zone and cross boundaries: After reading an article about the process when liquid becomes glass and the many unresolved fundamental questions associated with this phenomenon, she got interested immediately – even though the topic was completely unrelated to her earlier PhD work. "I wrote an email to the researcher, Prof. David Reichman, asking whether I could do a postdoc – and he placed confidence in me," Janssen recalls. She considers her development as a mixture of active engagement and support. "It is very useful to have a support network you can always fall back on. Moreover, if you want to push your career, you have to go to conferences, talk to people and present your work."

Due to her work with the experimental groups at Campus Bahrenfeld, Liesbeth Janssen can follow the output of her theoretical work, at the same times getting new data for her research

Liesbeth Janssen was a Humboldt Research Fellow at Heinrich-Heine-Universität in Düsseldorf. In April 2017 she became assistant professor at Technische Universiteit Eindhoven, the Netherlands.

SEVEN QUESTIONS ASKED OF ...

... DR. JANSSEN

When do you have the most brilliant ideas?
I think good inspiration can come from anywhere, especially from talking to other people, but turning inspiration into an actual feasible idea requires me to simply sit down, focus, and think. In my case, most of my scientific ideas need some time to mature and to be thought through carefully.

Which of your scientific works makes you especially proud?
I would say that is my postdoctoral work at Columbia. I chose to work on the theoretical description of glass formation – a topic that was very different from my PhD work. I didn't know anything about the subject before, so I spent the first year digging through textbooks and papers just to learn the basics. And then I wanted to develop this new theory and implement it numerically. At first my advisor thought it was too difficult, so we agreed I would work on it only for a short while, and if it failed I would switch to a different project. And then I got it working! It wasn't easy, but it makes me proud that I did it on my own, and it was an important step towards my independent career.

Who or what has pushed your career the most?
I think that would be my parents, who have always encouraged me to pursue my own ambitions, and my PhD advisors, who have always given me the freedom to pursue my own research interests. In addition, during my PhD I could go to many conferences, which has really helped me to establish a network for myself.

When you need an advice, who do you talk to?
I am very lucky to have had great PhD and postdoc advisors, all of whom I still turn to for career advice. Also friends and colleagues can offer a good (and sometimes different) perspective, so I also often ask them for advice.

How do you network? Do you use social media?
I enjoy talking to people in person, and conferences are great for that. As for social media I use Facebook, which I find to be helpful for staying in touch with friends, former colleagues, and people I met at conferences. People often share their latest research papers or career updates on Facebook, so it's a good platform for me to stay connected.

Your tip for young scientists how to climb up the career ladder?
First and foremost I think it's important to work on something that you're excited about. Furthermore, I've learned that making a career move requires you to step a bit out of your comfort zone, so don't be afraid to try something new.

What would you be in another life?
To be honest I think I would be quite similar to what I am now! Perhaps I would've studied physics instead of chemistry, but other than that, I certainly would still like to be a scientist.

PROF. ELSPETH GARMAN, SENIOR AWARDEE 2015

A LIFE-LONG JOURNEY: BOLD AND ENTHUSIASTIC

How much of a scientific career is planning, how much is networking, how much destiny or pure luck? Garman recalls an incident in her life, which has changed her career dramatically: Teaching physics at Somerville College, Oxford, in 1987, she was asked by Prof. Louise Johnson to have a look at the Laboratory of Molecular Biophysics (LMB) and meet with people. "I knew they were searching for someone to look after their new X-ray generator and electronic X-ray detector. But I thought this was just an informal meeting." Out of the blue she was asked a lot of strange questions and her wish to work part-time was challenged. A few days later she called the LMB office, to inquire about the application formalities for the job – which left the secretary bewildered. Apparently there was a misunderstanding: It turned out she already had the job without applying. "That was total destiny or chance."

However, her interest in physics is deeply rooted in her childhood and inspired by a Church of England nun with whom she is still in touch. "If Sister Janet Elizabeth had been a chemist, I would have been a chemist," she says. However, everybody in her family was expected to mend things and at the age of 11 she even built her own telescope. "This was part of life," Garman states, who later became an expert in complicated machines and coding computers. In the beginning, male colleagues in Oxford thought her too weak to move the helium gas cylinders and use the workshop. They didn't know she was a rower in a race team, "It was alright as soon as I showed how strong my muscles were."

Another part of life was the year she spent teaching in Africa before her physics degree. "I was always encouraged by my parents to care for others," she recalls. But Africa changed her outlook on life even more, influencing her attitude in the scientific community as well. Garman became a passionate teacher who loves to see the curtains open in young people's faces. In return she gets a lot of support from below, like the student award for the most acclaimed lecturer in the Oxford Medical Sciences Division.

