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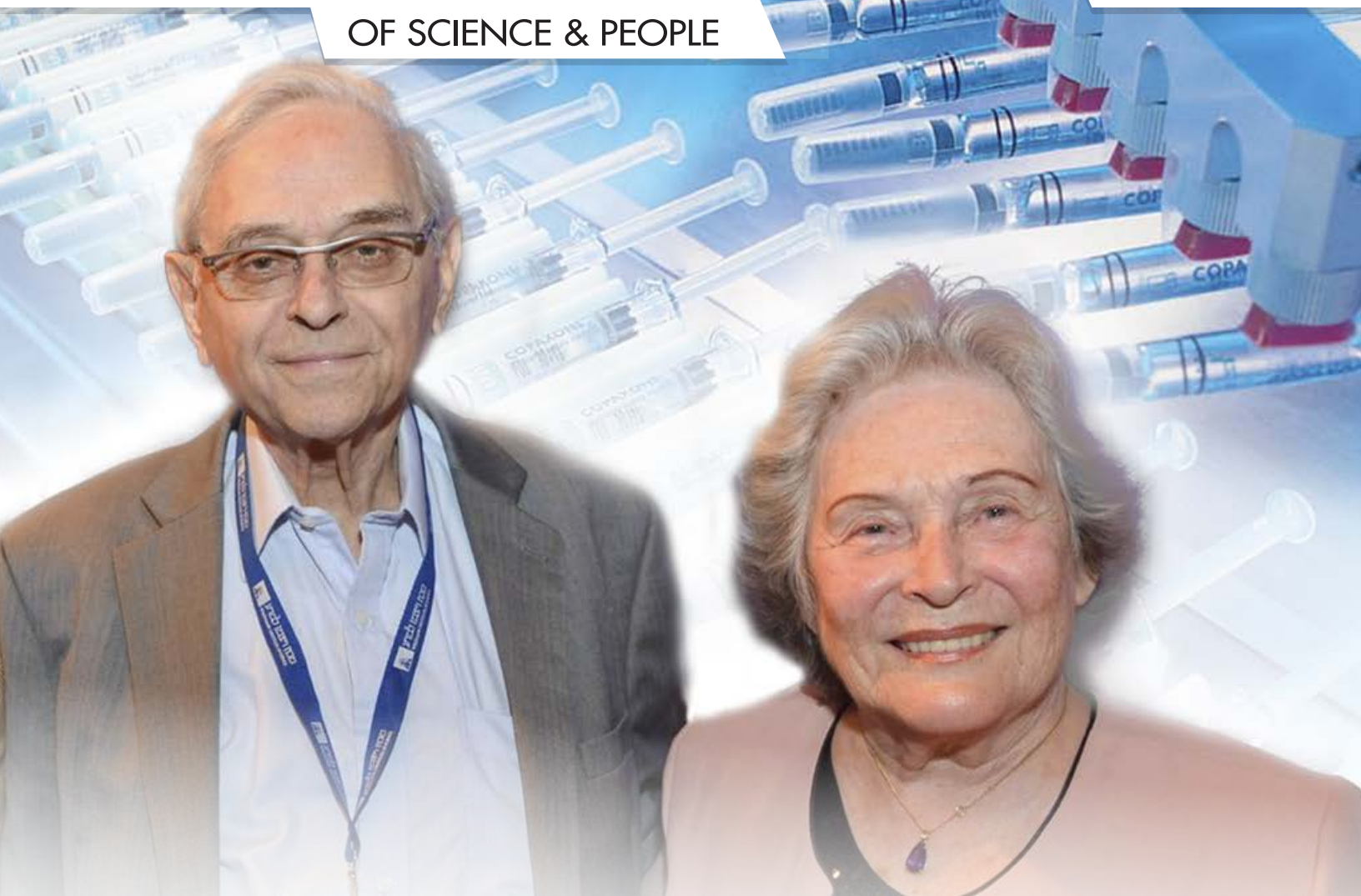

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Credits

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From the President

Dear Friends,

This is a special issue of *Weizmann Magazine* as it has a new "app" that will allow you to read issue after issue by pulling it from a virtual bookshelf on your device.

It is also a special issue because our cover story highlights the quintessential Weizmann Institute couple: Prof. Ruth and Dr. Uriel Arnon, who recently gave a transformational gift for the establishment of the Ruth and Uriel Arnon Science Education Campus adjacent to the Weizmann Institute. Ruth's career in science touches so many aspects of what the best possible science is all about—discovery and commercialization, a commitment to the next generation of scientific leaders, and investment at a national level to ensure the vibrancy of science and technology for all of Israel.

In this issue, you will also read about a major area of new emphasis, nuclear magnetic resonance research. This area is enabling scientists from a variety of fields to watch biological processes in action at super-high resolution, and examine and refine non-biological phenomena such as artificial nano-materials like never before. It is a new horizon and The Weizmann Institute has historically led in this field and recently recruited several young scientists who will enable us to move forward, in a dramatic way, in NMR.

Last but not least: This year we are celebrating 50 years since the establishment of diplomatic relations between Israel and Germany, a relationship that was, in great part, an outgrowth of scientific ties between the Weizmann Institute and the Max Planck Society. There is no greater example of science breaking through the walls of politics and leading to new achievements for the benefit of humankind—and, remarkably, so soon after World War II.

With all best wishes for a pleasant spring,

Prof. Daniel Zajfman
President, Weizmann Institute of Science

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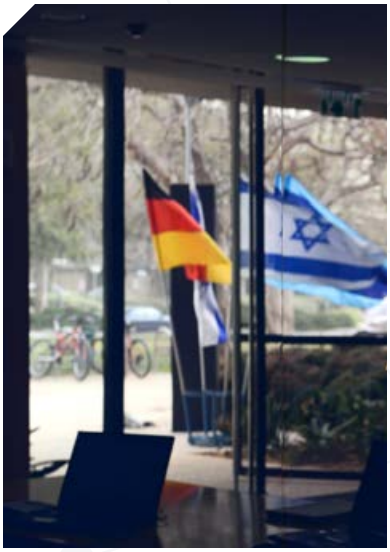

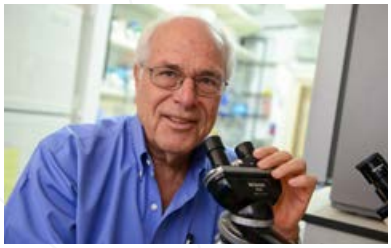

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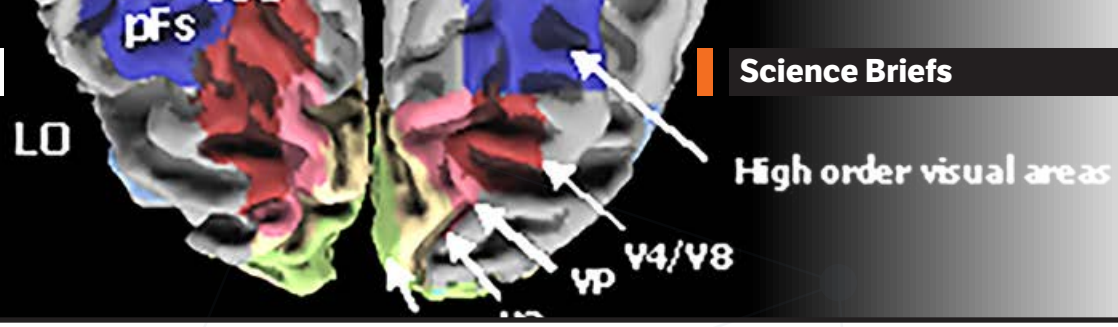


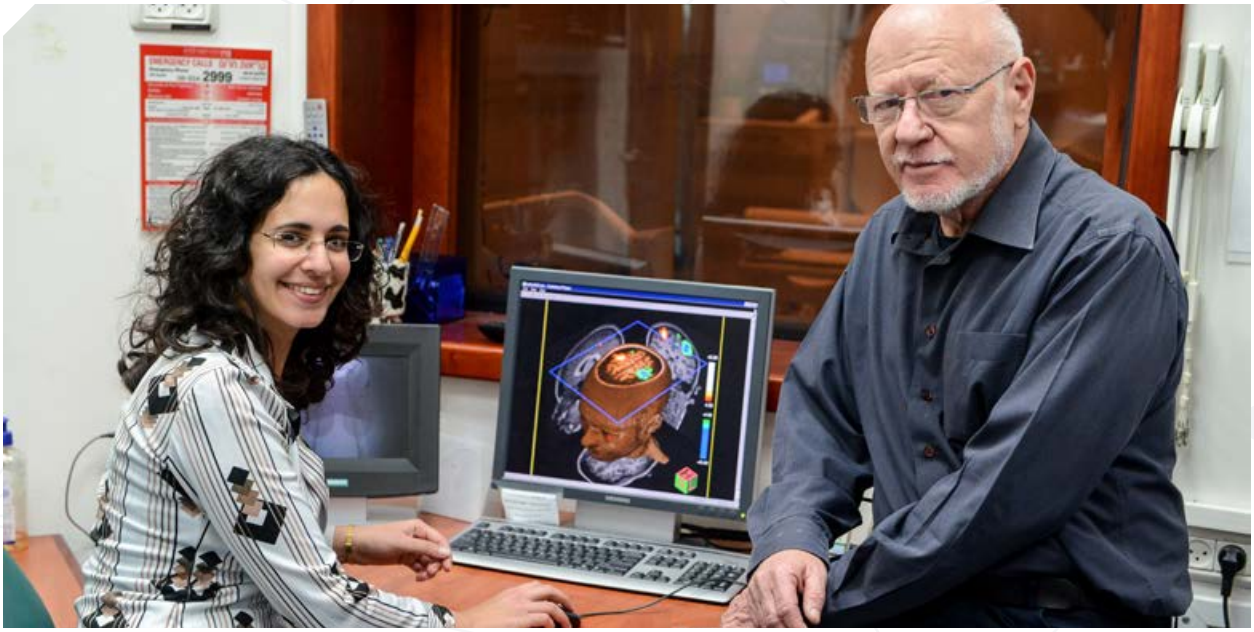
Idiosyncrasy and autistic brains

The language of people with autism spectrum disorder is sometimes said to be "idiosyncratic." New research conducted by Avital Hahamy in the group of Prof. Rafi Malach in the Department of Neurobiology suggests that idiosyncrasy may, in fact, be a much deeper principle—one that separates autistic brains from those of non-autistic people. The research was conducted in collaboration with Prof. Marlene Behrmann of Carnegie Mellon University.

The researchers looked at data collected in five experiments, in which functional magnetic resonance imaging (fMRI) was conducted on resting brains. When people are at rest—not thinking of anything in particular—patterns of slow oscillations emerge, and these tend to synchronize across the brain's two hemispheres. Previous research had suggested that there was under-synchronization between certain areas in the brains of people on the autistic spectrum, but other studies had shown that autistic brains had over-synchronization in these areas.

The new study suggests that both happen, in fact: Over- and under-synchronization may both occur in autistic brains. The real difference, according to the findings, is that non-autistic brains all tend to conform to a general pattern, while those of people on the autistic spectrum veer from the pattern, each in its own individualistic manner. The scientists even found that the severity of the disorder in an individual was reflected in how "idiosyncratic" their synchronization patterns were.

The researchers hypothesize that normal socialization and interaction with the environment may be what creates the "conformist" synchronization pattern in most individuals, while the brain of a person with autistic spectrum disorder, who lacks sustained interaction with his environment, may not be molded on such consistent patterns.



Doctoral student Avital Hahamy and Prof. Rafi Malach

Science Briefs

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Brain Waze?

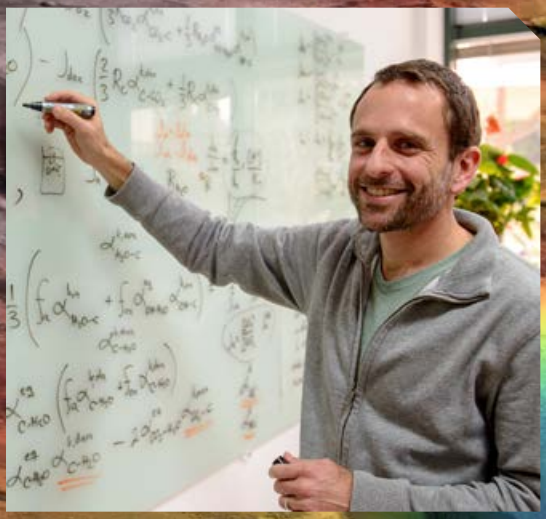
Pilots are trained to guard against vertigo: a sudden loss of the sense of vertical direction that renders them unable to tell "up" from "down" and sometimes even leads to crashes. Why does vertigo happen? Neuroscientists have suggested it is due to a malfunction in a sort of "3D compass" in the brain.

To find out where the brain's 3D system is located, Prof. Nachum Ulanovsky of the Department of Neurobiology investigated one of nature's most accomplished pilots: the bat. Much of his research involves bats precisely because their brains have evolved to navigate in the 3D world. In a finding published in *Nature* in December, he showed, for the first time, that the mammalian brain has a special network for dealing with the third dimension of that compass.

In conducting the study, he fitted Egyptian fruit bats with microelectrodes and their own video tracking devices, so that he and his team could see how the bats' brain cells responded as they freely flew around or roosted upside down. The team found that the cells that govern 2D, horizontal, orientation were located in a separate part of the brain from the one where the 3D orientation cells operated. These 3D cells apparently "compute" the head's orientation in a way that can be described by an exceptionally efficient system of mathematical coordinates. Of course, the bat is unaware of the complex computations going on in its brain—it simply points its head and flies off into the night.

The study won accolades from Prof. May-Britt Moser, a neuroscientist at the Norwegian University of Science and Technology in Trondheim, who shared the 2014 Nobel Prize for Physiology or Medicine for the discovery of a two-dimensional navigation system in the brains of rats. In an opinion piece that accompanied the article in *Nature*, she wrote, "Now this blueprint can be applied to other species that experience 3D in a more limited sense." The 'bat-nav' system is, she continued, "surprising—but also surprising in its beauty."

Martian fire and ice



Perspective view of southern Thaumasia, Mars, showing converging tributaries that are a major indication of running water and warm and wet episodes in the early history of Mars. Although the surface is now cold and desiccated, in early Mars history, water formed an open-basin lake, clearly filling the crater, forming a delta, and breaching the lower rim (foreground), draining water to lower elevations.

The image was taken by a Mars Reconnaissance Orbiter Context Camera overlain on Mars Global Surveyor Laser Altimeter data. Blue colors are low elevations, white is high. Rendering by James Dickson, Brown University.

The geography of Mars continues to be a puzzle: The most recent models show that the Red Planet has probably always been an icy cold place. But the geographical features on its surface suggest that liquid water once flowed there.

Dr. Itay Halevy of the Department of Earth and Planetary Sciences has now shown how the ice could have melted for short periods in the planet's history, producing a sort of "Martian spring." That spring, however, would have been anything but mild: The warming would have been the result of violent volcanic activity. Eruptions of such now-dormant volcanoes as Olympus Mons, the largest volcano in the Solar System, may have been hundreds of times the force of the average eruption on Earth—and may have lasted up to a decade. From what we know of Earthly eruptions, the quantity of gases spewed must have been enormous.

Dr. Halevy and his colleagues assessed these amounts and created a simulation of the way that those sulfurous gases would have interacted with the dusty Martian atmosphere. Sulfur can warm as a greenhouse gas or cool by forming particles that shade the surface from the Sun's rays. According to their calculations, the warming effects would have outweighed the added cooling, heating the surface just enough to allow water to flow at low latitudes—for dozens to hundreds of years at a time. It is during these repeated "brief"—in planetary terms—but intense wet periods that the surface of the planet was carved by flowing rivers and streams.

Israel Prize 2015

The Weizmann Institute has two Israel Prize winners for 2015: Prof. Zelig Eshhar (right) of the Department of Immunology, in the life sciences category and Prof. Shimon Ullman of the Department of Department of Computer Science and Applied Mathematics in the mathematics and computer science category. The Israel Prize is the country's highest honor.

Dr. Yifat Merbl

What happens to proteins after they leave the factory?

