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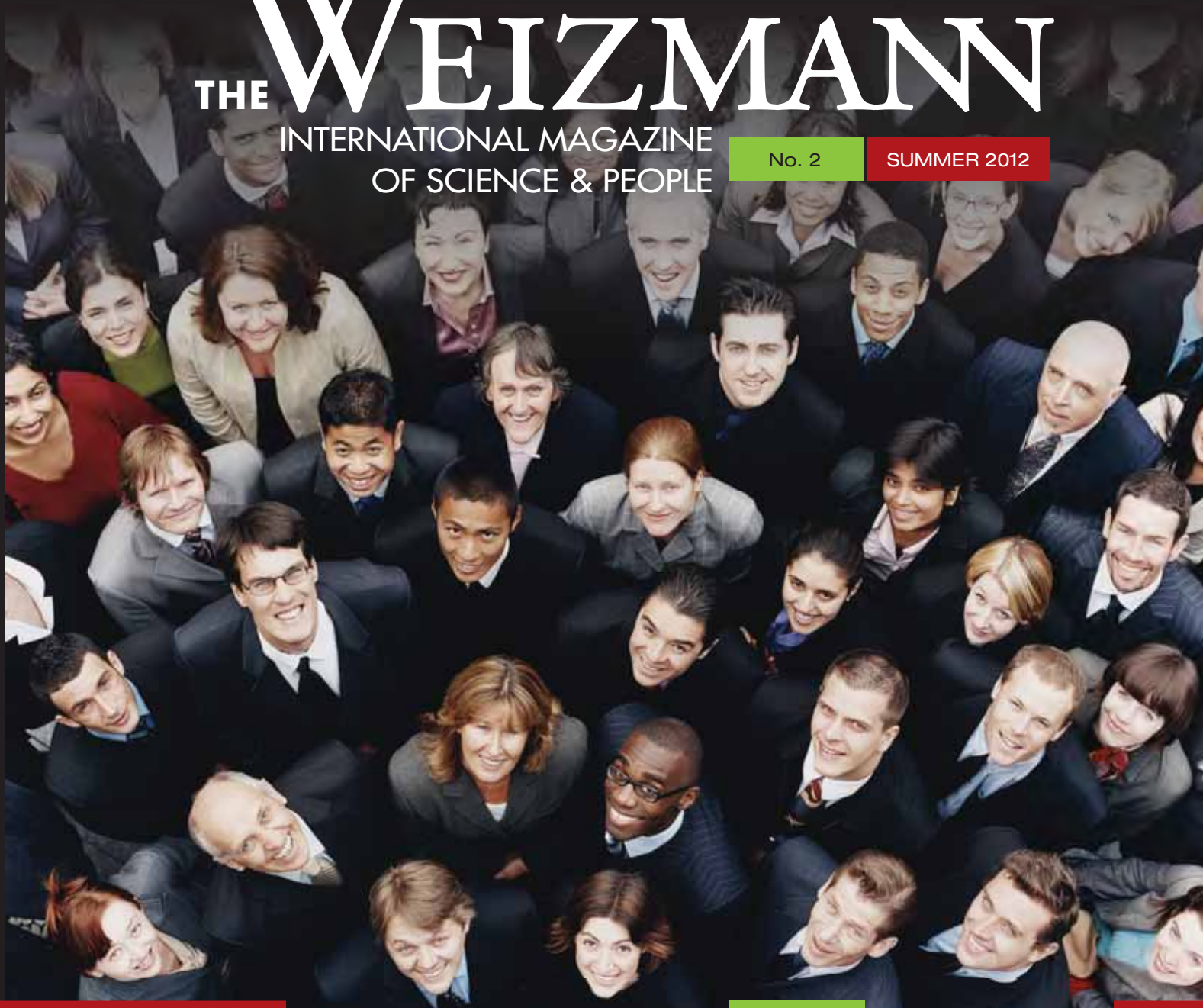