However, Garman admits that she herself learned some of the necessary lessons very late. As a mother of two daughters plus a Swazi foster daughter and taking care of her mother-in-law, she worked part-time for 12 years or, as she puts it, "I worked full-time for two-thirds pay." Due to her experience she developed what she calls her magic line, "You have part of my time but all of my brain." So when asked as a mentor, she tells women to give it a go and not to feel too bad when things don't work out, "It's hard to put yourself forward because you risk failure, but you have to be bold and enthusiastic, you have to say that you want to talk at a conference, you have to apply – applying makes a big difference."

Elspeth Garman is professor at the Department of Biochemistry, University of Oxford, UK.

Elspeth Garman (left) explains her research to Margaret Thatcher. The former Prime Minister of the United Kingdom studied chemistry and wrote a thesis on X-ray crystallography

SEVEN QUESTIONS ASKED OF ...

... PROF. GARMAN

When do you have the most brilliant ideas?
In the shower, on my daily ride to work on my bicycle and when exchanging thoughts with my graduate students.

Which of your scientific works makes you especially proud?
When I was a nuclear physics graduate student I helped develop a new way of Carbon 14 dating of artefacts by accelerator mass spectrometry. The Wien filter I designed for it and then machined up myself was used in Oxford on an accelerator dedicated to C14 dating for 25 years, and I was responsible for the performance tests on the C14 ion detector.

In structural biology, I am proudest of the experiment I carried out in 2005 with my then graduate student, Robin Owen. We determined the so called 'experimental dose limit' for a protein crystal held at 100 K during a diffraction experiment (embarrassingly sometimes called 'the Garman limit'). It is the maximum dose that can be absorbed by the crystal before the biological information from the protein structure might be compromised by radiation damage effects. The experiment involved a lot of 'crystal killing' in the X-ray beam, and use of microPIXE (proton induced X-ray emission) to accurately find the atomic species in the crystals so that we could calculate the X-ray absorption coefficient for them and thus estimate the absorbed dose. Over the last 20 years, I have developed the application of PIXE to proteins, to enable the metals in them to be unambiguously identified. I am really proud of using this methodological development, originating from my nuclear physics background and which has now been used successfully on over 300 proteins, sent to me by researchers all over the world.

Who or what has pushed your career the most?
Me: I am self-driven, no one has driven me.

When you need an advice, who do you talk to?
My collaborators and crystallographic colleagues worldwide. I also ask a dear school friend called Lucy. I have known her since I was nine years old, and I trust her wise judgement (she became a lawyer).

How do you network? Do you use social media?
I network preferably in person, and also with colleagues on Skype. I do NOT use any social media apart from email: there are surely more interesting ways to spend any spare time I have.

Your tip for young scientists how to climb up the career ladder?
Enjoy the work, retain your curiosity, and try to maintain a life-work balance (I am bad at this!). Most importantly, don't climb the ladder at the cost of other people, or by being unfair to those around you.

What would you be in another life?
An eye Doctor in Africa, because of my experience during my ten months of voluntary teaching in Swaziland in 1973 and from helping my father, who lost his sight six weeks before I was born and thus never saw me.

DR. FRIEDERIKE ERNST, JUNIOR AWARDEE 2016

ALWAYS DECIDING ON GOOD INSTINCT

"Almost anything is interesting when you look into it," says Friederike Ernst, shown here in the Mildred Dresselhaus Prize Ceremony

Dr. Friederike Ernst didn't have a role model for a career in the natural sciences – at least not in her family. She always trusted her instinct and decided for options that sounded interesting and promised to be fun. Thus she became a truly multi-disciplinary and international scientist: After studying and working in London, Berlin, New York and Stanford, the thirty year old Mildred Dresselhaus Awardee 2016 was doing research in Hamburg on nanoscale materials, specifically on depolarization mechanisms in two-dimensional materials.

"I did very well in trusting my instincts," Friederike Ernst says. After having graduated from high school in Bonn, she applied on a whim to study biology in London. Biology in wet labs, however, didn't suit her well, but Computational Neuroscience did – researching the brain. In doing so she watched how mathematicians and physicists formed brain models and decided, "I want to be able to do that as well." She enjoyed both the process and the idea of what you could achieve using such models.

So Friederike Ernst received her diploma in physics from Humboldt University in Berlin, where she finally heard about a professor who was doing research on carbon nanostructures at the Free University of Berlin. She didn't know much about that field but it sounded so interesting, that she got in contact with Prof. Stephanie Reich – a very enthusiastic scientist who finally offered her a position as a PhD candidate. "Actually, almost anything is interesting when you look into it," Friederike Ernst says. She did her doctor's degree in "a very nice group with very good results" and went to a lot of conferences. Thereby she benefitted from the contacts her professor had made teaching at the Massachusetts Institute of Technology (MIT).