Dr. Yifat Merbl recently returned to the very lab in the Weizmann Institute's Department of Immunology in which she conducted her MSc studies—now as the head of a new research group, following her PhD and postdoc at Harvard University. The view from the window of the lab—which used to belong to Prof. Irun Cohen, now Professor Emeritus—hasn't changed much in the time she was away. Inside, however, with new, advanced high-throughput equipment and unique techniques she has developed, Dr. Merbl will be making her way into uncharted territory in protein research.

"Proteins are templates," she says. Though we tend to imagine them as a 'final product,' in fact they undergo all sorts of additional changes after they leave the 'factory'." Without these changes, most proteins would not be able to function; the complexity this adds to our system is the 'fine-tuning' that enables highly specific responses, cellular stability, working regulatory mechanisms and more."

The process of manufacturing proteins from the DNA "instructions" is known as translation and thus the alterations to the resulting protein sequences are called post-translational modification (PTM). PTM comes in all shapes and sizes: Proteins may be cut or chains of proteins may be linked together. Bits may be added or removed; changes may be reversible or irreversible. Some 200 different types of PTM have been identified. All together, the number of protein configurations is around a thousand times greater than the number of genes in the human genome.

New Scientists

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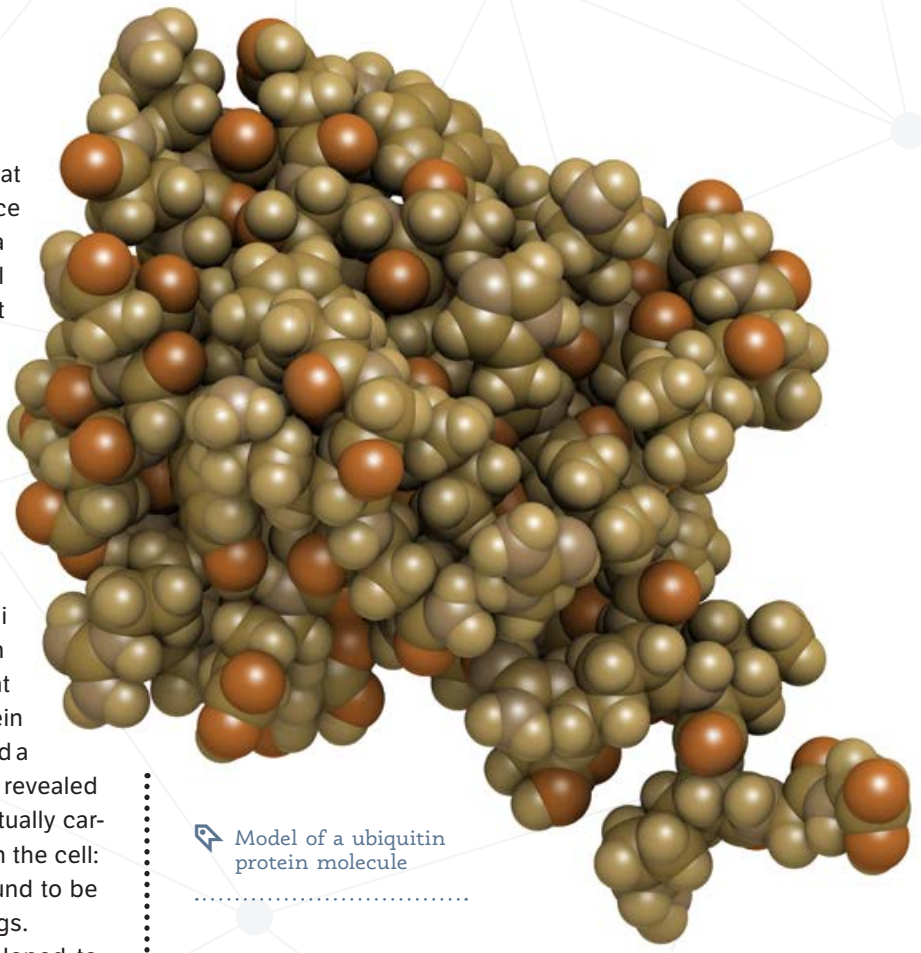
A grounding in immunology

Dr. Merbl grew up in Israel, in the town of Givat Shmuel. After an extended military service as an air force officer, she completed a BSc at Bar-Ilan University in computational biology. Prof. Cohen, of the Department of Immunology, made key discoveries with relevance to diabetes, though her research went in a different direction. He was an "amazing mentor," she says.

In her postdoctoral research in the lab of Prof. Marc Kirschner of Harvard University, Dr. Merbl began looking at a PTM step in which small tags are added to proteins. In the late 1970s, Israeli scientists Profs. Avram Hershko and Aaron Ciechanover of the Technion showed that these tags, called ubiquitin, signaled protein degradation, a finding for which they received a Nobel Prize. In the years since, research has revealed that ubiquitin and ubiquitin-like proteins actually carry out a large range of signaling activities in the cell: Some 600 different enzymes have been found to be involved in the regulation of these protein tags.

Dr. Merbl used the system she developed to identify the targets of a ubiquitin-like family member called FAT10, showing that it plays a role in cell division. When this protein was repressed, cell division of cancer cells was stopped.

In her new lab, Dr. Merbl will continue to investigate FAT10 to unravel the role it plays in both cancer and inflammation. She will need to identify effects that extend beyond the cell—to the tumor microenvironment, for example, or the entire organism. But FAT10 could be just the beginning: The method she has developed for profiling PTM casts a wide net over all sorts of protein modifications. This high-throughput method is capable of simultaneously capturing the activities of multiple proteins and their interactions with the molecules that perform the alterations; and Dr. Merbl is able to control the cellular conditions to see which modifications take place in situations of stress or disease.



Model of a ubiquitin protein molecule

In other research that she is conducting, Merbl will use the PTM profiling platform to analyze tissue samples to profile the "signature" of ubiquitin by analyzing its interactions across some 9,000 human proteins.

Progress in the field of post-translational modification, says Dr. Merbl, has been hampered by lack of analytical tools; but because it deals with the ways that individual proteins function in the cell, it has the potential to yield many clinically relevant results. Ultimately, she says, "we want to learn how to reshape the cellular environment."

Dr. Merbl is married to Einav Laser; the two are mothers to a four-year-old, and one-year-old twins.

Dr. Hagen Hofmann

The Edith Wolfson residences, which the Hofmann family now calls home.

One new country, two new labs

A two-month visit to the Weizmann Institute in 2006 changed Dr. Hagen Hofmann's life in a profound way. The German native worked that year as a research fellow in the lab of Prof. Gilad Haran in the Department of Chemical Physics. Today—eight years later—

Dr. Hofmann and his young family find themselves busy learning Hebrew and adapting to life on the Institute campus. He joined the Weizmann Institute's Department of Structural Biology in August 2014.

"It was really a totally rational decision," Dr. Hofmann said. "The Weizmann Institute is simply the best place to do science and offers unprecedented opportunities for a young scientist. I feel lucky to be here."

After earning his BSc and PhD *summa cum laude* in biochemistry at Martin-Luther Universität in Halle-Wittenberg, Germany, Dr. Hofmann spent the next six years as a postdoctoral fellow at the University of Zurich in Switzerland. Prof. Haran encouraged him to apply for a position at the Weizmann Institute.

In his interview, he talked to a dozen people who "were enthusiastic about what I was proposing to do," he says.

Dr. Hofmann says he has been given a "once-in-a-lifetime" opportunity to open two fully equipped laboratories. 8–9

Most surprising of all, he says, was the absence of discussions around administration and funding sources. "It was clear that the Institute offered real scientific independence and all the necessary support and facilities to realize my ideas while working in an excellent department."

When he visited with his wife, Andrea, and their two children, Charlotte and Karl (aged 4 and 6) a year ago, the young ones, he says, "immediately fell in love with Israel." They moved in the midst of Operation Protective Edge in the summer. Since then, he says, the friendly, open atmosphere of young scientists and their families living on campus made them feel welcome. "We were invited out for meals and visits constantly. And when Andrea's parents visited recently, they were impressed with Israel and are eager to return," he says.

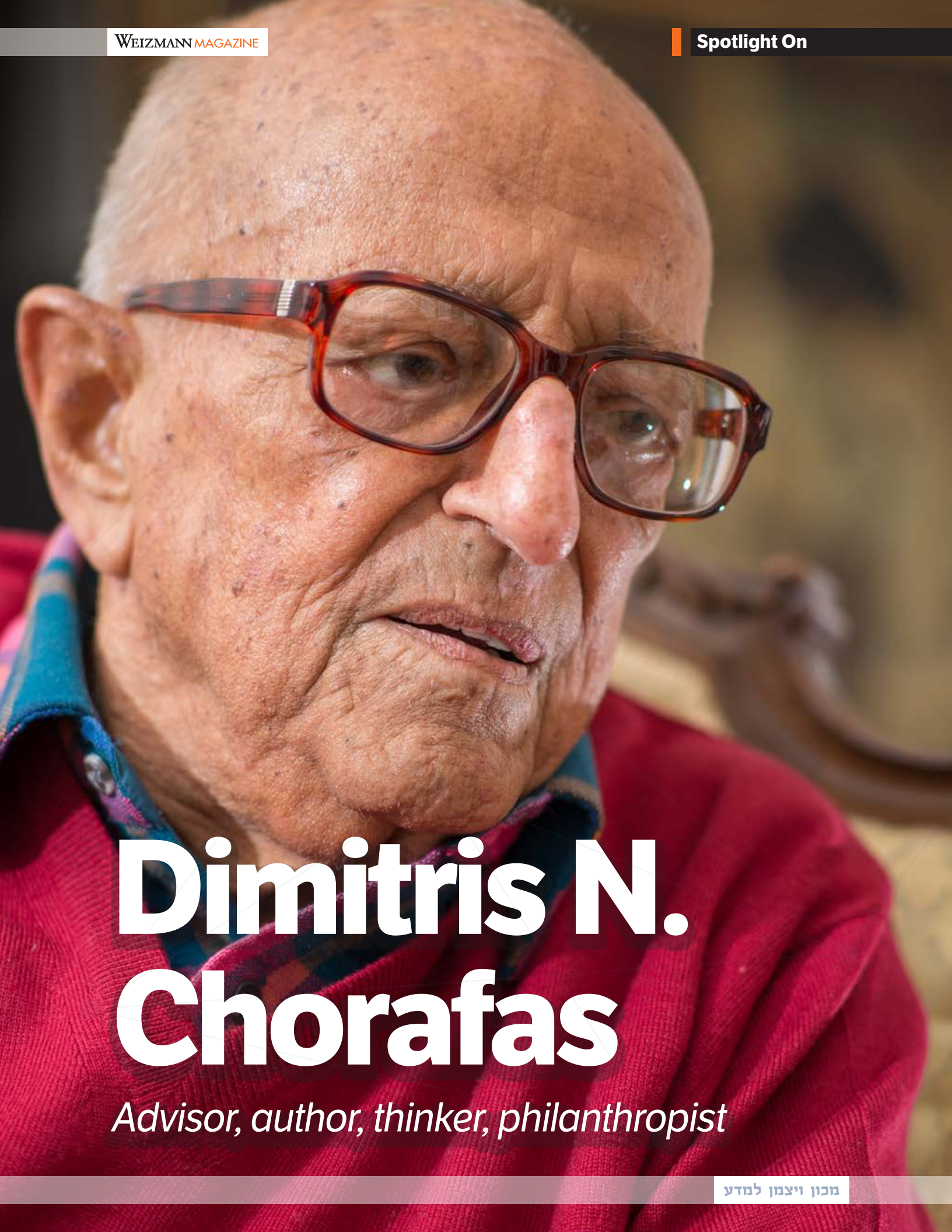
Dr. Hofmann says he has been given a "once-in-a-lifetime" opportunity to open two fully equipped laboratories: one for biochemistry and molecular biology, and the other for optics and laser spectroscopy. He plans to work from "the bottom up," starting at the molecular level, observing and measuring transcription factors—proteins that guide the actions of DNA—using *in vitro* single-molecule fluorescence spectroscopy. Then he will move to the cellular level, using single-molecule live-cell imaging to measure the number and distribution of the transcription factors. He plans to start with bacteria.

How bacteria survive

In contrast to humans, certain bacteria have a survival mechanism referred to as "competence" that enables them to incorporate whole chunks of DNA from sources outside the bacteria cells, and to form durable spores that can survive even space travel. However, competence develops in only a small number of cells, perhaps five to 10 percent of them, and only when nutrients are scarce. While the central transcription factor and its regulator—ComK and ComS, respectively—are well known, it is still a mystery how they affect only a small number of cells and how the individual molecules interact in this circuit.

Structural and dynamic information about ComK and ComS is scarce, and neither has been successfully crystallized, the first step to determining their structure using x-ray crystallography. ComS is what is known as an "intrinsically disordered protein," or IDP. In humans, ComS is suspected of playing a crucial role in the onset of numerous pathologies including cancer and age-associated neurodegenerative disorders.

Dr. Hofmann is investing in state-of-the-art technologies with single-molecule resolution that is required to find structural clues about these proteins. Future synthetic biology approaches to rewire or reprogram genetic circuits for pharmaceutical and industrial applications may greatly benefit from the single-molecule and nanofabrication techniques he plans to develop.



Dimitris N. Chorafas

Advisor, author, thinker, philanthropist

Spotlight On

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Loss of a dear friend: *Weizmann Magazine* interviewed Dr. Dimitris Chorafas shortly before his passing in November. To honor his memory, we have left the article intact as he approved it.

Dr. Dimitris N. Chorafas likes to say that "the most expensive thing in life is low quality" as it relates to industrial products and all sorts of services, including social services. He would know, as an engineer and long-time international financial advisor to some of the most prestigious global companies including IBM, General Electric, and many European banks. But he's also careful to point out that that goes for education too.

It is precisely this keen interest—a preoccupation, really—with educational excellence, conveying knowledge and wisdom to the next generation, and investing in the right people at the right time that characterizes Dr. Chorafas—and which led him to the Weizmann Institute of Science. A native of Greece who now resides in Switzerland and France, Dr. Chorafas, who is 88, recently gave a transformational gift to the Weizmann Institute to establish the Chorafas Institute for Scientific Exchange. The new entity will fund about 10 scientific conferences every year at the Weizmann Institute in a wide variety of areas of investigation.

"The Chorafas Institute will amplify our capabilities to bring together scientific leaders from around the world here at the Weizmann Institute, reinforcing and strengthening the Institute as a hub of scientific research," says Prof. Israel Bar-Joseph, Vice President for Resource Development and Public Affairs, and Dean of Education.

Chorafas's relationship with the Institute goes back nearly two decades, and the recent gift reflects a commitment to the Weizmann Institute that has grown and developed over that time.

Badge of confidence

In 1992, in collaboration with the Swiss Academies of Sciences, Dr. Chorafas established a foundation to reward the best scientists chosen by the correspondent academies of sciences in Western countries. Four years later, the Dimitris N. Chorafas Foundation of Switzerland began awarding merit-based financial prizes to outstanding science students completing their doctoral studies at about two dozen academic institutions around the world. The concept was that the prizes would encourage cream-of-the-crop

The Lopatie Hall of Graduate Studies housing the Feinberg Graduate School

students at the best universities to invest themselves in science, expand our understanding of the world, and lay the groundwork for future discoveries.

The Chorafas Foundation has distributed awards of up to $5,000 to hundreds of students at partner institutions in the US, UK, Canada, Japan, China, France, Germany, Italy, Greece, Switzerland and Israel. Today, it has 21 partner institutions; seven other institutions were partners in the past.

"What I found over the years was that, among all these excellent students, the Weizmann students were really the most impressive."
— Dimitris Chorafas

Dimitris Chorafas with his partner, Eva Maria Binder

At home in Lausanne

Nearly two dozen Weizmann Institute doctoral candidates have received the Chorafas Prize since it was launched. It is considered one of the most prestigious prizes offered by the Feinberg Graduate School. Past recipients include Dr. Shahal Ilani, Prof. Omer Reingold, Prof. Nirit Dudovich, and Prof. Ron Milo, all faculty members of the Institute today.

"What I found over the years was that, among all these excellent students, the Weizmann students were really the most impressive," says Dr. Chorafas, who has historically reviewed the candidates' profiles for selection himself, in cooperation with his board. In fact, for that reason, in recent years the Chorafas Foundation asked the Feinberg Graduate School to serve as an official advisor to the foundation in its annual selection process of all candidates worldwide, in an effort to ensure the prizes go to the most promising future scientists.