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Personalized Medicine

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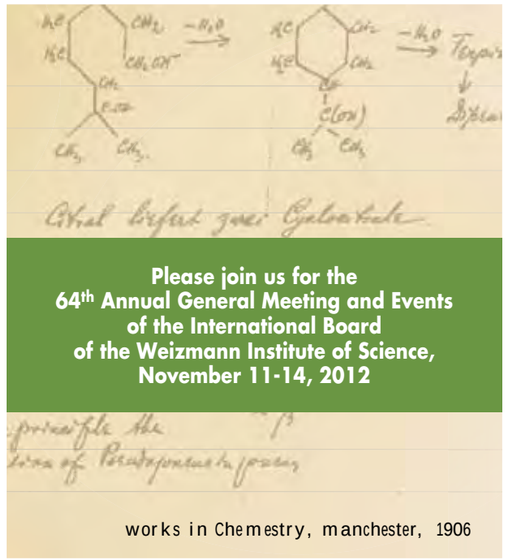

The Weizmann International Magazine of Science & People
No.2, Summer 2012

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From the President

Friends of the Weizmann Institute from all over the world came together recently in Montreal, Canada. It was an unprecedented show of support that was as impressive as it was uplifting. Public figures and leaders in finance and industry from around the globe expressed their trust in the Institute's direction and their desire to be partners in the path of excellence and striving toward progress. The participants in the Global Gathering met with a number of Institute scientists and heard firsthand of Institute activity on the frontiers of science and of plans for the future.

One of the major developments today at the Institute is the establishment of the Israel National Center for Personalized Medicine. This center will be a turning point for the field of biomedical research in Israel: The intent is to work with scientists and physicians from university research departments and medical centers around the country, giving them access to Institute facilities and equipment.

We are also developing two main research programs jointly with the Technion. The first will deal with alternative energy research. This program is supported by the Leona M. and Harry B. Helmsley Charitable Trust. The second program, supported by the Adelis Foundation, will focus on brain research. The combination of the unique engineering capabilities of the Technion faculty with the high quality of the basic research conducted by Institute scientists will create a synergy that will lead to new discoveries and insights in these areas.

A welcome development is the significant rise in the number of candidates for M.Sc. studies in the Feinberg Graduate School. It seems the School is more attractive than ever, and this allows us to accept the very best students.

We are continuing to recruit new scientists to our ranks from the top tier of young scientists around the globe. These young, brilliant men and women will reshape the face of the Institute, even as they greatly expand the borders of human knowledge.

On another note, we were recently reminded that the Israeli public is thirsty. That thirst is not just for drinks of various sorts, but also for knowledge of scientific advance. In the recent Science on Tap event in Tel Aviv, 57 scientists and research students went to 55 bars and coffee shops in Tel Aviv to give the patrons a condensed description of the work in their labs. The event was a complete success, with thousands of eager participants filling the venues to overflowing. Many organizations, in Israel and abroad, are already following in the Institute's footsteps with their own versions of public outreach events.

In other words, the general public is learning what we have been claiming for years – that science is an inseparable part of our culture and society.

Daniel Zajfman

A scientific quest to find the Higgs boson began 25 years ago with a single step. The search is now over

The cost of building it was eight billion dollars, making it the most expensive experiment ever to be conducted on the face of the earth. Five thousand scientists from 500 research institutes and universities in 65 different countries took part. All were focused on one common goal: to find the Higgs boson, the last brick in the edifice called the "Standard Model," which describes the makeup of all the material in the universe. The Higgs was especially sought after, as it is, according the Standard Model, the particle that gives all other elementary particles their mass.

The Large Hadron Collider (LHC), at the European Organization for Nuclear Research (CERN), is a modern-day Tower of Babel – but one where science, nonetheless, provides a common language. It is a rare and fascinating effort in which scientists, politicians and philanthropists from all over the globe have come together to answer one of the great mysteries of nature.