After receiving her PhD in 2013, Friederike Ernst moved to Columbia University, New York, to work on nanotubes in the groups of Prof. Tony Heinz and Prof. James Hone. In 2014 she received a three year Leopoldina Postdoc Scholarship to study two-dimensional nanostructures. When Tony Heinz and his group moved to Stanford in 2015, Friederike Ernst went along, built up the new lab together with her colleagues, and did her first accelerator based experiments.

In August 2015 she gave birth to her daughter Klara – the week before she had still been working in the lab, two weeks later she continued her research, "My husband and I could share the time with the baby. After four months we engaged a nanny and from then on we both worked full time again, meaning parental full, normal 40 hours," she describes everyday life.

In the meantime the family has moved the center of life to Berlin. Klara attends a daycare, and a second child was born. "Further aims? Well, let's see," Friederike Ernst says laughingly. She takes no stock in rigid career plans. Choose a direction and "just do it".

Friederike Ernst was a postdoc at Stanford University, USA, before she joined CUI. By now she is secretary general of Blockchain Bundesverband.

SEVEN QUESTIONS ASKED OF ...

... DR. ERNST

When do you have the most brilliant ideas?
I have the best ideas when I'm doing something else entirely and let my mind wander – going for a walk, sitting by the playground, hiking. Needless to say, 99 percent of my work as a scientist are not instances of having brilliant ideas, but actually seeing them through: Standing in the lab, adjusting mirrors, fixing pumps, following up on emails, scouring the literature. Not very glamorous...

Which of your scientific works makes you especially proud?
Our latest findings on modulating Casimir forces between layers of 2D materials: We show that layered materials contract before they thermally expand upon being optically pumped. We conducted several experiments over the course of two years to determine cause and effect – the collaboration became larger and larger and finally we understood what happens.

Who or what has pushed your career the most?
I have been lucky to work with extraordinary people – people who are passionate about what they do and are convinced they can push the boundaries. It rubs off! A willingness to take risks is also advantageous: it helps to unwaveringly believe that everything is going to be just fine. Scientists often work on a string of serial contracts until they secure a permanent position fairly late compared to periods in life when people typically desire stability: when they have kids.

When you need an advice, who do you talk to?
Trusted colleagues and ex-advisers, as well as friends, depending on the issue at hand.

How do you network? Do you use social media?
Mainly at conferences and at talks and seminars organized at the university. I find that the most valuable time at conferences and meetings is the supposedly free time, which is excellent for networking. It helps that conferences are often in out of the way places where there is nowhere else to go! I have tried social media but for me it doesn't work.

Your tip for young scientists how to climb up the career ladder?
Do something you're passionate about and don't undersell yourself. Sure, the more established scientists have more experience than you, but they were in your shoes once! Science relies on the constant influx of new ideas and new brains.

What would you be in another life?
An artist.

PROF. CRISTIANE MORAIS SMITH, SENIOR AWARDEE 2016

A WORLD LEADING CAREER IN PHYSICS – AGAINST ALL OBSTACLES

The path from a small town in the middle of Brazil to the renowned University of Utrecht is a rather long one. Cristiane Morais Smith has mastered this path with a clear vision and a deep interest in learning. Today Prof. Morais Smith is a world leading theoretical condensed matter physicist with a broad spectrum of research activities including topics such as topological quantum matter, graphene physics, quantum Hall physics, high temperature superconductivity, quantum gas physics, and nano physics.

Cristiane Morais Smith comes from a family of strong women. One grandmother consciously decided to move from a farm to a village and start making bread to enable her children to go to school; the other grandmother became a widow at the age of 29 and inherited her husband's work as an accountant at the City Hall. She was the first woman to work as a public employee in that small village, thus enabling her children to go to university – one of them being the mother of Cristiane Morais Smith. "My mother is an extreme key figure in my career," she says, recalling two significant events in early childhood: She and her brothers and sisters didn't know how to swim yet, but her mother allowed them to jump from the very high diving platform – after asking a young man to pick them up in the middle of the swimming pool and bring them to the edge. "This was a big lesson of courage," Cristiane Morais Smith says. The second event was a national drawing competition for celebrating forests. Although she wasn't good at drawing, her mother asked her whether she would like to win. Then she told her to find a tree that she liked and to copy it until it would be perfect. The girl was "only" second in the competition, but she thought, "Never mind, I will win the next one." At an early age she had learned her lessons: to find out what she liked, try it, and if necessary try again.