"Such a recognition of the work done at Weizmann clarified to me that what we were doing here was on par with anywhere else in the world." —Prof. Ron Milo

The goal of the prizes is to reward exceptional performance and encourage significant future contributions to science and technology. "Getting the Chorafas Prize as a young student made me feel that I was now playing in the real league of the 'grown-ups,'" recalls Prof. Milo of the Department of Plant and Environmental Sciences, who received the award in 2004. "Such a recognition of the work done at Weizmann clarified to me what we were doing here was on par with anywhere else in the world. It was the right boost at the right time for me and propelled me forward in deciding to make a career in basic science research."

A vibrant, intellectual life

Dimitris Chorafas was born in Greece in 1926. He volunteered for the government army during Greece's civil war (1944–49). The army—backed by Great Britain and the U.S.—fought against the military branch of the Greek communist party, which was backed by the Soviet Union and several eastern European countries. It was one of the first conflicts of the Cold War. To this day, Chorafas has 14 pieces of shrapnel in his body from a grenade that exploded nearby him. His most salient memory was from Christmas night in 1944, when he found himself and fellow volunteer Greek soldiers encircled in a factory near Athens with only provision bullets, whiskey and crackers. Communist forces were all around. Everyone in his group was untrained. Chorafas said they survived thanks to downing the factory's whisky, which settled their nerves and gave them the guts to shoot.

After the war, he received his bachelor's degree in electrical and mechanical engineering from the National Technical University of Athens, and went on to be a Fulbright Scholar. He received an MSc in computers from UCLA and a Doctor of Science in mathematics and logic at the Sorbonne in Paris. He did postgraduate studies in banking, finance and operations research at UCLA, the University of Denver, and George Washington University. He joined the faculty of The Catholic University of America in Washington D.C.

Then he moved onto the business world, where he helped establish IBM's Applied Science departments in Europe and was Director of Management

The Chorafas Prize

The Chorafas Prize is one of the Feinberg Graduate School's most prestigious prizes, awarded to the most outstanding students in any given year. "There is no doubt that in selecting the candidates for this award, we have always sought out the most promising

students and individuals, and we see years later that these exceptional students do become scientists who are leaders in their fields," says Prof. Irit Sagi, Dean of FGS. Prof. Sagi leads an FGS committee which serves as a formal advisory body to the Chorafas Foundation which reviews the candidates in all 21 partner institutions worldwide for the Chorafas Prize.

"The role of philanthropy is to step in and infuse funds into research so that societies can help themselves," says Dr. Chorafas.

Information Systems at Booz, Allen and Hamilton International, the consultancy. Following these affiliations, as an independent management consultant, he advised banks including the Union Bank of Switzerland and corporations including Honeywell, Univac, Nestlé, and the National Iranian Oil Company. Yet he always remained closely tied to academia, serving as a visiting professor at École Polytechnique Fédérale de Lausanne (EPFL) and head of information systems at the École d'Etudes Industrielles of the University of Geneva.

One of the seminal themes in Chorafas's life has been his thirst for knowledge, and, in parallel, his quest to disseminate it. He is a voracious reader with a phenomenal memory, and an unusual ability to synthesize information and clearly analyze it. He is a prolific writer, having published 165 books to date; his 166th, on business ethics, is to be published in 2015. His titles focus on a wide range of issues including research and development, reliability engineering, risk management and finance.

His lifelong partner, Eva Maria Binder, who is from Germany, serves as his editor and proofreader, working passionately and tirelessly on his behalf and serving as a liaison with publishers.

Chorafas has a rare dexterity with names and sayings of philosophers, political leaders, and

Prize student

One of the most recent recipients of the Chorafas Prize is Dr. Liron Barak, who completed her PhD studies in physics under the guidance of Prof. Eilam Gross in the Department of Particle Physics and Astrophysics. Dr. Barak, who is married and a mother of three, started a prestigious postdoctoral fellowship at CERN in Geneva as part of her research on the Higgs boson. Prof. Gross, who played a leading role in the 2012 discovery of the Higgs boson at CERN, calls Dr. Barak "an exceptional talent, and therefore it is very fitting that she is a recipient of the prestigious Chorafas Prize." Dr. Barak says it was a "huge honor" to be named a recipient of the prize, and it validated her chosen career path as a research scientist.

One of the seminal themes in Chorafas's life has been his thirst for knowledge, and, in parallel, his quest to disseminate it. 14–15

intellectuals. Among those he appreciates most are Golda Meir and Abba Eban. He has distant Jewish roots, but he was drawn to Eban—who was briefly President of the Weizmann Institute—and Meir because of their words. (Chorafas's paternal grandmother was Jewish, and his mother's lineage traces back to Spain, from which his ancestors fled to the Greek islands having faced persecution during the Inquisition.) An adamant proponent of self-responsibility and disdain for reliance on governments, he says that "Golda Meir said it best: that governments cannot do everything and they shouldn't do everything."

He worries about high expectations from governments to provide solutions in an era of dwindling budgets and burgeoning deficits. "The role of philanthropy is to step in and infuse funds into research," he says, "so that societies can help themselves. Philanthropy is an enabler, laying the groundwork so people can learn, grow, and create change."

Meanwhile, as a computer engineer, he developed a keen sense of the value of basic research as a foundation for applied science and technology.

Prof. Ron Milo and Dr. Shahal Ilani are among the previous recipients of the Chorafas Prize

The Chorafas Institute for Scientific Exchange

Chorafas's decision to fund intellectual exchange at the Weizmann Institute through the Chorafas Institute for Scientific Exchange was a natural outgrowth of his own commitment to the pursuit and sharing of knowledge, and to basic research. Importantly, he adds, with the closure of major private, industrial research laboratories across the U.S. and Europe in recent decades, basic research is now being carried out almost exclusively at academic institutions.

"A major source of basic research discoveries has nearly totally disappeared, and if research retreats, entire societies will retreat," he says.

The Chorafas Institute will enable small conferences of up to 300 top-notch scientists, postdocs, and students, around a single scientific topic on campus. The gift funds conferences that will take place at The David Lopatie Conference Centre.

One of his inspirations for establishing the Chorafas Institute was the Rothschild-Weizmann Program for Excellence in Science Teaching at the Weizmann Institute. The program offers MSc degrees in science and math to experienced high school teachers from all over Israel. The concept: a 'trickle-down' effect that will benefit students. The conferences his new Institute will support will have a similar impact, he says, "by generating knowledge that will be shared with others, and will positively affect science for decades, and generations, to come."

Ruth and Uriel Arnon

A legacy of scientific discovery

Cover Story

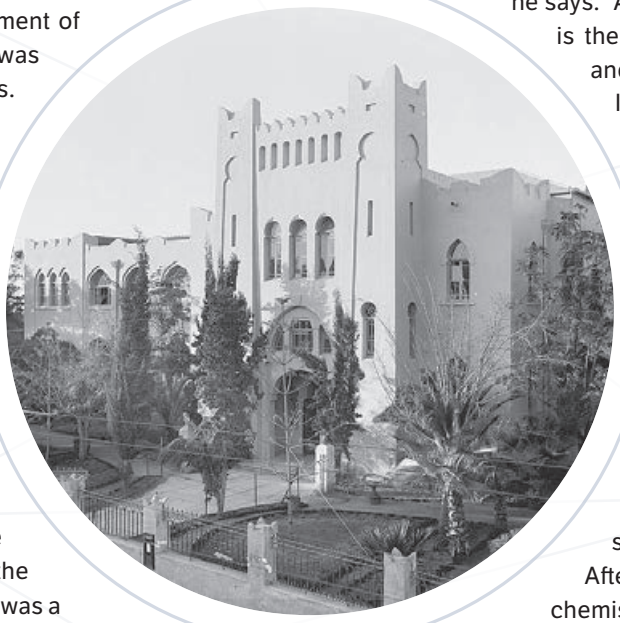
It was one of the important fields in biology developed during the 20th century—understanding the immune system and how it protects our body from foreign invaders and self-inflicted damage—and in her early years at the Weizmann Institute of Science, Prof. Ruth Arnon stepped right into it.

Fast forward nearly six decades and today she can look back on a stellar career in science that led to the development of the blockbuster drug Copaxone® sold by Teva Pharmaceuticals for multiple sclerosis (MS); national- and international-level leadership roles in the scientific arena in which she has made a major impact on the face of Israeli science; and, most recently, groundbreaking work on the development of a universal influenza vaccine. She and her husband, Uriel, who is an engineer, have lived on campus for decades and raised their children, Michal and Yoram, here.

The inventors of Copaxone: Prof. Ruth Arnon, Prof. Michael Sela, Dr. Dvora Teitelbaum

At the Weizmann Institute, she went on to head the Department of Chemical Immunology and was Dean of Biology in the 1980s. She served as Institute Vice President from 1988-1993.

The couple recently gave a transformational gift for the establishment of the Ruth and Uriel Arnon Science Education Campus at the Weizmann Institute, which actualizes the couple's dream of investing in the future of Israeli science through youth education at the highest level. Uri said the gift was a family decision based on their common conviction of the importance of investing in the future of Israeli science. "Chaim Weizmann said that Israel's economy will be built on human capital and our ability to develop science and technology," he says. "And in my view this is right. It is the developments in high tech and science that have brought Israel to its current position in the world. But Israel won't be able to sustain this position if it doesn't educate more students in science."



Herzliya Hebrew Gymnasium: The first Hebrew high school in Israel founded in 1905 in Ottoman-controlled Jaffa. As a young girl, Ruth Arnon attended the iconic Tel Aviv institution.

How did it all happen? From age 15, as a high school student at the prestigious Herzliya Hebrew Gymnasium in Tel Aviv, Ruth had her mind set on working on the scientific basis of medicine. After receiving her MSc in biochemistry at the Hebrew University and completing her army service, Ruth learned that Prof. Ephraim Katchalski (later Katzir, who became the fourth President of Israel), whose research focused on the properties of

Copaxone, the blockbuster multiple sclerosis drug co-invented by Prof. Arnon.

proteins and the construction of synthetic protein like polymers, was looking for scientists to work on a new project. Ruth had been his student at the Hebrew University, and she recalls, "I mustered the courage to approach him."

Prof. Katchalski accepted her on the spot as a PhD student but informed her that the project would be with (then-Dr.) Michael Sela, who was about to return from his postdoctoral studies at NIH. Thus, she became Prof. Sela's first doctoral student; the two worked closely as student and mentor on deciphering the chemical basis of the immunological properties of proteins. These studies culminated in the preparation and characterization of the first synthetic antigen, a material that arouses the immune system.

Several years later they were joined by Dr. Dvorah Teitelbaum (first as a student, then as a research associate in the Department of Immunology; she died in 2008). The trio set out to study a model disease for multiple sclerosis (MS) in mice that is induced by injection of a brain protein, in an attempt to better understand its mechanisms. The project began in 1967; the unique approach they took was to synthesize a polymer that would mimic the structure and properties of that brain protein.

Serendipity of the first order

They synthesized a series of polymers, the one that was best characterized denoted Copolymer 1. Their working hypothesis was that it would also induce the disease and provide an excellent research tool. But, after more than a year of work trying to get it to instigate the disease, they realized that perhaps there was something about it that did the opposite. And indeed this was true: Instead of Copolymer 1 working to instigate a model of MS, it did the reverse—it inhibited it.

"We just wanted to know more about how the immune system works," says Prof. Arnon, adding that MS—an inflammatory autoimmune disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged, leading to debilitating physical and mental symptoms in patients—was a disease that would help elucidate the immune system. "But we discovered that we had stumbled upon something that actually inhibited and suppressed the disease. We didn't intend to develop a therapy for multiple sclerosis. It just happened in this serendipitous way."

These unexpected results led them to switch tracks, to study the therapeutic potential of Copolymer 1. The group spent the next 15 years in experimentation in animals and development, including clinical trials. Teva, then an upstart Israeli drug company trying to prove its worth in the 1980s, purchased the rights to Copolymer 1 in 1987; it became the company's first innovative drug product. The drug received FDA approval in 1996, almost 30 years after the beginning of the project.

Today, some 40 percent of the world's MS patients take Copaxone®.

"We didn't intend to develop a therapy for multiple sclerosis. It just happened in this serendipitous way." —Prof. Ruth Arnon

The drug was one of the most important discoveries to have emerged from basic scientific research because it translated into one of the biggest pharmaceutical success stories in Israeli history.

Toward a universal flu vaccine

Today, Prof. Arnon is still involved in studies on the mode of action of Copaxone®, and in parallel she is developing a universal flu vaccine. The vaccine work was a logical outgrowth of her work on synthetic antigens, she says. "The thinking was: If the immune response, namely specific antibodies, can suppress the activity of some biologically active proteins, such as enzymes, can we suppress the activity of a protein that is a part of a virus?"

Prof. Ruth Arnon

Each year, the pharmaceutical industry devises a new influenza vaccine that targets the strain of the virus that is expected in that year. However, the viral proteins change from year to year, so there is never a guarantee of the vaccine's efficacy. Prof. Arnon set out to find a synthetic molecule that comprises pieces of the virus that are conserved among different strains.

The early experiments—over 15 years—on the flu were promising, and in 2003, the biotech company BiondVax was established based on a licensing agreement with the Institute. The company has advanced to phase II clinical trials for its Universal Flu Vaccine, M-001, which is based on a combination of peptides common to nearly all existing (and future) flu virus strains, including both seasonal and pandemic flu strains such as the avian and swine flu. The potential vaccine will work similarly to a tetanus virus, requiring innoculation once in five to 10 years.

Advancing a national agenda

Prof. Arnon has held a variety of national and international-level roles. Since 2010, she has served as President of the Israel Academy of Sciences and Humanities, where she has played a leading role in advancing a national strategy on science; she is the first woman in that role. She won the Israel Prize, the Wolf Prize, and the Rothschild Prize.

As President of the Israel Academy, she manages the Academy's role as advisor to the government on all matters of national importance related to science. She also oversees the Academy's role in promoting basic research in the country, fostering interaction between Israeli scientists and international scientific facilities and organizations, and deepening relationships with other countries' national academies. She is also chairperson of the council of the Israel Science Foundation (ISF), the country's predominant source of competitive grants for basic research. The most pressing agenda item, in her mind, in her role as President of the Academy, she says, is ensuring Israel retains its leading role in science and technology, "which requires deep thinking about and investment in our next generation."

Class act: The Ruth and Uriel Arnon Science Education Campus

Ruth and Uriel Arnon's latest gift to the Weizmann Institute, and their largest to date, established the Ruth and Uriel Arnon Science Education Campus, which houses a new center for science education, similar to the one that has proved so successful in Tel Aviv.

One of the Institute's biggest success stories in the field of youth science education is The Schwartz/Reisman Science Education Center (also known as HEMDA) in Tel Aviv, established in 1991, the brainchild of former Weizmann Institute President Prof. Haim Harari (Prof. Daniel Zajfman now serves as its Chairman). It began as an experiment in regional science education: Students from almost all Tel Aviv high schools who excel in science receive their physics and chemistry education at that center in lieu of at their schools, and are taught by professional teachers with advanced science degrees .

The Tel Aviv center's success—evidenced in matriculation grades and other measures—gave impetus to the formation of the second such center in Rehovot, adjacent to the Weizmann Institute campus. The Schwartz/Reisman Science Education Center, which will be located in a new area called the Ruth and Uriel Arnon Science Education Campus, adjacent to the Davidson Institute on land provided by the Rehovot municipality—is now temporarily housed at the Davidson Institute for Science Education while the construction of a new facility is underway. It offers quality physics curricular education to excellent science students from seven feeder high schools in Rehovot and Ness Ziona.

The Campus caters to over 500 high-school students in 23 classes. These students benefit from highly trained teachers with advanced science degrees who form a vibrant intellectual community; state-of-the-art lab equipment that any single school cannot offer; and courses at the highest levels of sophistication.

The new building, will include 18 designed "class-labs" equipped with the most advanced materials and equipment, preparation rooms for teachers and lab assistants, and a Fabrication Laboratory (a so-called "Fab Lab") where students can create tools and parts for experiments from scratch using 3D printers, laser cutters, circuit board printers, and more. The Arnon Campus is thus poised to become a standout in the Israeli educational environment and thereby play a key role in educating the next generations of leaders in Israeli science and technology.