Three generations of scientists

Weizmann Institute scientists have, over the years, played leading parts in this scientific quest, some of them heading international teams of hundreds of physicists. Over the two and a half decades of the search, Institute scientists provided important, creative solutions that were key to the eventual discovery. Prof. Giora Mikenberg, the Lady Davis Professor of Experimental Physics, led the hunt for the Higgs for many years in a previous experiment at CERN called OPAL. From there, he headed the group that designed and built the muon detectors for the ATLAS experiment – one of the two groups that announced the discovery of the particle this July. Prof. Ehud Duchovni, the Wolfgang Gentner Professor of Nuclear Physics, who heads the research group at the Institute, leads a team that is looking for answers to some other central physics questions that may arise out of the data. Prof. Eilam Gross heads the ATLAS experiment research group that has been looking for the Higgs boson. In addition to these three, a number of other Weizmann Institute researchers and scores of engineers and technical people have been involved in the project, including Prof. Vladimir Smakhtin, and Drs. Daniel Lellouch and Lorne Levinson.

Three generations of Weizmann scientists are represented here: Mikenberg was the scientific adviser of Duchovni, and both, in turn, were Gross's advisers. Nella and Leon Benoziyo, along with Friends of the Weizmann Institute in Mexico, were inspired early on by the three physicists and their quest, and their efforts brought about the significant investment needed to conduct the basic research that helped lead to the eventful discovery.

From Earth to Neptune in five hours

The LHC is not only the most expensive experiment ever built, it is the largest single machine in the world. It is a giant particle accelerator, consisting mainly of a circular tunnel 27 km in circumference (20 times the length of the Golden Gate Bridge) spanning the border between France and Switzerland at CERN, near Geneva. It is 100 m under the surface – the height of Big Ben – and the area inside the circle is 58 sq km – about the size of Manhattan.

Inside the LHC tunnel, beams of protons are accelerated to 99.999998% of the speed of light. When these beams travel in opposite directions, they crash into one another, releasing huge amounts of energy that blow apart the protons and create, for less than the blink of an eye, conditions similar to those that existed in the first fraction of a second

(l-r) Profs. Ehud Duchovni, Eilam Gross and Giora Mikenberg. Background: Artist's conception of the "giant detector wheel"

Particle detector assembly in Mexico Building under the supervision of Prof. Giora Mikenberg

after the Big Bang. When the experiment is running, there are a billion collisions occurring every second. The protons fly at a speed of 11,245 circuits a second – a billion kilometers an hour. An object travelling this speed would get from Earth to Neptune in five hours.