Cristiane Morais Smith has a long standing connection to the Hamburg research landscape

At the age of 23, Cristiane Morais Smith published her first paper as a Rapid Communication in Physical Review A. The work was part of her master's thesis, which was supervised by a young professor who later became one of the most important physicists in Brazil. At the age of 25, she got a permanent assistant professor position at the University of Sao Paulo state. Two years later, she was invited to a conference at the ICTP in Trieste and to her surprise a German professor presented the results that she had obtained during her master's thesis. "This is when I realized that I had done something important. And I could do more." She decided to go for a PhD abroad and was then accepted at ETH Zürich. After holding a C1 postdoc position in Hamburg, Germany, she was awarded the Professor Boursier Fellowship from the Swiss National Science Foundation and became associate professor in Fribourg, Switzerland. Finally, in 2004 she was offered a Chair in Condensed Matter Theory and became a full professor at the Institute for Theoretical Physics of Utrecht University, the Netherlands. In 2008, she was awarded the prestigious VICI fellowship from the Dutch Research Organization (NWO), which has strongly boosted her research. She had to overcome quite a few obstacles to get where she is today, but she says, "Bad things that come in your life can also be important impulses. One should just keep focus and never give up."

Cristiane Morais Smith is a professor at the Institute for Theoretical Physics at the University of Utrecht, the Netherlands.

SEVEN QUESTIONS ASKED OF ...

... PROF. MORAIS SMITH

When do you have the most brilliant ideas?
During seminars. When I hear what my colleagues are doing, I get a kick, I get highly inspired by their work and brilliant minds.

Which of your scientific works makes you especially proud?
The ones which involve simple calculations, because the initial model has been so well chosen. I believe that we are in the right way to describe Nature when the solutions are simple, but this requires a very strong intuition to start with the right model description.

Who or what has pushed your career the most?
My fear of not being up to the standard. I came from a little place in an underdeveloped country, I always had the impression that I need to know more, to learn more, to do more, to be up to the ideal standard. It is a never ending process.

When you need an advice, who do you talk to?
My husband. He is a very wise and equilibrated person.

How do you network? Do you use social media?
I try to be very serious and competent in whatever collaboration that crosses my way. I believe that these collaborators will spread good words about me, and the reputation will be established. I do not use social media for my work.

Your tip for young scientists how to climb up the career ladder?
Be passionate, be ethic, be true, and don't be naive. The rest will follow.

What would you be in another life?
I would repeat it all, still be a scientist, working on theoretical physics. The only difference is that I would concentrate on fewer topics from the beginning, and I would be more strategical than I have been. I have always been too idealistic. My life could have been much easier if I had been more aware of the rules of the game, and I would have simply played accordingly...

PROF. TANYA ZELEVINSKY, JUNIOR AWARDEE 2017

THIS CAREER GIVES YOU A LOT OF FREEDOM

A trip to New Mexico changed a lot for Tanya Zelevinsky. She was an undergraduate at the Massachusetts Institute of Technology (MIT) in Cambridge, USA, when she got a chance to attend a summer school on atomic physics in Los Alamos. "I really enjoyed the fact that only two or three investigators work on each experiment and that one can experience and understand the whole project," Zelevinsky recalls this important point of her career.

At that moment in life, Zelevinsky had already mastered a rather long journey. She grew up in Siberia in a quiet place surrounded by nature, very much focused on science and exposed to how scientists live. As a physicist and an engineer, her parents were both part of this community. "You absorb the family culture and your perception of science is positive. I didn't understand the details then, but it helped not to be intimidated," she explains.

When the family moved to the US, life became more difficult for a couple of years. Tanya had to find her place in an American high school and adjust to the culture. She already knew, however, that she wanted to focus on a precise science like maths and jubilated when she was accepted at MIT: "I was really glad to get there and be surrounded by people who are passionate about science." After graduating in maths and physics, she enrolled in a PhD program at Harvard University. The experiment was along her advisor's side interest so she had to figure out a lot on her own, which was very challenging but it made her stronger in the long run. "Realizing that the project depended mainly on me was quite daunting," she remembers. Stubbornness then became part of her work ethic.

At the age of 26, Tanya Zelevinsky moved on to Boulder, Colorado. She enjoyed the beautiful and intellectually stimulating environment. It was there that she learned the value of working in a larger group – and the value of scientific risk taking. "If you are creative enough, a few ideas will always come out. But this works only in an environment where you feel free enough to take the risk," she thinks.