The gift follows an earlier one from the Arnons that established a fund for equipment for this center.

Prof. Michael Sela, who collaborated with Prof. Arnon on the development of Copaxone® and previously served as Weizmann Institute President, says about his colleague, "After dozens of years of collaborative work with Ruth, I want to express my pride and heartfelt congratulations to her and Uri on their meaningful support of science education."

"This model is a good solution in a country where public schools are the norm; this is an alternative to the private school solution that exists in the U.S. and elsewhere. Hopefully, this will become a national phenomenon." —Prof. Ruth Arnon

Dr. Eran Grinvald

Uri points out that about one-fifth of today's high school students focus their studies on science and math, as compared to about half in their youth. "I am worried about the influence of religious extremism and the disappearance of secularism, in addition to the receding levels of education in science and math; investing in science literacy is therefore our way forward on this issue," he says.

"What is particularly special about this gift is that it comes from a member of our own scientist community," says Prof. Daniel Zajfman. "Ruth and Uri are members of the Weizmann family and have helped define the Weizmann community, and in their generosity, they have given back to their home, which is both very moving and also sends a signal of the importance of philanthropy from within Israeli science."

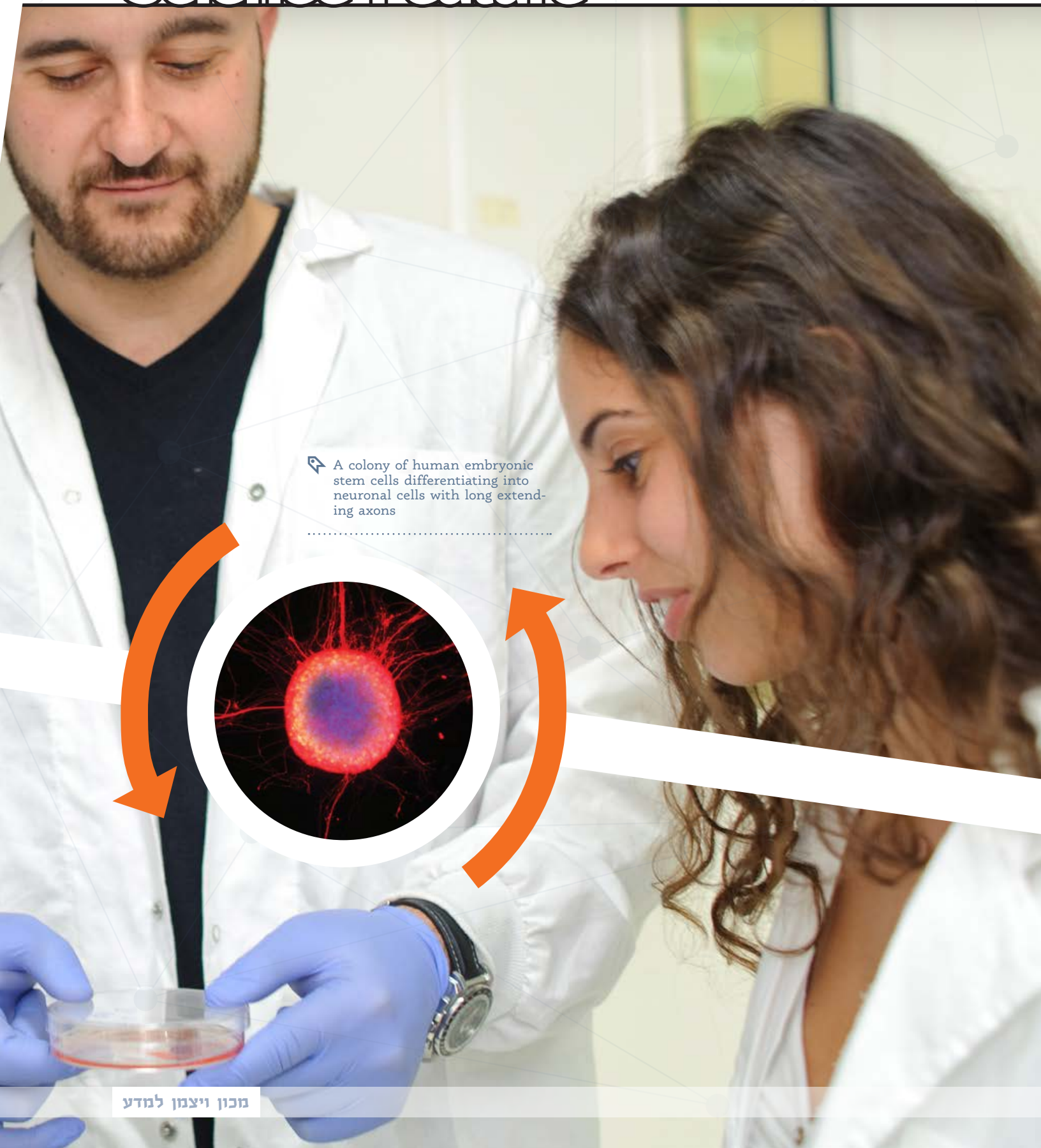
While closing the issue of *Weizmann Magazine,* the Weizmann Institute received another magnanimous gift from the Gerald Schwartz and Heather Reisman Foundation of Canada, which in addition to already funding the activities in Tel Aviv and Rehovot, will add a center in Rishon LeZion and most likely an additional one in another location in Israel. You will have the opportunity to read more about Gerald Schwartz and Heather Reisman and their commitment to advancing science education in Israel in an upcoming issue of this magazine.

Turning back the hands of time

In stem cell science, the body's earliest cells are the key to the tomorrow's medicine

Science Feature

22–23



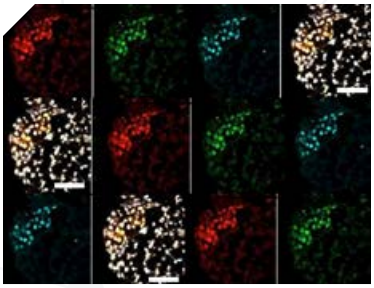
A colony of human embryonic stem cells differentiating into neuronal cells with long extending axons

When Dr. Jacob Hanna talks about turning back the clock, he is not referring to the latest anti-aging supplement. He is developing the means to undo time's arrow in human cells so that they can revert all the way back to their earliest form—the embryonic stem cell state. And then he is moving the hands of the clock forward by just a second or two—to create the cells that naturally appear in the very early embryo and eventually give rise to the sperm and ova. This is what his latest study, published in *Cell* in December, did—representing the first time that human cells have been programmed into this early developmental stage.

The results of the study will likely help provide answers to fertility problems, yield insights into the earliest stages of embryonic development, and potentially enable the development of new kinds of reproductive technology. This is an exciting horizon. How have we come this far?

Scientists have long understood that mouse embryonic stem cells have the ability to differentiate into any cell type in the body, so their potential for curing disease would appear to be nearly unlimited—if only we could figure out how to get enough of them, and how to ensure they turn into the kind of healthy cells that we want in humans. This is precisely the focus of Dr. Hanna in the Department of Molecular Genetics.

A major boost in the field came in 2006, when Japanese researchers showed that regular adult cells—for example, skin cells—could be "reprogrammed" to an embryonic-like state. The method for creating these so-called "induced pluripotent stem (iPS) cells" involved inserting four genes into the cells. Stem cell researchers worldwide were excited by the findings, but many challenges remained.



Clusters of human embryonic stem cells that were differentiated to an early germ cell (PGC) state (colored cells). Each color reveals the expression of a different gene with all three genes combined in a single image (in white).

For one, the original iPS cells were very similar to embryonic stem cells. However, unlike with mouse iPS cells, human-derived ones retain some traces of "priming" that would direct their differentiation along particular pathways—but just traces. In addition, only around one percent of the treated cells in culture actually tended to revert to a stem cell state and these cells

were hard to maintain in the lab.

Thus, the research in Dr. Hanna's lab has been focused on elucidating how to remove some of the obstacles to creating iPS cells for use. To understand how to create better iPS cells, Dr. Hanna first asked some basic questions: What is preventing the other 99 percent of the cells from reverting to the stem cell state? Why is it that whereas mouse embryonic stem cells are relatively stable in the lab, their human counterparts—induced or natural—are notoriously hard to maintain and become primed and restricted in their potential?

Comparing mouse embryonic stem cells with human iPS cells gave his research group some insights into the genetic pathways in the iPS cells that induce differentiation. "The four genes turn many processes 'on,'" says Dr. Hanna. "But to get to the true, embryonic stem cell state, other things needed to be turned 'off'." They managed to turn those switches 'off', and went ahead and successfully created cells that they termed "naïve" iPS cells, which they showed were viable. They also devised a method that could revert many more of the adult cells—up to 100 percent—to an iPS state.

Recreating the feat in human cells

Directing the differentiation and development of iPS cells is, of course, the ultimate goal of stem cell research—and could lead to major advancements in tissue repair and replacement, fertility, and possibly, even in cancer treatment. Dr. Hanna came to this avenue of research after attaining a medical degree and thereby grasping the real needs in medicine.

Dr. Hanna's postdoc fellowship was done at one of the world's leading stem cell labs, at MIT; since his return to Israel and joining the Weizmann Institute in 2011, he has established a robust lab that has generated a string of key findings. Such advancements, he says, could not be possible without donor support, for instance that of Ilana and Pascal Mantoux who have sponsored his lab (*see sidebar next page*).

"One day, we will be able to use this technology to help women who want to conceive after chemotherapy or help men with fertility problems."
—Dr. Hanna

Another key breakthrough in the field came in 2011, when a Japanese research team had succeeded in creating primordial germ cells in mice. Once the news of their methods got out, says Dr. Hanna, "the race was on to create them from human cells." But once again, what worked in the mouse cells did not quite work in the human ones.

Three years later came Dr. Hanna's latest discovery, the generation of human primordial cells. These cells, which eventually can give rise to sperm and ova, appear within the first week or so of gestation. He created naïve mouse-like iPS cells according to their method, and applied the protocols the Japanese team had used on the mouse cells. It worked: The fluorescent marker his team had added to the genomes of the cells showed that some 40 percent of the cells in the lab cultures had become primordial germ cells.

Investigating further, Dr. Hanna's team discovered a new genetic pathway controlling the process—different from the one that had been identified in mice. This significant finding raises a number of fresh questions for stem cell researchers who aim to direct the differentiation of human cells.

"For now, the quantity of primordial germ cells we obtained gives us a good number to study, so we can continue our research," says Dr. Hanna. "There is still a lot to do before we can create sperm or ova in the lab. But one day, we will be able to use this technology to help women who want to conceive after chemotherapy or help men with fertility problems.

He continues, "It is by asking the most basic questions—why human stem cells behave as they do, why they quickly lose their capabilities in conventional growth settings, or what drives them to differentiate—that we will ultimately be able to employ them for our own use."

A very personal commitment

Ilana and Pascal Mantoux

Four years after Ilana and Pascal Mantoux first became involved with the Weizmann Institute, they made a major gift to support the lab of Dr. Jacob Hanna, in 2011. They were drawn to his work on stem cells and its widespread implications in diseases and malfunctions of organs.

Since the establishment of the Ilana and Pascal Mantoux Wing for Stem Cell Research dedicated to the memory of their parents, the couple has developed a personal connection with Dr. Hanna. "We remain in close contact with Jacob at all times, whether at home in Israel or in France or even while traveling. Jacob keeps us in the loop about his research and his team's progress and we feel very fortunate to be associated with him." The feeling is mutual. Adds Ilana, "We once asked Jacob about whether he was happy to be part of the Institute to which he answered enthusiastically: 'Yes!' He stressed how he benefited from the Institute's state-of-the-art facilities, dedicated human resources, interactions with other scientists, and support, which afford him the freedom to explore his research."

"The Mantouxs are some of the most special people I have ever met," says Dr. Hanna. "They have become like family and they know my own family and my students personally. Furthermore, as we work in a highly competitive field and take on extremely challenging projects, it is incredibly empowering to know that the Mantouxs are rooting for us. Every time we have a breakthrough in our research, the first thing I think about is sharing it with Ilana and Pascal and how grateful I am to be in a position of being worthy of their trust and investment."

The Weizmann Institute was the couple's first venture into philanthropy in 2008, and their giving has continued at a steady pace over the years. They have supported a variety of projects in other areas of research, including scientific collaboration between the Institute and the Chaim Sheba Medical Center. That endeavor was recognized with the naming of Prof. Benjamin Geiger's lab in the Department of Molecular Cell Biology as the Laboratory in Cancer Cell Biology in memory of Lt. Olivier Mantoux, Pascal's father who was killed in action during World War II.

And more recently, in 2013, the Mantouxs made a major contribution that established one of the four pillars of the Nancy and Stephen Grand Israel National Center for Personalized Medicine: the Ilana and Pascal Mantoux Institute for Bioinformatics.

Ilana's keen interest in personalized medicine, stem cells, and cancer research has driven her enthusiasm in these areas of research at the Weizmann Institute, areas that hold great promise in improving health and well-being.

The Weizmann Institute has "opened a door," says Pascal, "through which we have happily and proudly stepped in." Ilana says she has been particularly touched by the "human side" of the Institute and immediately felt like she became part of a family. "The warmth, openness and friendliness of everyone has touched us, giving us a true sense of purpose in our actions and a strong sense of belonging."

Pascal's area of interest is primarily in the operational side of the Institute. He became a member of the International Board in 2009 and has since been appointed to the Executive Board, and serves on

The Weizmann Institute has "opened a door," says Pascal, "through which we have happily and proudly stepped in."

several management committees—an experience that allows him to better appreciate the high standards and intricacies of the Institute, he says.

They have five children and 10 grandchildren. The couple shares their time between Israel and Pascal's native France as he continues to actively operate his real estate and land management company in France. Previously, he held various senior management positions with global industrial corporations. His educational background is in mechanical engineering and business administration in France, and he attended the Harvard Business School. Ilana is a graduate in sociology and political science from the Hebrew University of Jerusalem and has worked in human resources in the cardiology department of the Sourasky Medical Center (Ichilov) for many years.

In 2008, the Mantouxs also established a cancer outpatient clinic and in 2012, a heart and chest intensive care unit at the Sourasky Medical Center in memory of Ilana's parents, a project close to Ilana's heart.

They are loyal participants in many of the Weizmann Institute events and have developed numerous personal relationships with faculty, scientists, and management over the years. Says Ilana, "We feel privileged to be able to support great scientific endeavors, and we are grateful for the opportunity to contribute toward creating a better future for generations to come, and we consider ourselves goodwill ambassadors of the Weizmann Institute."