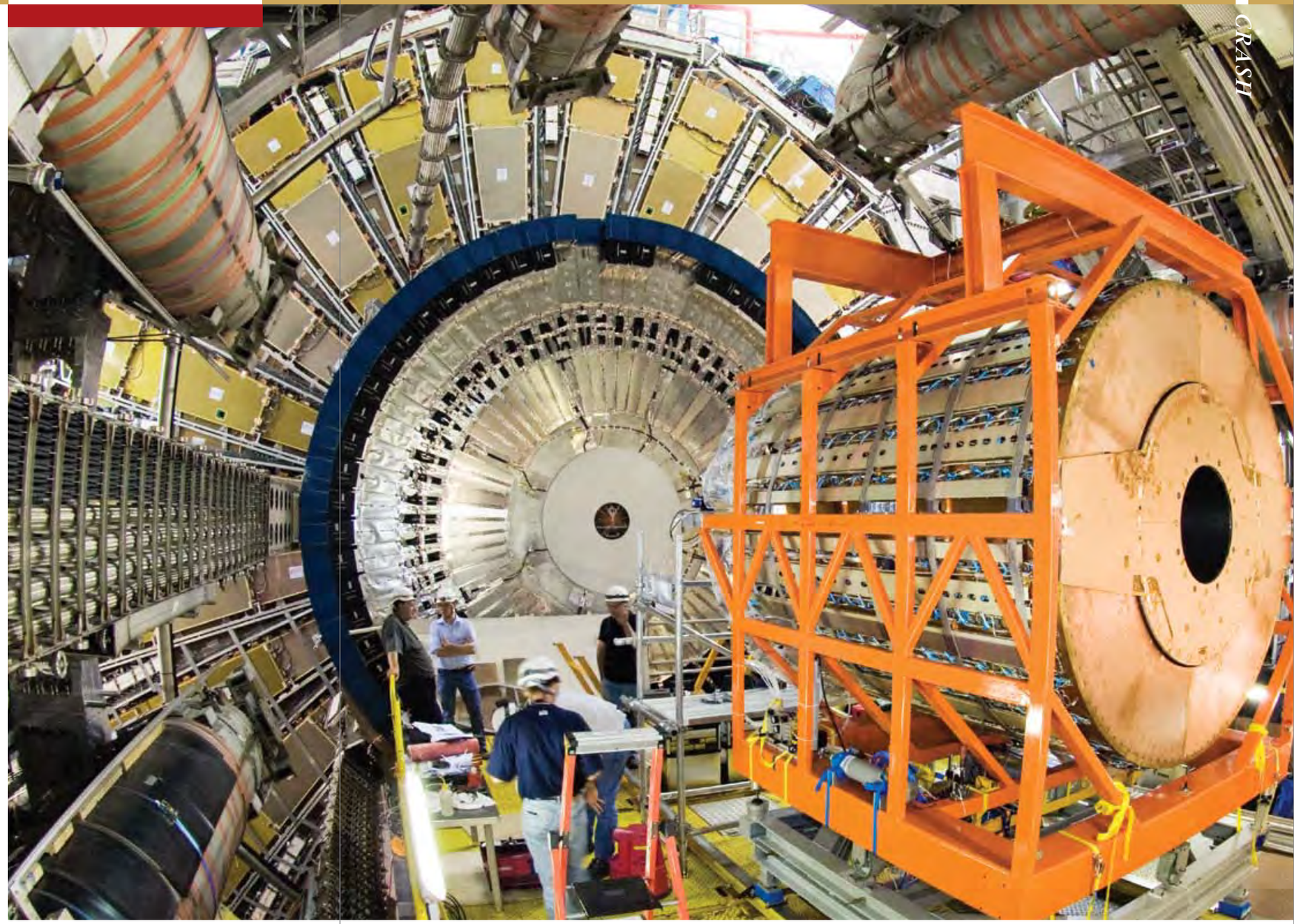
To find a particular signal in all the information from all these collisions is something like trying to understand what is being said by all the people in the world at once – if each were holding 20 phone conversations simultaneously.

The collisions produce energetic particles, some of which only exist for a tiny fraction of a second before decaying into other types of particles. There is no way to directly observe the Higgs boson and tell it from the other particles, but scientists have figured out ways to look for the traces it leaves behind. Each of the particle detectors they developed is designed to trap one specific type of particle.

Mexico City – Rehovot – Geneva

One of the more significant clues left by a Higgs boson is the appearance of four muons. But muons, themselves, are fleeting and hard to detect.

Together, the Weizmann scientists used their ingenuity to build a prototype of a muon detector and adapt it to the needs of the CERN experiments. But soon, another question arose: How to produce the large number of detectors needed for the "giant wheel" of detectors in the accelerator? A group of Mexican friends of the Institute heard of the urgent need for a development and production facility, and they organized the funding for Mexico Building. Here the team had access to the necessary clean rooms to develop and assemble the particle detectors that would play key roles in the quest to find the particle that gives all the others their mass.