After finishing her postdoc, Tanya Zelevinsky left Boulder to start a new field at Columbia University in New York. The same year her son was born, but by then she was trained to cope with challenges. There was no program in atomic physics at Columbia and it was her job to put the university on the map for this kind of research. While taking care of a baby, Zelevinsky built the first lab and hired students. There was no colleague to talk to and expectations were very high. In 2012, her daughter was born. "I had to take it one day at a time and go slowly. Now it's getting where I wanted it to be," she says happily. The prospect of hiring new colleagues clearly improved her environment.

Today, Tanya Zelevinsky is satisfied with what she and her team have accomplished so far. Thinking about the future, she hopes that they will still have opportunities to try new directions. Her research field is testing the fundamental laws of nature using atomic and molecular physics. Zelevinsky: "This career gives you a lot of freedom."

Tanya Zelevinsky is an associate professor of atomic, molecular and optical physics at Columbia University, New York, USA.

Stubbornness became part of Tanya Zelevinsky's work ethic

SEVEN QUESTIONS ASKED OF ...

... PROF. ZELEVINSKY

When do you have the most brilliant ideas?
The best ideas usually come when I am thinking about physics but doing something else. For example, I solved the most frustrating and puzzling problem in my PhD experiment while going for a run along the Charles River in Boston.

Which of your scientific works makes you especially proud?
At this point in time, I am very pleased that I was able to re-introduce modern atomic and molecular physics to Columbia University, and to create a group pursuing work with ultracold molecules from several new angles, including photodissociation chemistry and fundamental metrology. And I am certainly proud that my recent PhD student received a well-deserved thesis prize from the American Physical Society for some of this work.

Who or what has pushed your career the most?
The support from my family has been most critical to my career. And I received much inspiration from observing the work ethic of my former advisors. It also helped to not worry excessively about all possible difficulties with various projects that I've worked on along the way, and just jumping into the work!

When you need an advice, who do you talk to?
I've found it helpful to talk to a family member or friend outside of physics, since they can offer a fresh perspective. Some of my senior colleagues have also been very generous with offering good tips and support when needed, although initially I didn't always have the confidence to approach them for advice.

How do you network? Do you use social media?
I do not find time to network extensively, nor do I use social media. However, conferences and workshops often present the best opportunities for networking, since everyone is separated from their daily obligations and there is plenty of flexible time to learn about new unpublished ideas, start or enhance collaborations, and get to know colleagues on a more personal level.

Your tip for young scientists how to climb up the career ladder?
One has to be hard-working, curious, and lucky! I feel it is important to work on projects that truly appeal to you and excite your creativity, and not feel pressured to join any particular research direction that may seem popular at the moment. And finding an independent project that is interesting and yet relatively unchartered is essential.

What would you be in another life?
Probably I'd still be a scientist, but one that works more closely with the natural world. I would likely enjoy a career with more field work, for example studying biodiversity.

PROF. ANNA KRYLOV, SENIOR AWARDEE 2017

MAXIMAL SATISFACTION COMES FROM HARDEST PROBLEMS

Anna Krylov comes from a country that, she says, "is not on the map anymore": the Soviet Union. Despite officially having gender equality, the society was conservative, which explains why her mother was not thrilled when Anna as a sixth grader got hold of a molecular biology textbook and saw her future in science. She harassed her parents to buy her a chemistry set and participated enthusiastically in science Olympiads. Later she decided to study organic chemistry at Moscow State University but changed her mind when a male friend raved about a theoretical physics program in the chemistry department that was "not suited to a girl". Anna Krylov says, "I chose quantum mechanics on a dare."

Anna Krylov believes that failures are instrumental to success

It worked. Anna Krylov completed her undergraduate studies with excellent distinction, married, gave birth to a girl – and, for once following her family's expectations, took a year's maternity leave. Her "time off" was eye opening. "I understood that giving up my career is not an option," Anna Krylov remembers. She returned to the university in 1989, a time of political upheaval. When The Wall came down the professor announced that questions about the Eastern Bloc would be removed from the exam, because it had just ceased to exist. "Imagine what that meant for us!" says Anna Krylov.

Two years later, in 1991, the family emigrated to Israel. It was a jump into the unknown. Speaking neither Hebrew nor English, she communicated science using mathematics and was accepted to the Ph.D. program at the Hebrew University of Jerusalem, where she spent the next 5 years studying molecular and quantum dynamics. Still, she took occasional cleaning jobs to complement the family's income. "I liked to make things clean and shiny, it made my inner chemist happy," Anna Krylov recalls.