The 66th Annual General Meeting of the International Board

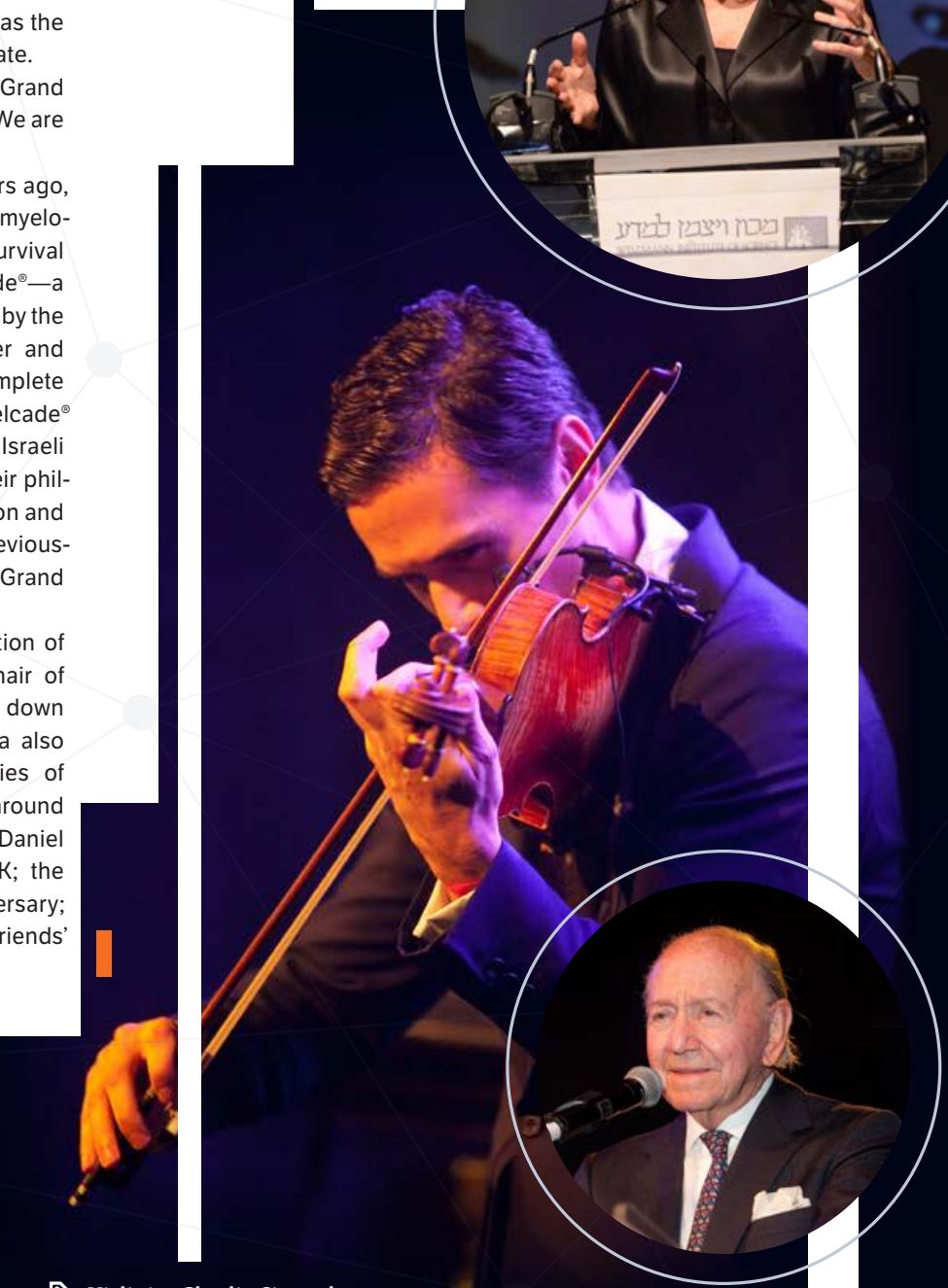
The opening gala of the 66th Annual General Meeting honored Nancy and Stephen Grand of San Francisco, celebrating their visionary gift to establish the Nancy and Stephen Grand Israel National Center for Personalized Medicine. It was the couple's largest philanthropic gift to date.

"We don't call it a gift," said Nancy Grand at the event. "We call it an investment. We are thrilled to be part of this effort."

Nancy described how, eight years ago, Stephen was diagnosed with multiple myeloma, and was told that his likelihood of survival was slim. He was prescribed Velcade®—a drug based on research breakthroughs by the Technion's Profs. Aharon Ciechanover and Avram Hershko—and he went into complete remission. The Grands' gratitude for Velcade® and its origin in basic science, and for Israeli science in general, she said, led to their philanthropic involvement with the Technion and the Weizmann Institute, where they previously established the Nancy and Stephen Grand Center for Sensors and Security.

The closing gala was a celebration of the leadership of Mandy Moross, Chair of the International Board, who stepped down after nine years in that role. The gala also celebrated the milestone anniversaries of the Weizmann Institute committees around the world: the 80th anniversary of the Daniel Sieff Institute honoring Weizmann UK; the American Committee's 70th anniversary; Weizmann Canada's 50th, the Israeli Friends' 40th, and the Mexican Friends' 30th.

Nancy Grand at the Festive Opening



Violinist Charlie Siem plays in honor of his grandfather, Mandy Moross

Fingerprint for the Future

Special Events

28–29

Larry Marks and Dr. Gladys Monroy-Marks, with Dr. Assaf Tal

Newly established chairs

Donors and scientists alike were honored for five newly established chairs at the Festive Open Session of the International Board. Sisters Rachel Schwartz, Marla Buck, and Nancy Buck established the Roel C. Buck Career Development Chair with its first incumbent, Dr. Ravid Straussman of the Department of Molecular Cell Biology. "We know that this CDC was the right way to honor our father," who was a donor to the Weizmann Institute, said Rachel Schwartz. "He had a strong attachment to Israel and he was an entrepreneur—so the connection to the Weizmann Institute is a fitting match."

"For us it is a privilege to be part of the Weizmann Institute family. We are honored, and a little bit in awe. We feel especially blessed," said Larry Marks, who, with his wife Dr. Gladys Monroy, established the Monroy-Marks Career Development Chair, held by Dr. Assaf Tal of the Department of Chemical Physics, and the Monroy-Marks Career Research Associate Chair, held by Dr. Tali Scherf. Larry and Gladys are co-chairs of the Bay Area Region of the American Committee for the Weizmann Institute of Science.

Dr. Gil Omenn and his brother Neil established the Leah Omenn Career Development Chair in honor of their mother, with Dr. Ayelet Erez as its first incumbent.

Robin Chemers Neustein established the Robin Chemers Neustein Chair with Prof. Nirit Dudovich of the Department of Physics of Complex Systems as the first incumbent.

Former Ambassador to U.S. Dr. Michael Oren speaks at Clore Lunch

Dr. Chaim Weizmann was a political entrepreneur who knew how to take advantage of opportunity when he saw it—even in the midst of the chaos of the 20th century, said Dr. Michael Oren, Israel's former ambassador to the U.S. This is the lesson in leadership that Israel's first president and the founder of the Weizmann Institute offered us, Dr. Oren added in his keynote speech at the Clore luncheon on November 10.

The state Dr. Weizmann helped establish has followed in this form, the historian and author added. "Creativity and innovation is enabling us to grapple with and survive threats and emerge from them with a high-functioning society," said Dr. Oren.

Dame Vivien Clore Duffield presented the 2014 Sir Charles Clore Prize in Research to Dr. Ofer Firstenberg, a new recruit to the Department of Physics of Complex Systems. She also awarded 10 Clore Postdoctoral Fellowships to recent PhD graduates in science from Israeli universities.

Prof. Simon Schama, Prof. Stanley Fischer

among PhD *honoris causa* recipients

Every year, in a special session of the Annual General Meeting, the Weizmann Institute recognizes the achievements of individuals whose inspiring contributions to society resonate well beyond their own fields of activity, by conferring on them its highest honor, the degree of Doctor of Philosophy honoris causa.

This year, six honorary PhDs were awarded to:

Prof. Marvin L. Cohen, one of the world's foremost condensed-matter physicists. Speaking at the ceremony, the celebrated scientist referred to the use of math and physical concepts to explain nature as the driving force of his life, and called the PhD a "special honor" as it is given "...for the work that I love, from an Institute that I love, in a country that I love."

Prof. Stanley Fischer, a preeminent economist and expert on financial crises and current Vice Chair of the U.S. Federal Reserve. Prof. Fischer was an academic-turned-policymaker whose term as Governor of the Bank of Israel (2005-2013) earned him plaudits across the board, as well as the respect and trust of the Israeli public.

Lia Koenig, an acclaimed stage and screen actress, whose supreme comic ability combined with a sensitive dramatic power has left an indelible mark on Israeli culture. Koenig said that unlike scientists "who leave a mark on time itself, I am an actress; what I do lasts just a short time. Yet we share a sense of play in what we do—whether it's Shakespeare or quantum physics."

Prof. Jesse Roth, a world-renowned diabetes researcher, best known for his work on cell-surface membrane receptors and other molecules of intercellular communication. He spoke of his enthusiasm at the Weizmann Institute's decision to take a leading role in personalized medicine, which, drawing from his vast experience, he explained as "a richer ongoing exchange between patient, doctors, and researchers."

Dr. Herbert Winter, a highly esteemed member of the European legal establishment whose life-long commitment to public service and to the Jewish community are manifested, among many other endeavors, by his activities on the Weizmann Institute's Swiss Association of Friends and European Committee. Speaking of his many years' of association with the Institute, he called curiosity the "the key motor for scientific success."

Prof. Simon Schama of Columbia University has researched, lectured on, and written about history and art history, with a remarkable *oeuvre* that includes scholarly writings, popular books, and 50 documentaries on art, history, and literature. Delivering the ceremony's keynote speech, he underscored the "indivisibility of the humanities and the sciences in any account given of the thinking Jewish mind" throughout the ages, saying "...it was through medicine that Jews opened the doors to their host cultures; cultures that where often very suspicious of them".

Q&A with Prof. Stanley Fischer

Fingerprint for the Future

Prof. Stanley Fischer of MIT is the Vice Chair of the U.S. Federal Reserve System's Board of Governors and was Governor of the Bank of Israel from 2005-2013, among other leadership roles. He received an honorary PhD from the Weizmann Institute in November.

Q Prof. Fischer, what role should governments play in nurturing scientific discovery?

A Governments can and have played a fundamental role in building up the human capital of a country. The government's role starts with school education and goes on to include providing support for higher education, and particularly for research. That is not controversial, and even the great American private universities and other research institutes, such as the NIH, receive all or much of their research funding from government sources. This is true particularly of funding for basic research. When it comes to applying the fruits of that research, of course, the government can, and in many countries does, encourage scientific discovery and investment in modern technology through the use of tax incentives and direct funding.

Q Basic research leads to insights and discoveries that inform major developments in science and technology. What is the importance of basic research in any economy, and in Israel's in particular?

A At least since the fundamental econometric work of Robert Solow in the 1950s, and also from economic historians, we know that productivity growth—the increase in output per unit of labor or some other input—is the key to raising living standards in any economy. Further, technological advances are the most important factor driving productivity growth. For the most advanced economies, the connections between basic research and the applications of that research in technological advances that raise productivity and living standards are abundantly clear. Less-advanced countries can upgrade their technology by importing both the knowledge and the embodiment of that knowledge in state-of-the-art equipment (capital goods).

The U.S. has traditionally been a place of considerable public and private investment in basic research. The productivity gained from applying the fruits of that research in agriculture, manufacturing, transportation, telecommunications, and most recently in information technology have been a significant factor in America's economic success. The same has been true, especially in the past 20 or 30 years, for Israel—for while globalization has lowered many barriers to the spread of technological advances, the location of basic research still matters, as Israel's successes in the most modern technologies demonstrates.

Q As a corollary, what role does the Weizmann Institute of Science play in Israel's economy?

A I have seen estimates that research by Weizmann was responsible for $28 billion in sales in 2013, which is more than 10 percent of Israel's GDP. I'm not sure of the precise details underlying that estimate, but I certainly know that Weizmann is one of Israel's premier research institutions and widely recognized in Israel and abroad as such.

But there is a great deal of skepticism about the ability of governments to play a constructive role in the industrial use of science by picking winners—that is, engaging in industrial policy and becoming in effect a venture capitalist. The general view is that government officials are not very good at predicting winners and losers, and historically, targeted help of this kind to build "the industry of tomorrow" is often wasted. However Israel is generally cited as a counterexample—at least with regard to the role of

the Chief Scientist in the 1990s. That got Israeli high tech innovation off the ground; more recently, private sector venture capital has played a larger role in financing and encouraging the applications of technology in Israel. The Israeli example is regarded as exceptional, and it is likely that other government institutions, including the army that has long understood the importance of modern technology, have also been extremely important in the development of high tech in Israel.

Q For Israel, a country whose greatest resource is brain power, why does science education matter?

A This is a question that answers itself. Israel's greatest economic resource is and has to continue to be its brain power, especially the capabilities of the scientists who were among Israel's and Weizmann's founders, and continue to serve as its leaders and its entrepreneurs. Science education makes it possible for scientific knowledge to grow and the fruits of that knowledge to create jobs and sustain economic growth and rising living standards. Those benefits can also extend beyond national borders.

Q It is considered a virtual requirement for any freshly minted Israeli PhD graduate in the sciences wishing to attain a faculty position in Israeli academia to conduct postdoctoral research in the U.S. or Europe—to learn from world-leading labs and bring fresh, modern ideas back home. And throughout a scientist's career, this close, ongoing connection to the West is essential, since scientific research is a truly global endeavor. At the same time, do you think that the U.S. and the West in general have something to learn from Israel's special brand of entrepreneurship and its science- and technology-driven economy?

A Israel's success in science and technology is widely known and envied around the world, and that probably helps account for the success students educated in Israel have in continuing their studies in the West. The barriers to the flow of information and innovation have been greatly lowered by globalization, and by technological advances themselves in communications and computing. The late Prof. Don Patinkin, who came to Israel in 1949 and is generally regarded as the founder of modern Israeli economics, once told me that the most important change in the ability of Israeli economists to stay in touch with the rest of the economic research world was the Xerox machine. We have come a long way since then, and research collaboration is now conducted globally, among labs and businesses and institutions in different countries.

Q What do you miss about living in Israel?

A The old friends of ours, and the many new friends we made—and of course the many challenges that the country still faces.

An historian's tale

Prof. Simon Schama, PhD honoris causa *keynote speaker, on storytelling, Israel, and the Weizmann Institute*

Taking his place on the podium as keynote speaker at the Institute's PhD *honoris causa* ceremony in November, Prof. Simon Schama summoned, as a good storyteller will do, a tale culled from his private history to 'connect the dots' of personal and national Jewish identity and basic scientific research. Tying in to the words of Dr. Herbert Winter, a fellow honorary PhD recipient, he considered "Through what olfactory conduit would I remember my first visit to Israel? That is easy: 51 years ago, you would have found me in the chicken house of Kibbutz Beit Haemek. *That* is a smell that lasts a lifetime."

The writer-presenter of the epic documentary *The Story of the Jews*, then a young visitor from Britain, contended to himself that what he was witnessing was "another great Jewish moment: this, after all, is the beginning of chicken soup!"

Prof. Schama was born in 1945, a second-generation Britton whose grandparents from both sides fled persecution to settle in England; immigration, movement, and cultural collision are part of his experience and are central themes in his work. He studied history at Christ's College, Cambridge, graduating with particular distinction in 1966 and earning an MA in 1969. He then became a lecturer in history at Cambridge and at Oxford, specializing in the French Revolution. In 1980, he moved to the U.S. and became a professor of history and art history at Harvard (1980-1993), and today is at Columbia University, as is his wife, geneticist Virginia Papaioannou.

"The discipline of writing beautiful narrative is extraordinary; it is constantly challenging and liberating as well," he says. Drawing on a myriad of sources, including standard chronicles, legal documents, artwork, craft items, fiction, private letters, architecture, and cutting-edge academic studies, he cuts no corners in providing a rich account of the topic at hand, which invariably presents the audience with relevant insight into modern-day society.

"All of history," he says, "is about experiencing others' lives—people who are separated from you in time." He delved into Dutch, French, British, and American history, producing 15 books and dozens of documentaries on topics in history, art, literature, and art history.

Yet for Prof. Schama, "Jewish history has been in my cultural DNA," he says, explaining why he accepted the BBC challenge of making a documentary series about it—which became the five-part *The Story of the Jews*—taking on that daunting task in part, he says, because "most of the non-Jewish world knows of Jewish history only through the Holocaust and the Israeli-Palestinian conflict". Indeed, he sees himself as an "interlocutor, especially for the non-Jewish world." His book, *The Story of the Jews: Finding the Words 1000 BC-1492 AD*, was published in 2013 and the second book in this two-part series will be out later this year.

In accepting his honorary PhD from the Weizmann Institute, he said that in the face of destruction and conflict in Israel, "the Weizmann story is about construction, building things, and it feels good to be part of 'that' Israel."

Herbert and Anita Winter

Ambassadors extraordinaire of the Weizmann Institute in Switzerland

In 1984, Dr. Josef Cohn, Dr. Chaim's Weizmann personal secretary and political advisor, and a Weizmann Institute representative in Europe, was ready to retire.

Herbert Winter, at that time a young leader in the Swiss Jewish community and today a successful attorney with an international practice, was introduced to Dr. Cohn and Dr. Veit Wyler, who was a co-founder with Dr. Cohn of the European Committee for the Weizmann Institute of Science (ECWIS). Dr. Winter then had what he describes as "an incredibly interesting meeting with a very young scientist by the name of Doron Lancet," who today heads the Department of Molecular Genetics. And my fate was sealed. This was the start of my relationship with the Weizmann Institute, which has lasted 30 years."