At CERN: Assembling the "giant wheel" of particle detectors

The coolest place in the universe

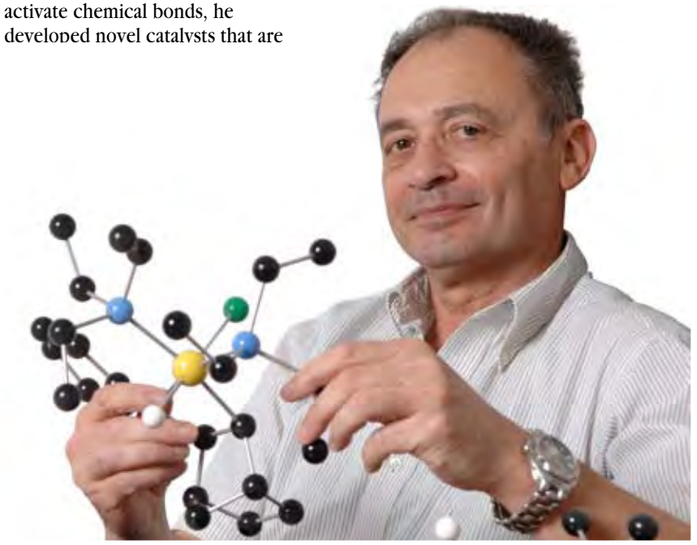
In addition to being one of mankind's most ambitious quests, the LHC has been an experiment in human relations that brings a ray of hope: The scientists and technical teams came from many different ethnic groups and countries – including some that do not normally get along. They all left their differences at the front gate so they could focus on the common goal. At a depth of 100 m below the earth's surface, people were content to let the particles collide, while they worked side-by-side in peace.

Finally, one more interesting fact: The superconducting magnets in the accelerator work at temperatures of 1.9° Kelvin. That is colder than the outer universe, which, due to background radiation, has a mean temperature of 2.7° Kelvin. So scientists at CERN can truly say they work in the coolest place in the universe.

Israel Prize to Prof. David Milstein

On Israel Independence Day, the Institute's Prof. David Milstein, the Israel Matz Professor of Organic Chemistry, received the 2012 Israel Prize for chemistry and physics. The Israel Prize is the country's highest honor.

Interactions between metal atoms and organic molecules are at the heart of Milstein's work, and he is a leader in the field of organo-metallic chemistry. Based on principles he discovered, including new ways to selectively activate chemical bonds, he developed novel catalysts that are



mild conditions, emit no pollutants and do not require the addition of harsh chemicals.

In 2007, *Science* magazine cited as one of ten "breakthroughs of the year" his group's development of a ruthenium-based catalyst to convert starting compounds, called amines and alcohols, directly into another class of widely useful compounds, called amides, which play crucial roles in chemistry and biology. This catalyst, called the "Milstein catalyst," is used today in labs around the world.

In other recent work, Milstein has not only demonstrated greener ways of producing vital organic compounds but has also developed new chemical reactions for sustainable energy. For instance, in 2009, he devised a two-step sequence that uses sunlight to split water into hydrogen and oxygen, and releases no chemical waste. Crucial to the process is a completely new way of generating an oxygen (O_2) molecule.

Yet another new reaction process developed in Milstein's lab may, in the future, lead to practical methods for turning waste carbon dioxide (CO_2) into fuel. New versions of the organic-metal catalysts were used to create methanol from CO_2. The chemical reaction is both green and mild, and fuel production based on this method could recycle greenhouse gasses in the process. In the latest research to come out of his lab, yet another new ruthenium-based catalyst was used to produce primary amines – compounds that are widely used in the chemical and pharmaceutical industries. These compounds are generally produced at high pressures and temperatures, and generate a fair amount of waste; but the new method works at low temperatures and pressures, and yields are selective for the desired compound with no waste.

Milstein studied under Prof. Jochanan Blum at the Hebrew University of Jerusalem, receiving his Ph.D. in 1976. His postdoctoral research was conducted at the University of Iowa and Colorado State University, where he invented, together with his adviser John K. Stille, the Stille reaction, which is widely used for the generation of carbon-carbon bonds. He then went on to work in the Central Research and Development Department at DuPont Co. (Wilmington, Del.). Milstein joined the Weizmann Institute faculty in 1987. In 1996, he was appointed Head of the Organic Chemistry Department, a position he held for three consecutive terms. In 2000, he founded the Kimmel Center for Molecular Design, and he continues to head this Center today. In June, Milstein was elected to the Israel Academy of Sciences and Humanities.