After graduation in 1996, Anna Krylov moved to Berkeley, intending to learn how to use quantum chemistry for studying excited-state dynamics. But she soon realized that these tools simply did not exist. Inspired rather than intimidated, Anna Krylov dedicated herself to electronic structure method-development. "I decided to work in this area because it is extremely challenging. It requires advanced mathematics, a deep understanding of physics, and programming prowess," Anna Krylov explains.

It also takes a lot of investment to test new ideas. After joining USC as an assistant professor in 1998, it took her two years to develop her first project – only to discover that the key idea was "garbage". Yet, from this failure came a deeper understanding of many-body problems. New ideas of how to address strong correlation followed, and they worked. Anna Krylov believes that this failure was instrumental to her ultimate success. She believes that "maximal satisfaction comes from attempting to solve the hardest problems, even if you fail in the process." As she learned from rock climbing: "Never be afraid to fail. If you never fail, you're not attempting hard enough problems."

Anna Krylov is Gabilan distinguished professor in science and engineering and professor of chemistry at the University of Southern California, USA.

SEVEN QUESTIONS ASKED OF ...

... PROF. KRYLOV

When do you have the most brilliant ideas?
They come unpredictably. Sometimes when my mind wanders, like when sitting at a dull lecture or hiking. Or during a lazy chat about science over beers. Sometimes in my dreams. Sometimes when I am arguing with someone about a certain point, I suddenly see how that exact point relates to a problem I'm working on.

Which of your scientific works makes you especially proud?
Difficult question – it is hard to choose favorites. And the answer may change several times per day! But I would say my work on connecting many-body wave-functions and molecular orbital theory via observables. This includes developing and extending the concept of Dyson orbitals and natural transition orbitals into new domains. I am also proud of my contributions to methods for open-shell and electronically excited states within the EOM-CC framework, especially for strongly correlated systems – the spin-flip approach. What makes me proud the most, however, is the success of my students and postdocs.

Who or what has pushed your career the most?
I think the best push came from realizing that failing is not an option, because no one has my back, and the accepting that, as a woman, I need to work twice as hard. This said, I have been extremely fortunate to have had supportive mentors, from my days as an undergraduate to the present.

When you need an advice, who do you talk to?
Depending on the problem, my colleagues, my friends, my mentors, my peers.
You need to gather information to arrive at the best decision. Sometimes it is not who you talk to, but the act of talking itself – it helps you organize your thinking and often takes you half-way to the decision. I often talk to my partner; he is patient and is a good listener.

How do you network? Do you use social media?
By talking to and corresponding with people, going to and organizing conferences, visiting and hosting visitors. Networking opportunities also arise through service – you meet people at panels, committees, and boards. I do not use social media: I have completely quit Facebook.

Your tip for young scientists how to climb up the career ladder?
Do not follow the fashion, follow your passion. Be a trendsetter, be stubborn, be the best. Work on the hardest problems.
Critical for success is how you communicate your science to others in papers and at conferences. Put your best effort into this, do not cut any corners. Learn from each paper you read, every talk you hear. Take advantage of professional training in speaking and writing.
Be stubborn about science, but listen to your senior colleagues about strategies to advance your career. But do not take advice blindly; remember that there are always other strategies available to you.

What would you be in another life?
Sometimes I think I would be a biologist; sometimes a pure physicist. And I would have discovered my passion for outdoor sports earlier and pursued it more vigorously.

A LIFE SCIENTIFIC

By Elspeth Garman

Prof. Elspeth Garman (right), University of Oxford, UK, has been awarded the senior Mildred Dresselhaus Award 2015. Her mentee, CUI Professor Arwen Pearson gave the honorary speech

I am 6½ and it is a special day. The desks in my Village Primary School in mid-Northumberland in the north of England are cleared to the sides for the first time since I started there, and a large chalk circle has been drawn in the middle of the floor to represent the sun. The teacher has an orange speared by a knitting needle, and walks round the room rotating the orange on its axis. I am fascinated and inspired. That evening I carefully note the view from my bedroom window in our large freezing cold Victorian vicarage, and then again in the morning. To my great disappointment the view is unchanged – the earth has not rotated beneath us. I thus get the idea of relative motion...

I am 7 and I do my first experiment. My mother returns from the nearest town 20 miles away with a tube which produces red stripes on the outside of white toothpaste. I am very curious and ask if the stripes are already on the paste inside or if they appear as the paste comes out of the end. I get a non-committal 'adult' reply, so after dark I dissect the tube with scissors to find out. I make a big mess and get into trouble.