Dr. Winter received a PhD *honoris causa* from the Weizmann Institute in November, in recognition of his position as an esteemed member of the European legal establishment, a lifelong commitment to public service and the European Jewish community, and decades of service on behalf of the Weizmann Institute in Switzerland. He is a member of the Institute's International Board and for 25 years has been active on the Boards of the European Committee of the Weizmann Institute and of the Swiss Friends of the Weizmann Institute.

"I take advantage of every opportunity to come to the Weizmann Institute, which I consider my home in Israel. There is an air of excitement, and an orientation toward the future and mankind here," he says. "It gives me great pride—it always has—to be involved

with the Institute and to be an informal ambassador for it in Europe."

In the 1990s, he played a starring role in recovering funds from dormant Swiss bank accounts and insurance companies on behalf of Holocaust survivors and their descendants. "I realized time was running out for these individuals, and we had to act fast," he recalls. He immersed himself in the monumental task until a $1.25 billion settlement was reached. In the same spirit, he initiated a campaign within Switzerland's Jewish community to aid refugees of the Kosovo War (1998-1999); the funds were used to set up and run refugee camps and schooling programs in Albania. Today, he is president of the Swiss Federation of Jewish Communities.

Although the Swiss Jewish population has been dwindling slightly in recent years, Dr. Winter says he "feels very optimistic" about its future, adding that "the devotion to Israel among Swiss Jews is great and only growing."

He and his wife Anita have four children—Gadi, Manuel, Rafael, and Alisa. In 1990, Anita founded the Weizmann Women for Science group in Zurich with the help of Lady Sieff of Brimpton, the wife of Marcus Sieff, whose father Isaac founded the Daniel Sieff Institute, the predecessor of the Weizmann Institute, in 1934.

Today, Anita, who is a daughter of Holocaust survivors, supports Swiss Holocaust survivors living in poverty through her Gamaraal Foundation. She is also an official representative to the UN Human Rights Council in Geneva, where she is involved in deliberations on human rights in the context of the Israeli-Palestinian conflict.

The couple has opened their home for Weizmann Institute events throughout the years, and Herbert has done substantial legal work on estates in which the Weizmann Institute is a beneficiary.

Breakfast of scientific champions

At a breakfast celebrating the establishment of the Abramson Family Center for Young Scientists, funded by Pennie and Gary Abramson of Washington, six new recruits shared similar stories about their decision to accept positions heading labs at the Weizmann Institute: The Institute's reputation as one of the best places in the world to do interdisciplinary scientific research, combined with the draw of home and family and returning to Israel after postdoctoral studies abroad.

Pennie and Gary Abramson fund the Abramson Family Center for Young Scientists

"For 30 years, Pennie has been an exceptional leader both locally, in the Washington area, and nationally, engaging new friends and, together with Gary, generously supporting the Institute," said Prof. Daniel Zafjman. "They have always understood that it is excellent scientists who do excellent science."

Dedication of the Nancy and Stephen Grand Israel National Center for Personalized Medicine

In the presence of the founding donors, the Weizmann Institute dedicated the Nancy and Stephen Grand Israel National Center for Personalized Medicine at the newly refurbished facility.

Among the distinguished guests were Nancy and Stephen Grand, Lester Crown, founder of the Crown Institute for Genomics; Ilana and Pascal Mantoux, founders of the Ilana and Pascal Mantoux Institute for Bioinformatics; Martin Paisner, CBE, on behalf of the Maurice and Vivienne Wohl Charitable Foundation, founder of the Maurice and Vivienne Wohl Institute for Drug Discovery; and the Wolfson family, which provided the funds required for re-purposing the building. The David and Fela Shapell Family Institute for Preclinical Studies, also part of the Nancy and Stephen Grand Israel National Center for Personalized Medicine, was dedicated in October.

Nancy and Stephen Grand

Dr. Maya Schuldiner

Spotlight on scientific excellence

Dr. Maya Schuldiner of the Department of Moleular Genetics was one of six distinguished scientists who presented their research to the International Board in November. Each of the six received prestigious international recognition this year. Dr. Schuldiner, along with Dr. Jacob Hanna of the Department of Molecular Genetics (see story p. 22) who also presented, was recognized by *Cell* as one of the ,"40 Under 40" most likely to make a significant scientific advancement.

Prof. David Milstein of the Department of Organic Chemistry, a 2013 winner of the Israel Prize, Prof. David Wallach of the Department of Biological Chemistry, a 2014 Israel Prize winner, and Prof. Zelig Eshhar of the Department of Immunology, who won the 2014 Massry Prize and the 2015 Israel Prize, also described their research.

Celebrating the Wolfson Family

A personal gift by Sir Isaac Wolfson in 1947 to establish the Isaac Wolfson Building on campus launched a long-lasting friendship between the Wolfson family and the Institute, manifested in numerous buildings, centers, and research initiatives. Most recently, the family has given a major gift to support the construction of the facility housing the Nancy and Stephen Grand Israel National Center for Personalized Medicine. The partnership was celebrated on November 11 in Tel Aviv at a festive dinner.

Isaac Herzog, a member of Knesset for the Israeli Zionist Union Party and Chairman of the Opposition, spoke about his family's deep personal connection with the Wolfsons, beginning with his grandmother and Sir Isaac sharing the same kindergarten in Glasgow in the early 1900s, to his father (Chaim Herzog, 6th President of Israel) working for Sir Isaac after his discharge from the IDF, and the warm relations between his uncle, Abba Eban, the Institute's President in the 1960s, and the Wolfson family. Mr. Herzog praised the dedication of the Wolfson family to the Weizmann Institute, which he called "the true center of gravity of the success of the State of Israel", and said he was pleased to witness a third and fourth generation of Wolfson philanthropy to Israel and the Institute.

Fingerprint for the Future

Shapell family dedications

Weizmann Institute scientists and staff gathered on October 12 for the dedication of the David and Fela Shapell Family Institute for Preclinical Studies (under the auspices of the Nancy and Stephen Grand Israel National Center for Personalized Medicine) and the David and Fela Shapell Family Holocaust Memorial Plaza, in the presence of Mr. and Mrs. Shapell and their grandchildren.

David Shapell passed away last month and was buried in Israel. David and Fela Shapell, Holocaust survivors who lived in Beverly Hills, California, supported the Weizmann Institute for many years. They funded the David and Fela Shapell Family Center for Genetic Disorders Research and the research of Prof. Yoram Groner of the Department of Molecular Genetics.

The David Moross Fitness Center

A major gift by David Moross (pictured) enabled the construction of the David Moross Fitness Center, which was dedicated at the International Board in the presence of members of the Moross family. The Fitness Center is a vibrant, modern facility serving the Institute's entire family of scientists, students, and staff.

Siem Childcare Center dedication

Edna Moross visits the Siem Childcare Center

The dedication of the Siem Childcare Center took place outside the childcare facility in the presence of Karen Siem, her family, and the Board guests, as well as representatives from WIZO, who collaboratively manage the daycare centers on the Weizmann Institute campus. "This type of daycare is the right mechanism for advancing women's careers," said Prof. Irit Sagi, Dean of the Feinberg Graduate School, and formerly the Chair of the Early Childhood Education Center Steering Committee at the Institute.

The Moross family

Karen Siem, a longtime supporter of women in science initiatives at the Institute, is the daughter of Mandy Moross, who stepped down as Chair of the International Board in November. Her gift was made in his final year as Chair, honoring her father's nine years of service.

Major league magnets

Nuclear magnetic resonance in the service of science

Students and postdocs of the Frydman lab

Prof. Lucio Frydman

When the Weizmann Institute's first Nuclear Magnetic Resonance (NMR) spectrometer was built at the Institute in the 1950s, it was an ingenious machine, cobbled together out of electronic equipment left behind by the British army, for the purpose of peering into a multitude of materials. Later, NMR machinery was bought from manufacturers, but Weizmann Institute scientists have continued improving the equipment and refining the techniques, several of them becoming leaders in the field.

The Institute's NMR activities span a wide range of scientific disciplines, ranging from physics and chemistry to cancer research and neurobiology. Much of this work has been funded through the Ilse Katz Institute for Material Sciences and Magnetic Resonance Research and the Helen and Martin Kimmel Institute for Magnetic Resonance Research. To stay on the cutting edge, the Institute is now planning on installing new scanners, including one that boasts 30 times the field of that original NMR—21 Tesla—as well as an additional 7 Tesla NMR imaging (MRI) magnet that will be used on humans. (The numbers are a measure of magnetic strength; magnets used in clinical MRIs are 1.5-3 Tesla, for instance).

The first of these instruments will help Institute researchers, including a new generation of Weizmann Institute scientists, to develop innovative technologies for human health, advanced materials and biomolecular research. The second, a 7 Tesla instrument—for which the Israeli government recently pledged $8 million out of the total $12 million price tag—will be devoted to cancer and brain research. The Institute plans on acquiring additional magnets in the future.

Prof. Lucio Frydman of the Department of Chemical Physics, who is leading the Institute's

Science Feature

efforts in this realm, describes the basis of NMR and its familiar form, MRI—as centered on "quantum compass needles." At the heart of any NMR scanner is a strong magnet that uses the magnetic properties of atomic nuclei to "polarize" them—that is, to align them parallel to the external magnet. When these aligned nuclei—for instance, the protons in water molecules that make up our bodies—are pulled away from their normal balance, they return to equilibrium, emitting low-energy radio waves in the process that can be used to characterize their position or their chemical environments.

But even with the strongest magnets, NMR technology has been hobbled by twin limitations: time and sensitivity. As anyone who has held perfectly still for an MRI knows, the process can be time-consuming. And the sensitivity of human scanners is usually only sufficient to image the water that makes up most of our body. Other types of NMR scans, for example those of complex molecules, would take hours or days, while many fragile or dynamic objects cannot be scanned at all by standard methods.

Prof. Frydman has developed "ultrafast" NMR and MRI methods, which can obtain multidimensional data and images in a fraction of a second. These methods have had most of their applications in the realms of chemistry, biology, and medicine. In studies conducted this past year together with Prof. Michal Neeman of the Department of Biological Regulation, ultrafast MRI equipment was used to image one of the most complex fluid flows in nature—the interface between fetal and maternal blood in the placenta. The ability to sort and image these entangled flows could be used in the future to identify early signs of fetal distress. Some of Prof. Frydman's methods are already used in humans, including ongoing collaborative

Dr. Assaf Tal: Beyond the standard fMRI

Dr. Assaf Tal works between two worlds: One is that of subatomic particles exposed to strong magnetic fields and the other, no less mysterious, is the human brain. His office is in the Department of Chemical Physics; his experiments are conducted in the fMRI lab in the Arison Laboratory for Human Brain Imaging.

Dr. Tal, who grew up in Rehovot, completed an MSc in the Weizmann Institute group of Prof. Gershon Kurizki in Chemical Physics and did his PhD research in the lab of Prof. Frydman. After a short stint in industry, Dr. Tal returned to postdoctoral research, first in the lab of the Institute's Prof. Hadassa Degani and then at New York University Medical Center, at a radiology lab that specializes in imaging the brain.

His decision to return to Israel, he says, was dependent on a magnet, specifically the super-strong magnet found in MRI machinery: "Few research institutions could offer me both access to a large magnet and openness to collaboration with neurobiologists. Here, at the Weizmann Institute, I am building that connection."

Dr. Tal is attempting to image such large biomolecules as neurotransmitters—substances used by neurons to communicate. His challenge is to separate out the signal of these from that of the ubiquitous water. "It's like training the ear to hear the notes played by just one instrument in an entire symphony," says Dr. Tal.

Imaging neurotransmitters might enable researchers to observe such elusive processes as the consolidation of memories. "We want to move beyond the standard fMRI and ask totally new questions about the workings of the brain," says Tal.

Magnetic resonance image of a rat's brain with a partial stroke in the right hemisphere; the left hemisphere illustrating how the levels of metabolites in the brain's hemisphere affected by stroke were altered compared with those in the healthy hemisphere.

efforts with the group of Prof. Hadassah Degani of the Department of Biological Regulation to detect breast cancer without the use of contrast material.

Another breakthrough that Prof. Frydman is developing together with his Weizmann Institute colleagues Profs. Shimon Vega and Daniella Goldfarb of the same department concerns so-called hyperpolarization methods. This team aims to depart from the nuclear polarizations that conventional magnets can deliver—which are on the order of one nucleus out of every 100,000 becoming aligned—and orient nearly one out of every five "compass needles."

This advance could open the door to imaging many kinds of molecules whose signals would normally be too faint to see in ordinary MRI. These include, for example, such metabolites as the lactate produced in leg muscles during running, or others whose levels are altered in the brain following a stroke. In recent studies, Prof. Frydman demonstrated the imaging of each of these in rodents. If they are eventually adapted for humans, the former could tell

Dr. Amnon Bar-Shir: In living color

Dr. Amnon Bar-Shir has a dream. In it, today's black-and-white MRI technology will be brought to us in living color. Those colorful images will greatly increase our ability to observe and trace, for example, the success of implanted cells, the progress of anti-cancer treatments, or the release of neurotransmitters in the brain.

The inspiration for some of his work comes directly from the fluorescent protein technique that has revolutionized microscopy and for which the Nobel Prize in Chemistry was awarded in 2008. "Why not do the same thing for MRI?" says Dr. Bar-Shir, who joined the Weizmann Institute in 2014 after a postdoctoral fellowship at Johns Hopkins University School of Medicine. "Then we could observe many processes deep inside tissues of live subjects, non-invasively and over time." Dr. Bar-Shir has been working on developing proteins that may yield different colors in the MRI scanner. He helped create a viral protein that, when paired with a synthetic sensor, acted as a high-contrast, colorful reporter in a mouse brain.

"I hope to create a whole palette of colors," he says. "The idea is that we can image several different molecules at once. If we insert different color-coded genes into immune cells that have been modified outside the body to fight cancer, for example, we might be then able to see where these cells actually go in the body and how they attack the tumor cells. In the future, this might be used as a diagnostic test to fine-tune treatment."

athletes whether their muscles are more evolved for "sprinting" or "distance running"; the latter could provide a non-invasive way to accurately assess which areas of the brain are affected by a stroke.

"This is what is so fascinating about research in magnetic resonance," says Prof. Frydman. "It is a blend of theories and experiments deeply rooted in the elusive concepts of quantum physics, which demand overcoming significant engineering and signal processing challenges to yield their full potential. Yet as a result of these multidisciplinary efforts emerge real-life tools that, if blended with sufficient ingenuity, can provide us with unprecedented descriptions of dynamic molecular and biological processes, as well as with diagnostic evidences that can literally change the fate of individuals."

Several new scientists have joined the ranks of the Weizmann Institute in this field in recent years (see sidebars). In September, Dr. Michal Leskes will join the Department of Materials and Interfaces, where she will focus on advancing technology for rechargeable batteries so they have faster charging capabilities and improved power storage. This work requires the ability to investigate lithium-ion and lithium-air batteries by monitoring the dynamics of electrochemical products formed at their electrodes during charging and discharging. This research will advance the overall effort in creating renewable energy options that are practical, dependable, and affordable.

Also, Dr. Rina Rosenzweig will join the Department of Structural Biology at the Weizmann Institute starting in 2016. She uses NMR to understand the molecular mechanisms involved in diseases associated with protein misfolding and the accumulation of toxic protein aggregates. These include Alzheimer's and Parkinson's diseases, type II diabetes, and the spongiform encephalopathies, such as Creutzfeldt-Jakob disease. Therefore, understanding the molecular mechanism involved in triggering protein aggregation *in vivo* is essential to prevent, slow down, or even ultimately, reverse the progression of these diseases.

Major government investment in brain imaging

In December the Israeli government's Forum for National Infrastructure Forum for Research and Development (TELEM), which is tasked with budgeting for major national science and technology initiatives—announced its decision to provide major funding to establish the Israel National Center for Brain Imaging and Stimulation led by the Weizmann Institute of Science and in collaboration with the Technion—Israel Institute of Technology, the Hebrew University of Jerusalem, and the Tel Aviv Sourasky Medical Center. The Center will be located on the Weizmann Institute campus and will revolve around the facility.

"This decision is a huge vote of confidence by the Israeli government for the Weizmann Institute," says Prof. Daniel Zajfman, President of the Weizmann Institute. The joint proposal submitted to TELEM was reviewed by experts from abroad who said that the "excellent" project "makes considerable sense given the Israeli research landscape in human cognitive neuroscience... It will bring Israel to an even higher level of brain imaging capacity, available to only the best international neuroscience centers."