Israel Prize ceremony (l-r) Prof. David Milstein, Israel's President Shimon Peres and Prime Minister Benjamin Netanyahu

Deciphering Money Laundering

Citigroup Inc., one of the largest banks in the world, has decided to step up its war on laundering: Thanks to a major grant from the Citi Foundation, Weizmann computer scientists are spearheading a research project to characterize money-laundering behavior – and suggest ways to identify the perpetrators.

Money laundering is a global problem, yet there is no theoretical or scientific foundation for the topic. "Citi thought it was about time someone in academia tackled this, so they came to us," says Dean Prof. David Peleg, the Norman D. Cohen Professor of Computer Sciences.

One of the challenges is identifying complex money-transfer events, where a large sum of money is broken down into hundreds – if not thousands – of smaller transactions in an effort to conceal it. Searches for suspicious activity involve investigating many types of financial transactions – from credit cards to securities – over millions of customer accounts across many countries. Only sophisticated computer-based algorithms can take on this major data challenge. They can learn the regular patterns and then identify and characterize any irregularities, which will help provide early-warning indicators for money laundering. The Weizmann team will make use of recent advances in machine learning, data streams, combinatorial optimization, data mining and ultra-efficient algorithms (known as "sublinear algorithms").

In addition to Peleg, the team consists of Profs. Michal Irani, Ronen Basri, Uriel Feige, Moni Naor and Adi Shamir, Drs. Robert Krauthgamer, Boaz Nadler, assistant staff scientist Dr. Dorit Ron and some of their students.

To Read the Gene Code – Rewrite It

While we can now read all the letters of the human genome, it is still far from an open book to us. One way to advance our understanding of the "words" and "sentences" contained in the code is to rewrite the text – to change a letter or phrase here and there, or the order of an apparent sentence, insert the new text into a cell and see what changes ensue.

Prof. Eran Segal and his team recently developed a method that can rewrite DNA – the language of the genome – and test the results in living cells. If previous methods took several weeks to alter just one DNA region at a time and even longer to test the effects, the new method makes it possible to simultaneously introduce tens of thousands of DNA regions into living cells – each region in a separate cell – in a planned and systematic manner, and to measure the results of each such change with great precision and within a single experiment.

This method might be used, for instance, to identify which genetic differences between individuals contribute to variations in susceptibility to certain diseases or differences in body types. The Weizmann Institute technology can also lead to improved therapies based on introducing new genes or improved regulatory sequences into cells in order to repair genetic defects.

Thanks to a major grant from the Citi Foundation, Weizmann computer scientists are spearheading a research project to characterize money-laundering behavior – and suggest ways to identify the perpetrators

A Sense of Loss

How does our brain respond to loss? New research by Dr. Rony Paz, incumbent of the Beracha Foundation Career Development Chair, demonstrates that even minor financial loss may cause a stress response in which perceptions blur together.

In the experiment, subjects heard three different notes, each associated with money – gain, loss or neither. When the subjects were given a learning task – training their ear to distinguish between those notes and other similar notes – they improved over time at telling the "gain" or "neutral" notes apart from similar ones, but they actually got worse at distinguishing the "lose money" note from others.

Paz believes this perceptual blurring may have evolved to help our early ancestors react quickly to threats, automatically lumping together every sound that is remotely similar to a predator's growl, for example. But in today's world, everyday stress may induce this blurring and the response can be out of proportion to the real threat. In extreme cases, problems in distinguishing between different negative stimuli may contribute to post traumatic stress syndrome.

Functional MRI (fMRI) scans of the brain areas involved in the learning task showed why some subjects seem to be more susceptible to this blurring than others. The amygdala – the brain's emotion and reward center – was strongly involved. But a second area in the front of the brain that modulates the amygdala's activity was also active; subjects with stronger activity in this area showed less of a drop in their abilities to distinguish between tones.

The grant from the Helmsley Trust for alternative energy research is the Trust's third major grant to Weizmann

Racing Toward New Energy Options

The Leona M. and Harry B. Helmsley Charitable Trust announced a gift of $15 million over three years to fund joint alternative energy research at the Weizmann Institute of Science and the Technion – Israel Institute of Technology. The intiative combines the institutions' outstanding brainpower and research capabilities in three key areas: biofuels research, solar cells and optics to improve solar light harvesting.