I am 11, I have failed the 11+ and I am at a Church of England Convent boarding school (St. Hilda's, sadly closed in 1995) in Whitby, Yorkshire, and the summer end of year exams are not going well. I am bottom of the class in most subjects, with only Algebra left to go: the 'B' stream beckons. Two 'friends' lock me in the school library for three hours as a joke. All I have for entertainment is my algebra exercise book, and it occurs to me that I could read through it: revision was not a word or practice I had previously contemplated. I come top in the exam with 87 percent and thus cling to my A stream status and acquire a competitive urge.

I am 13. The class are in a bus travelling up to the Senior School for a lab session. Our Physics teacher, Sister Janet Elizabeth, asks us how long it takes for light to travel from the sun to the earth. I shout 'eight minutes'. My classmates turn on me and ask how I can possibly know this, and I can't answer. I have somehow just always known, and now my destiny is set. I will study physics. From then on my nickname on good days is 'Prof', but never in my wildest dreams do I imagine that this will be apposite one day!

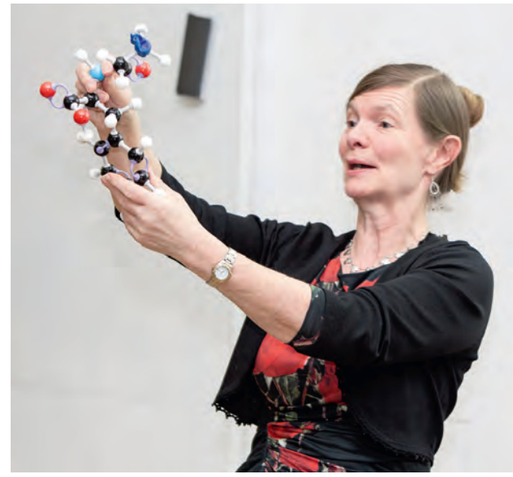
I am 18 and have just failed (by a long way) the 3rd year 6th form November entrance exams to read Natural Sciences at Newnham College, Cambridge. I leave for nine months of teaching Maths and Science in a large girls' secondary school in Manzini, Swaziland, Southern Africa. I cover for every subject on the curriculum (even games, at which I have always failed to shine) except Zulu. I discover I am born to teach. This experience changes my life and eventually results in the amazing gift of a Swazi foster daughter, the orphaned child of one of my pupils, now with three children of her own.

I am 20 and in my second year at Durham University reading Physics. I work and play (row and sing) hard and love it. I go as a summer student for 15 weeks to CERN in Geneva and join the team determining the magnetic moment of the muon. It is very stimulating but tough. I realise that not many women go into nuclear physics research, but decide I will be one of them. The experiments involve lots of people, too many for me to understand every aspect of the data collection, so after Durham, I go to Oxford to do a DPhil (PhD) in experimental low energy nuclear physics where, with a small team, we can plan and execute the whole experiment ourselves on the accelerators housed four floors under Keble Road. I am trained to use the workshop (lathe, milling machines etc) which has stood me in excellent stead ever since.

I am 24 and rowing for Osiris (University's 2nd crew) with Oxford University Women's Boat Club, having started a women's club at my College, Linacre. During my DPhil and the seven subsequent years as a Research Officer and College tutor in the Nuclear Physics Department, I teach Physics at seven different Oxford Colleges. Having married my landlord, Dr. John Barnett who was permanently based in the Atmospheric Physics Department, I want to stay in Oxford, but Nuclear Physics research funding is starting to dry up.

I am 33 and while tutoring Physics at Somerville I am approached by Louise Johnson from the Laboratory of Molecular Biophysics (LMB), who asks 'What next?'. I don't really want to think about this since I now have a two year old daughter and am prime carer for my 81 year old mother-in-law, who lives with us. However, she persists, telling me that LMB are searching for someone to look after their new X-ray generator and nuclear physics type electronic detector, with which they carry out protein crystallography, a technique used to find the three-dimensional shapes of biologically important macromolecules. Six weeks later I am working in LMB 66 percent time and have changed fields to protein crystallography/structural biology, but I do not know what an amino acid or a protein is, and I have a lot to learn!

After 12 years of looking after the LMB X-ray equipment and assisting researchers to use it, and with a second daughter (now eight) at home, I start to work fulltime and begin my own research group. I have been lucky enough to work with a continuous stream of great graduate students, and together we have made well recognised contributions to methods development for structural biology (cryo-cooling techniques for crystals to extend their diffraction lifetime, elemental analysis of proteins using a nuclear physics proton accelerator, systematic studies on radiation damage induced artefacts in protein crystallography).