Telem will allocate millions of dollars for the establishment of the Israel National Center for Brain Imaging and Stimulation, to be divided between the Weizmann Institute (which will receive the lion's share), Technion, and Sourasky Medical Center. The funds provided by the Israel government to the Weizmann Institute will cover the cost of purchasing the system. Each of the collaborating entities in the Israeli National Center for Brain Imaging and Stimulation will provide an additional aspect to brain imaging.

A half-century of Israel-Germany diplomatic relations

L to R: Prof. Michael Sela, Dr. Josef Cohn , Hans-Hilger Haunschild (German Vice Minister of Research and Technology). Photo: 1983

"Science broke the ice between Israel and Germany," said Prof. Dr. Peter Strohschneider, President of the Deutsche Forschungsgemeinschaft, a major German research funding organization, among the largest in Europe. The words represented the central theme of a two-day conference, held February 10 and 11 in Tel Aviv and at the Weizmann Institute, celebrating 50 years of German-Israeli diplomatic relations.

Dozens of German scientists and other officials participated in the event, including Prof. Dr. Johanna Wanka, the Federal German Minister of Education and Research. At a festive dinner at the Yitzhak Rabin Center on February 10, she called the 21 Minerva centers across Israeli institutions—the central German funding entity for joint Israeli-German research—the "crown jewels" of relations between the two countries. Prof. Dr. Martin Stratmann, President of the Max Planck Society, also spoke, as did Weizmann Institute President Prof. Daniel Zajfman and Prof. Ruth Arnon in her role as President of the Israel Academy of Sciences and Humanities.

In the aftermath of the Holocaust, there was great resistance in Israel to brokering ties with Germany, but in 1952 ties began to thaw when Germany agreed to pay reparations to victims. Meanwhile, desire for scientific cooperation between the Weizmann Institute and the Max-Planck-Gesellschaft (MPG) emerged as Germany strived to rebuild its academic institutions in the wake of the war and Israel's nascent scientific community required ties to the West in order to truly flourish.

In 1959, the first scientific delegation from Germany arrived in Israel to visit the Weizmann Institute; the German delegation was headed by Prof. Otto Hahn, Nobel Laureate and President of the MPG and other pioneers of German-Israeli scientific collaborations, including the Director of the Max Planck Institute of Nuclear Physics, Prof. Wolfgang Gentner, who later became a member of the Board of Governors of the Weizmann Institute. The Weizmann representatives included Prof. Gerhard Schmidt, then administrative director of the Weizmann Institute and Prof. Amos de Shalit, who would soon become the

Weizmann World

Scientific Director and, later, Director General of the Weizmann Institute.

An agreement followed, signed in 1964 between the Minerva Stiftung—a foundation backed by the German government and affiliated with the Max Planck Institutes—and the Weizmann Institute, which led to a comprehensive program, the Minerva-Weizmann Projects Program, that finances excellent individual and group projects at the Weizmann Institute. A key player in the signing of this agreement was Dr. Joseph Cohn, Dr. Chaim Weizmann's former assistant. With its signing, the Weizmann Institute became the first academic institution in Israel to accept German researchers—faculty, postdocs, and students—and to encourage its own young scientists to go to Germany.

This program led to a nationwide funding effort by Minerva—across all Israeli institutions—which paved the way to a formal diplomatic relationship, established in 1965.

Since its inception, the Minerva-Weizmann Projects Program has secured funding for nearly 2,000 projects in chemistry, physics, mathematics, and the biosciences with approximately 80 projects receiving funding on an annual basis. Joint discoveries of Weizmann/German scientific teams have resulted in more than 1,090 publications in the last five years; and one-quarter of all publications authored by Weizmann Institute scientists have German co-authors. At any point in time, a third of Weizmann Institute scientists is involved in a Minerva project, and 70 percent of Institute research teams are engaged in ongoing collaborations with German partners.

Prof. Dr. Martin Stratmann, President of the Max Planck Society

Prof. Daniel Zajfman with German MInister of Education and Research Prof. Dr. Johanna Wanka

Bay Area mission

The American Committee's Bay Area Region hosted a mission to the Weizmann Institute in November, coinciding with the 66th Annual General Meeting of the International Board. Mission Co-Chairs Dr. Gladys Monroy and Larry Marks led an intimate group of 20 friends on a seven-day tour of Israel and the Weizmann Institute of Science.

On campus, the group met with scientists involved in the Integrated Cancer Center, met with Prof. Brian Berkowitz of the Department of Earth and Planetary Sciences, and attended the dedication of the Nancy and Stephen Grand Israel National Center for Personalized Medicine, followed immediately by a private tour of the Grand INCPM led by its director, Dr. Berta Strulovici.

Canada's Leading Men Gala

Weizmann Canada celebrated 50 years of supporting the Weizmann Institute of Science by honouring 10 remarkable Canadian men at its Leading Men Gala in Toronto on November 16.

The event featured William Shatner, the Canadian-born actor and performer most well-known for his leading role in the *Star Trek* movies and television series. Prof. Oded Aharonson of the Department of Earth and Planetary Sciences was the Weizmann Institute speaker. The event raised $6 million for multiple projects including those chosen by the "leading men" themselves, including research fellow chairs, scholarships, an annual conference, and a collaboration.

The honorees each chose projects that will fund basic research in neuroscience, complex systems research, Alzheimer's disease, memory research, personalized medicine, diabetes, olfaction, cardiac disease and neurological studies.

The Leading Men Gala was co-chaired by Francie Klein and Darlene Switzer-Foster, and Weizmann Institute President Prof. Daniel Zajfman was in attendance.

The Leading Men honored at the Gala included:

- Dr. Daniel C. Andreae, academic and philanthropist
- Tom Beck, Founder of Noma Industries
- Jordan Banks, Global Head of Vertical Strategy & Managing Director, Facebook Canada
- Sam Belzberg, Chairman & CEO, Gibralt Capital Corporation
- David Cynamon, Co-Founder & Executive Chairman at K2 Pure Solutions
- Jeremy Freedman, President & CEO, Gluskin Sheff + Associates Inc.
- Rob McEwen, Chairman & Chief Owner, McEwen Mining Inc. and Lexam VG Gold
- Ralph Medjuck, Chairman & CEO, Centennial Group Ltd
- Calin Rovinescu, President & CEO of Air Canada

L to R: Mrs. Gudrun Hasler, H.E. Mr. Adrian Hasler, H.S.H. Hereditary Prince Alois von und zu Liechtenstein, Prof. Daniel Zajfman, Mrs. Pamela Sommer Dickson, H.E. Mr. Albert Frick, H.E. Mr. Yigal B. Caspi, Mrs. Rita Kieber-Beck, Mr. Robert Drake

European flair

More than 140 guests gathered for the annual dinner of the European Committee for the Weizmann Institute of Science (ECWIS) at Hotel Baur au Lac in Zurich on January 21. The theme was advancing women in science.

Bob Drake, Chair of the European Committee, spoke about the growth of the Institute's network of friends in Europe, evidenced by the establishment of three new societies of friends: in Italy, Hungary, and Sweden. He described the diverse range of scientific projects supported by ECWIS in 2014, and emphasized the importance of securing European support for the Weizmann Institute moving forward.

Weizmann Institute President Prof. Daniel Zajfman gave an overview of recent key developments on campus and his keen interest in advancing women in science.

Prof. Daniella Goldfarb, President's Advisor for Advancing Women in Science, gave a keynote speech in which she described the challenges in securing the best female scientists.

On January 20, some 80 senior business and government leaders from the Principality of Liechtenstein participated in a festive gala dinner hosted by ECWIS and chaired by Mrs. Rita Kieber-Beck, Former Deputy Prime Minister of the Principality. Says Mrs. Kieber-Beck, the event conveyed the "tradition of innovation, collaboration, and promotion of excellence that makes the Weizmann Institute unique".

The event took place at the Ballenlager in Vaduz, in the presence of H.S.H. Hereditary Prince Alois von und zu Liechtenstein; H.E. Mr. Albert Frick, President of the Parliament of the Principality of Liechtenstein; and H.E. Mr. Adrian Hasler, Prime Minister of the Principality of Liechtenstein. ECWIS chair Bob Drake spoke about securing European support for the Institute, and Prof. Zajfman gave the keynote speech on the global impact of the Weizmann Institute.

מכון ויצמן למדע

Actress Natalie Portman and her husband, dancer Benjamin Millepied, with French Prime Minister Manuel Valls and his wife, violinist Anne Gravoin, celebrating 40 years of collaboration between the Weizmann Institute and the Pasteur Institute at the National Opera of Paris on January 12th.

Luis and Miriam Stillmann

From Europe to Mexico, and always Israel

Luis and Miriam (Buba) Stillmann of Mexico City have been close friends of the Weizmann Institute for more than three decades. But, says Luis, it was the horrors of the Holocaust, which he survived, that gave him great affinity for Israel and his long-lost dream of being a medical doctor which drew him to the Weizmann Institute of Science.

"I am a Diaspora Jew. Just to be here in Israel and see an outstanding scientific institution is a dream that I thought I'd never see in my life. It is a major source of pride and joy for me," said Luis.

As a boy in Hungary, Luis dreamed of becoming a medical doctor, but as a Jew in that country in the 1930s, it was impossible to receive acceptance to medical school. So he got a law degree. He survived the Holocaust in Mauthausen concentration camp, and was later employed by the United Nations Relief and Rehabilitation Administration in Germany after the war. He moved to Mexico in 1947, and married Buba Weisz Sajovits—a Romanian Holocaust survivor—a year later. Buba's parents perished in Auschwitz.

In Mexico, he worked in the pharmaceutical industry and held leading positions in the field. He co-founded the Mexican Association of Friends of the Weizmann Institute of Science in 1983. (The Mexican Association is today part of the Latin American Association of Friends of the Weizmann Institute). "It was the Weizmann Institute that brought me back to my passion—medicine and science," he says. He is a Life Member of the Institute's International Board, and has been a member since 1985. Throughout the years, he has helped the Institute develop a network of friends and supporters in Mexico. Luis received an honorary doctorate from the Institute in 2013.

The tragedy of the Holocaust and her survival tale has also played a dominant role in Buba's life. In her 2013 book, *A-11147: Tattooed in My Memory*, she depicts her experience in the concentration camps of Auschwitz, Unterluss, and Bergen-Belsen. She does so through paintings she began creating some 20 years ago, which gave "form and shape to the pain" of her memories, says her daughter Patsy Stillmann Weiss. In one of her most vivid memories, Buba describes a scene from her arrival at Auschwitz when her father ran after her and her sister to hand them their high school diplomas, in the hopes that they would be able to present them to the Nazis and thereby save themselves from hard physical labor. That was the last time Buba saw her father.

The final painting of the book is the "most memorable to me," said Buba. It depicts her and her sister, Itzu, weakened and sad, holding hands at Auschwitz.

Ultimately, writes Patsy in the introduction, the book is a "palpable testimony of one life. As such, it is also a reflection of millions more." In addition to Patsy, Buba and Luis have a second daughter, four grandchildren and five great-grandchildren.

Meeting of the Israel Science Club

The Israel Science Club of the Israeli Friends of the Weizmann Institute of Science hosted Israeli photographer Alex Levac on January 18. Levac discussed his professional journey in photography and his longtime aspiration to capture the nuances of Israeli life and human nature on film. Prof. Nirit Dudovich of the Department of Physics of Complex Systems gave a talk on her research on ultra-fast optics at the event, which was held at the Dan Hotel in Tel Aviv.

Prof. Nirit Dudovich, Prof. Daniel Zajfman and Alex Levac

The art of science at Christie's in London

An evening of science and sushi at Christie's auction house in London on January 27 was held in support of Alzheimer's disease research at the Weizmann Institute.

The event, which attracted 350 young professional guests, aimed at encouraging a new generation of potential philanthropists to engage with the work of the Weizmann Institute. The evening was organized on behalf of Weizmann UK by the newly formed Young Weizmann Committee chaired by brothers Jony and Salomon Aaron.

"Alzheimer's is a terrible and hugely challenging debilitating brain disease," said Salomon Aaron to the guests. "Scientists at the Weizmann Institute are revising what is known about Alzheimer's in order to help find a cure. Proceeds raised from the event were directed to Institute research.

Guests were treated to an exclusive private viewing of Christie's 2015 Impressionist and Modern Art Auction. They were joined by Prof. Noam Sobel from the Department of Neurobiology. He spoke about how his research at the Institute has led to advances in diagnosing autism.

A blockbuster auction took place in Christie's main sale hall. Luxury lots such as fine dining experiences and accommodations at five-star hotels in the UK and Israel were included and added to the evening's fundraising total.

Weizmann-University of Michigan-Technion conference

A delegation of more than 50 scientists from the University of Michigan and the Technion – Israel Institute of Technology and the Weizmann Institute gathered on campus for a three-day conference on biomedical and bioengineering research in late January. “The Weizmann Institute has world-class scientists who have made paradigm-changing discoveries,” said Dr. David Pinksy, Chief of Cardiovascular Medicine at the University of Michigan Medical School, who has helped spearhead the tripartite collaboration. To date, 21 joint grants have been awarded to collaborations between scientists at the three institutions. Two of this year’s grants are being given to Prof. Orly Reiner of the Department of Molecular Genetics and Prof. Steffen Jung of the Department of Immunology.

The story of our origins

Prof. Benny Shilo's Life's Blueprint, *out in print*

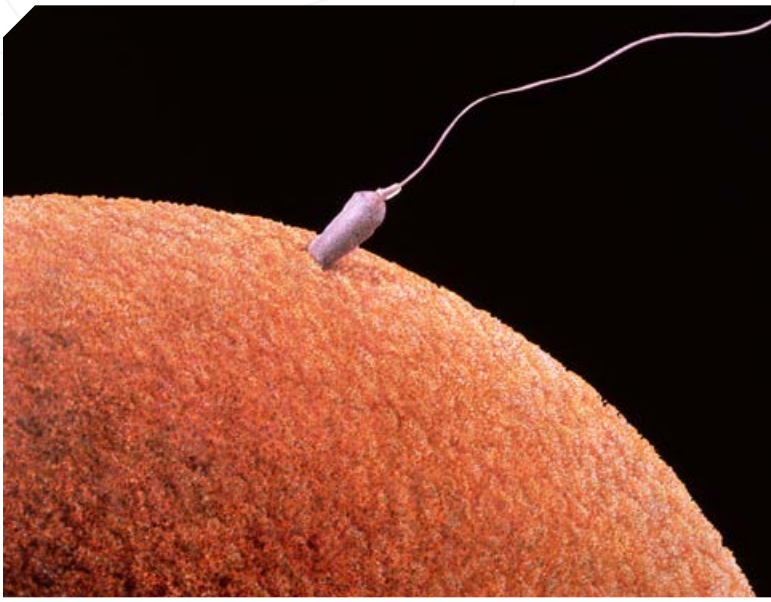
Scientist-photographer Prof. Ben-Zion (Benny) Shilo's new book on the understanding of the formation of embryos brings to life the current scientific knowledge on embryonic development. *Life's Blueprint: The Science and Art of Embryo Creation* (Yale University Press, 2014) was the outcome of a year's sabbatical at Radcliffe Institute for Advanced Study at Harvard University. Prof. Shilo is a member of the Department of Molecular Genetics.

The impetus for the book project was his wish to convey principles of embryonic development to the general public. For each paradigm he describes, he provides both a scientific image and a photo he has taken in the human context, as a corresponding analogy—for instance, the similarities between communication among cells and among human beings.

"In our research, we generate microscopic images that are not only highly informative to the researcher, but also exceptionally beautiful," he says. "Yet, in the absence of sufficient background knowledge, these images can be largely meaningless to the general public... Concentrating on common underlying principles between the two worlds, our intuitive understanding of the human world can be harnessed in order to grasp scientific paradigms of embryonic development."

Pictured here is a pair of images from the book conveying the concept that all cells in the human body carry identical genetic information. On right, the image (a scanning electron micrograph) is of a sperm fertilizing an egg—the moment at which the first cell of the embryo is formed. Throughout the many divisions that will follow, all cell descendants will contain the same genetic data. This genetic information will dictate the pattern of the embryo. Thus, identical twins (above) that carry the same genetic material exhibit such similar features.

Images courtesy of Prof. Shilo; F. Leroy/Science Source



Robin Chemers Neustein and Prof. Nirit Dudovich

Prof. Nirit Dudovich with Robin Chemers Neustein and her daughter.

An ultrafast connection—that's a good way to describe the relationship between Prof. Nirit Dudovich and Robin Chemers Neustein. Prof. Dudovich, a member of the Department of Physics of Complex Systems, is advancing the field of "ultrafast light" to capture atoms and molecules in action. Last year, Mrs. Neustein established the Robin Chemers Neustein Chair with Prof. Dudovich as the first incumbent.

Mrs. Neustein initially established a career development chair for Prof. Dudovich, then raised her giving level to a professorial chair "to honor Nirit upon her promotion in November," Mrs. Neustein says. Upon her promotion, Prof. Dudovich became the Weizmann Institute's first female professor in the Faculty of Physics.

Mrs. Neustein frequently targets her philanthropy to outstanding female research scientists. She became acquainted with the Weizmann Institute through her Rockefeller University co-trustee, D. Ronald Daniel. Mr. Daniel chairs the investment committee of Weizmann Global Endowment Management (W-GEM). He recruited Mrs. Neustein to join the committee when he learned she would be going to Israel in 2010 for her daughter to attend ninth grade.

"Trusteeship service at Rockefeller sparked my interest in scientific research", says Mrs. Neustein, a Senior Director at Goldman Sachs. At Rockefeller, she endowed the chair held by neurobiologist Dr. Leslie Vosshall, renowned for her contributions in the field of olfaction. More recently, she endowed Rockefeller's Laboratory of Mammalian Cell Biology and Development directed by the cell biologist Dr. Elaine Fuchs. At Mount Sinai Medical School, she endowed a postdoctoral fellowship for female research scientists.

The Neustein family's year in Israel turned into four years—for her daughter to complete high school—and Mrs. Neustein commuted back and forth to New York.

Profile of a Pair

During these years, she became more involved with the Weizmann Institute, joining the Executive Board and its Management Committee.

"Research scientists are some of the most entrepreneurial people I know," she says. "They think up new and important questions, write a plan, get it funded, hire staff, work hard for information, and then get the results out there. They are among the best start-up people on Earth."

Fast friendship

In establishing the professorial chair, Mrs. Neustein wanted the incumbent to be a female research scientist. "I read and heard about Nirit's accomplishments in fast physics. Endowing a chair for Prof. Dudovich felt like an amazing opportunity to provide support for a creative scientist early in her career." Mrs. Neustein, together with her daughter, researched Prof. Dudovich's work and visited her lab.

Prof. Dudovich works on generating and applying ultra-short pulses of laser-produced light to probe extremely fast processes in nature, atoms, and molecules. Using these light bursts, she hopes to capture snapshots of things never before seen by the human eye—electron dynamics in atomic and molecular systems, which are at the heart of chemical and physical reactions. A tool for scientific investigation, and a better understanding of light and manipulating light, could have an impact on a variety of scientific fields.

"I made an immediate connection with Robin and am particularly inspired by the fact she 'broke the glass ceiling' in her career, as a woman in a senior position in the male-dominated field of investment banking," says Prof. Dudovich. "Also, her devotion to Israel and her understanding of the importance of basic science are ways in which we connect, and I look forward to a long friendship with Robin and updating her on my progress."

"Nirit is extremely personable as well as being an outstanding scientist, says Mrs. Neustein." She is inquisitive, super-creative and dedicated both to the Institute and to Israel as her home. Her attachment to Israel is meaningful to me and my husband and daughter, because we have become very attached to Israel. We have established a home here too."

So why women? The choice to invest in women scientists originates in the need for science "to have freedom to ask all the questions and get the broadest perspective, and that requires making sure that you pull in both genders," she says. "And the untapped gender is women. This endowment gift reflects two generations of female philanthropy, mother and daughter, choosing to invest in a female scientist. Women funding women."

"The leadership at the Weizmann Institute recognizes that, worldwide, there are relatively few women scientists, and that Israel is a small country reliant on human talent to drive its economy." The Institute, she says, "has tackled the challenge" by running the National Postdoctoral Program for Advancing Women in Science, a nationwide fellowship program, which provides financial support to outstanding female science and math PhD graduates from all Israeli institutions of higher learning.

It turns out that Mrs. Neustein's connection to the Institute transcends her focus on outstanding female scientists. Her own brother attended a high school program on campus in the 1970s. In addition, she always wondered about her own family's connection to Dr. Chaim Weizmann: Her father's family, Chemerinsky, traces back to the tiny town of Motol in Belarus, birthplace of Israel's first President and the Founder of the Weizmann Institute, whose mother was a Chemerinsky.

"The Weizmann Institute is the part of Israel that feels most like home to me," she says. "Science on a world-class level, a spirit of free inquiry and academic freedom, and worldly, open-minded people committed to new discovery and to bringing up new generations of scientists. Scientists at the Institute understand and have reverence for history, have an attachment to the country, and work hard for the benefit of humanity."

Zafra Lerman:
The chemistry of diplomacy

After Prof. Zafra Lerman received her PhD in chemistry in 1970 in the lab of the late Prof. David Samuel, a chemist and neurobiologist, she embarked on a career marked just as much by bringing people together through science as by synthesizing chemicals.

She was a distinguished professor at Columbia College Chicago who founded and was the head of its Institute for Science Education and Science Communication, where she advanced creative methods of combining science with drama, music, dance and other art forms. Much of her work has

Alumni

taken her beyond her own lecture halls. From 1986 to 2010, she was the chairperson of the Subcommittee on Scientific Freedom and Human Rights for the International Activities Committee of the American Chemical Society (ACS). In that context, she worked with dissident scientists from the former Soviet Union, China, and other countries to help them move to the West.

However, it is her work bringing together scientists throughout the Middle East that recently won her the recognition of the American Association for the Advancement of Science (AAAS), bestowing on her the 2014 Award for Science Diplomacy last month.

Her initiative began in 2001, after 9/11, when the ACS subcommittee turned its attention to the Middle East. She launched the first biennial Malta Conference to reduce animosity in the region and to provide opportunities for scientific collaboration. The conference, which has since been held in different locales, is attended by scientists from Bahrain, Egypt, Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, the Palestinian Authority, Qatar, Saudi Arabia, Syria, Turkey, the United Arab Emirates, the United States, and Israel.

What's her secret for drawing dozens of scientists from so many countries, for a five-day event—attended by Israeli scientists? First, each event is attended by a handful of Nobel laureates—individuals who don't usually frequent many of the scientists' home countries. Second, the conference provides forums to develop ideas and strategies on topics requiring regional cooperation, for instance water quality, chemistry safety and security, alternative energy, and—perhaps the most relevant to all parties—science education. Third, she says, "These are people who are eager to collaborate and learn and create global networks. In some cases, the Israeli scientists they meet are the first Israelis they have ever met, and they say the experience challenges all the preconceived notions they have been taught."

It hasn't always been smooth sailing. The second intifada broke out when the first of the Malta conferences was being planned in 2003, and many scientists were hesitant to take part because of the backlash they expected to receive in their home countries should they participate in a conference involving Israelis. That's when Prof. Lerman's idea to invite Nobel laureates surfaced—and the respective governments allowed the scientists to participate for this reason. She chose Malta for security reasons, as it takes at least two flights (typically a stop in Europe) to get there from most Middle East countries. Since then, the conference has been held in Istanbul, Amman, Paris, and again in Malta; the next one will be held in Morocco in November 2015.

Several Weizmann Institute scientists are involved: Prof. David Cahen of the Department of Materials and Interfaces; Prof. Lia Addadi of the Department of Structural Biology; and the husband-wife pair of Prof. Ron Naaman of the Department of Chemical Physics and Dr. Rachel Mamlok-Naaman of the Department of Science Teaching. Additionally, Nobel Laureate Prof. Ada Yonath of the Weizmann Institute participated in Malta VI and will participate in Malta VII.

"The close friendships that have formed as a result of the Malta Conference gatherings are one of the most valuable results," says Prof. Naaman. Last year in his lab, he hosted Prof. Hasan Dweik, a chemist from Al-Quds University in Jerusalem (and Executive Vice President of the university) for a full sabbatical year; the two continue to collaborate and they and their spouses have become close friends. A diverse group of scientists is working on a major project assessing the quality of drinking water and another group is designing a science curriculum.

Prof. Lerman says she wouldn't have had the career that she has had without her education at the Weizmann Institute, where, she says, "I was exposed to a culture of science and science education and an open-minded worldview that emphasized collaboration and freedom of thought, unhindered by artificial boundaries." She continues, "I am extremely proud to be a Weizmann Institute alumna."

Low-tech instruments used to adjust the optical axis of the microscope.

Prof. Shuji Fujii

Biophysics and gaining 'a wider view' of science

For Prof. Shuji Fujii, a visiting scientist from Japan, his year-long stay on the Weizmann Institute of Science campus will be a memorable one. It is here that he started his journey into a new scientific field and where his baby daughter took her first wobbly steps.

A faculty member of the Department of Material Science and Technology at the Nagaoka University of Technology and a rising star in Japan's scientific community, Prof. Fujii has spent the last two decades studying various topics concerning soft matter physics. He is particularly interested in the rheology of liquid crystals—that is, the relationship between the pressure exerted on a liquid crystal and the resultant deformation. This topic intrigues him because there has yet to be formulated a physical law or principle regarding how liquid crystals flow.

Liquid crystal rheology is of great interest to industry because the potential applications are numerous. Prof. Fujii explains: "If you push the liquid crystal, it will deform and make a temporal defect, leading to strange patterns or phenomena, which present problems to manufacturers. I study how the defects correlate with this kind of strange phenomena, a basic research topic with an eye to application."

From physics to biophysics

His interests in recent years, however, have shifted to the world of living matter. The desire to gain the tools to enable him to switch from soft matter physics to biophysics prompted him to take a sabbatical at the Weizmann Institute. Here, he is learning the secrets of the trade from Prof. Michael Elbaum, another physics-to-biophysics convert. Prof. Elbaum studies the various biophysical properties of protein transport mechanisms within cells.

"I was interested in coming to Israel because it is far from Japan and it is also a crazy island of sorts.

Visiting Scientists

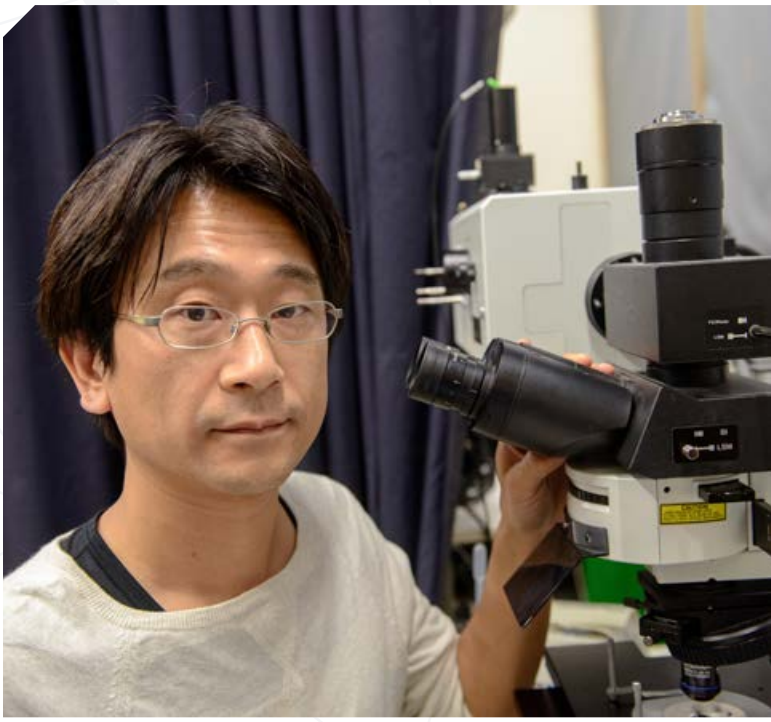
We don't get enough information about Israel in Japan; all you hear about are the bad aspects, like war and missiles flying, but it is also known for its many excellent scientists," he says. "Yet when it comes to the science, we can read articles but it is hard to get information about the researchers themselves—such as *how* they do their research—so I thought to myself, 'Let's go to Israel.'"

In his plunge into the world of the cell, Prof. Fujii has chosen to study one of the key issues in cell biophysics: protein movement. When viewed from a physical perspective, proteins are minute particles somewhat suspended in a large container filled with a gel-like medium. Their movement in the cell is a random motion resulting from their collision with the gel's atoms and molecules, combined with occasional motions driven along protein tracks by tiny molecular motors. These movements expose the nature of the surrounding medium. Is the cell viscous, like honey, or bouncy, like gelatin? By careful analysis of movies made through the microscope, Prof. Fujii can extract information regarding the viscosity and elasticity of the cell itself, which is what he is striving to accomplish in Prof. Elbaum's lab. Much of his time is spent learning relevant biophysics techniques and basic concepts in the field.

"From the first Skype conversation, we immediately found a common language," notes Prof. Elbaum, who has always looked forward to scientific contacts in Japan, an interest he attributes to his mother, who grew up there and still speaks Japanese. "It was very easy to come up with projects of interest to both of us and to make good use of the resources of the lab. It is a pleasure to host Shuji, and I do expect we will stay in touch."

Prof. Fujii greatly values his time on campus. "The Weizmann Institute is a wonderful place, and I enjoy working with Michael, who has an open mind and is always willing to discuss new research proposals," he says. He is particularly amazed by the Institute's strong network of donors and tradition of philanthropy, a rarity in Japan's government-funded higher education system. "I think that philanthropy is a good thing, because total governmental control may potentially restrict scientific progress by directing it to certain areas of science. The advantage in gifts is that they enable flexibility and greater cooperation with other researchers, allow research to be more active, and promote progress."

Prof. Fujii's wife, Chiemi, has also taken full advantage of the Weizmann Institute campus. During her strolls with their daughter, Mahoro, on the campus



lawns, she has made friends with other mothers of newborns, which has resulted in many dinner invitations. The family has also traveled around Israel.

For Prof. Fujii, his stay at the Weizmann Institute has opened his mind: "My impression is that in Japan, you focus very narrowly on your topic whereas in Israel one can 'see' much more—Israelis have a wider view of science. I definitely want to continue to collaborate with scientists at the Weizmann Institute and keep in touch."

Students

Ziv Zwighaft: Ultra-marathoner, ultra-scientist

Photo courtesy of Yonatan Blum and Globes

Running long distances isn't just a hobby for Ziv Zwighaft. It dovetails perfectly with his passion for science—the circadian clock and human metabolism. A PhD student in the lab of Dr. Gad Asher of the Department of Biological Regulation, Zwighaft researches the mechanisms of circadian rhythm, and in his spare time frequently competes in ultra long-distance marathons of up to 217 km (regular marathons are 42.2 km), with all the required training, usually daily, that goes with it.

The circadian clock is a biochemical mechanism that synchronizes body functions and behavior with geophysical time. It is based on a 24-hour cycle that corresponds to regular days and nights and enables an organism to predict, and prepare for, the daily routine and its challenges.

"Being aware of my body's circadian rhythms helps me best prepare for races," says Zwighaft. For instance, the body's greatest cardiovascular and muscle strength is around 4 pm. Races can take up to 48 hours—non-stop. So runners can foresee "the fatigue crises" that occur at the opposite time (like at 2 am). Nevertheless, they must prepare themselves mentally and physically at the highest levels of fitness. And learning is a two-way street as he gleans not only knowledge from his sport that informs his research, but also manages to challenge what he calls his "grit reservoir" that reinforces his persistence on the scientific front.

The longest competition he took part in was a single-day, 217 km race—slightly longer than five consecutive marathons. It took him about 27 hours to complete—a new Israeli record. But, he says, the most memorable and strenuous race he participated in was the Ultra Trail du Mont Blanc (UTMB), a 168 km race that circles the Alps. The trail included ascents and descents of more than 9600 m. "It was the hardest and longest I have ever completed—it took me more than 28 hours—and I gained very deep insight into my soul in the process. I learned that I have the ability to endure even in the most severe conditions."

Meanwhile, he adds, scientific research is a lot like distance running: "You have to pace yourself, knowing when to push and when to slow down a bit; you have to be prepared for the obstacles in your path; to remember you're in it for the duration," he says. "But achieving the goal makes it all worth it."

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