Elspeth Garman keeps thrilling her audience

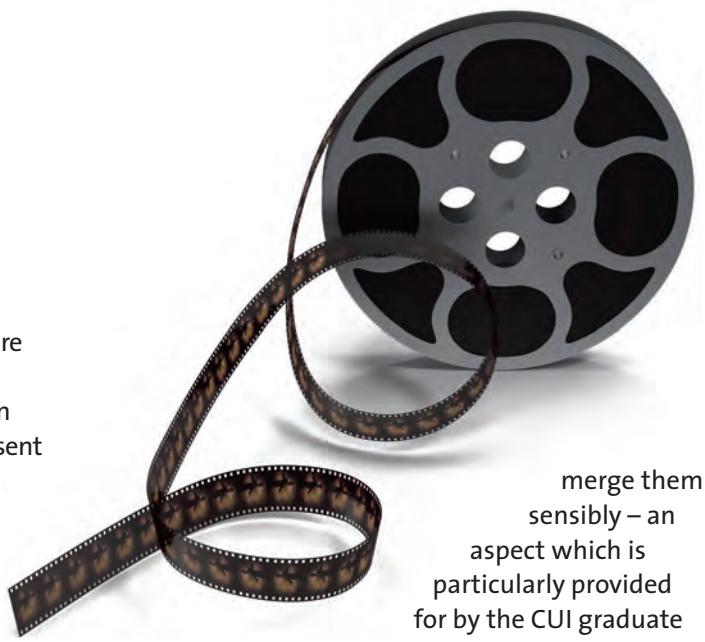
I have travelled the world teaching, demonstrating and lecturing these methods, and made many friends. In 2009 I looked at my group: as research students there were two Mexicans, a Russian, and a Jordanian, as well as an Indian postdoc and me. I love the international nature of our science and the cross-cultural exchange it fosters. In the same year I was seconded 50 percent time for five years from Oxford University's Medical Sciences Division to the Maths, Physics, & Life Sciences Division Doctoral Training Centre, as Director of first the Life Sciences Interface and then the Systems Biology Programmes: a wonderful interdisciplinary experience which has resulted in four outstanding graduate students joining my group.

I have not regretted my crazy move of research fields for a second. Macromolecular crystallography requires intellectual contributions from many different fields of science, and communication is a very useful skill. Despite now having a Senior Rail Pass, I am still learning, and I feel fortunate to work with the next generation of inquisitive and enthusiastic young scientists.

Elspeth Garman had originally written her story for "Phenotype", a magazine of the Oxford University Biochemical Society, where a shortened version appeared. The unabridged German translation was first published in "CUI News".

THIS IS CUI

MAKING THE MOLECULAR MOVIE



How do the elementary building blocks of nature move? Can atoms, molecules and electrons in matter be controlled and driven with precision on all length and time scales? These questions represent some of the largest and most exciting challenges of modern science – and the central aim of the "The Hamburg Centre for Ultrafast Imaging" (CUI).

The cluster of excellence was founded in 2012 within the German excellence initiative. Interdisciplinary teams of Universität Hamburg, Deutsches Elektronen-Synchrotoron (DESY), the Max Planck Institute for the Structure and Dynamics of Matter (MPSD), the European XFEL GmbH (XFEL), and the European Molecular Biology Laboratory (EMBL) have joined forces under the umbrella of CUI to work at the interface between quantum physics, molecular biology and nanochemistry. The processes occurring here usually start with the very fast movements of electrons within atoms or between neighboring atoms. Using the ultrafast radiation sources on Campus Bahrenfeld, the scientists produce pictures at femtosecond temporal resolution and combine them into a molecular movie. The conclusions about elementary motion processes drawn from this procedure help to understand complex functions of matter and finally controlling them.

Thereby, the borders between the different disciplines of physics, chemistry, biology, and medicine gradually dissolve. People who work at these interfaces have to know different scientific concepts and be able to merge them sensibly – an aspect which is particularly provided for by the CUI graduate school's training program.

Another special focus is on equal opportunities. The CUI action plan has two significant goals: to enable a good balance between a scientific career and family and to increase the percentage of female scientists at all levels of a scientific career. Hence CUI initiated two programs, the Mildred Dresselhaus Guest Professorship Program and the Louise Johnson Fellowship for female postdocs. Workshops and events covering the compatibility of family and work, leadership, and intercultural competence provide the requisite know-how for a scientific career. A mentoring program offers customized support for selected female junior scientists. Most offerings are developed in cooperation with partners.

After the funding period has ended, the new cluster CUI: Advanced Imaging of Matter has started operating on 1 January 2019. It focusses on new functionalities emerging with increasing complexity and growing system size.

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

DESY. mpsd Max Planck Institute for the Structure and Dynamics of Matter European XFEL EMBL

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