Technion President Prof. Peretz Lavie: "The Helmsley Technion-Weizmann grant will enable us to combine the engineering expertise of the Technion with the scientific excellence of Weizmann, to conduct innovative and groundbreaking research in the field of solar energy. Both institutes have had major achievements in energy research, which make this collaboration so promising." The partnership builds on the Israeli Center of Research Excellence (ICORE) in alternative energy, in which the Weizmann Institute participates together with the Technion and Ben-Gurion University.

"There is no doubt that in this alternative energy research program, the whole is greater than the sum of the parts. We thank the Helmsley trust not only for their support, but for their understanding of the synergy they have helped to create," said Institute President Prof. Daniel Zajfman.

Today's promising alternative energy options, including biofuels and photovoltaics, rely on the conversion of sunlight. The expectation is that insights from these areas will pave the way towards artificial photosynthesis, mimicking the energy conversion in plants to generate synthetic fuels. The biggest research challenge is finding ways to overcome loss during the energy-conversion process: In existing methods, only a small portion of the sunlight is ultimately converted to electrical or chemical energy. The Weizmann and Technion scientists will include basic research in optics to find ways to minimize this loss.

The Helmsley energy program will build on the Institute's Alternative Sustainable Energy Research Initiative (AERI); it will enable scientists to work in the three areas – biofuels, solar cells and optics – in parallel. The best solutions may involve combinations of all of them, explains AERI director Prof. David Cahen, the Rowland and Sylvia Schaefer Professor of Energy Research, who will head the Weizmann projects. Cahen has worked closely with his Technion counterpart, Prof. Gideon Grader, and he received the Technion's Kolthoff prize in 2009 for his contributions to energy research.

The grant from the Helmsley Trust for alternative energy research is the Trust's third major grant to Weizmann; the other two are for Crohn's and stem cell research.

Medicine Up Close and Personal

The Weizmann Institute is spearheading a national initiative for state-of-the-art biomedical research in Israel

By the end of the 21st century, people will by carrying around chips containing their entire DNA profile. Suspected malignant cells will be screened for gene and protein profiles to determine a personalized course of treatment. People will enjoy longer and healthier lives because their physicians will recommend individualized preventative measures.

This is the future of modern medicine. So how do we get there?

A consortium of Israel's leading academic and medical entities, headed by the Weizmann Institute of Science, is working to establish the **Israel National Center for Personalized Medicine (INCPM)**, a state-of-the-art research platform aimed at personalizing medical treatment. Among those supporting the new Center are Lester and Renee Crown, whose establishment of the Crown Institute for Genomics is a natural continuation of their deep commitment to this field, which dates back to their founding of the Crown Human Genome Center at the Weizmann Institute in 1999. (For more on gifts to the INCPM, see p. 14.) The Center will enhance Israel's research capabilities in four key cutting-edge fields: **genomics, protein profiling, bioinformatics and drug discovery**.

Four approaches to research in one facility

The current cancer study of Dr. Ido Amit of the Immunology Department is a prime example of how **genomics** will aid in personalizing treatment. Amit is investigating how cancer cells manipulate the immune system to assist tumor growth. Using genomics and high-throughput approaches, he compares gene expression profiles of immune cells from healthy individuals with those of liver cancer patients at different stages of the disease. In addition to understanding the nature of the cancerous beast, this knowledge can be applied to the development of prognostic tools to aid doctors in determining the best course of action for each individual patient.

With genomics – studying whole genomes or large sections of DNA – scientists can now compare the full genomes of healthy and malignant cells. At this point, sequencing an entire human genome takes one to two weeks at a cost of $10,000-20,000. Scientists and industry in Israel and elsewhere are working to reduce these figures to less than a day and $1,000-2,000.

Prof. Mike Fainzilber, the Chaya Professor of Molecular Neuroscience, is one of the many scientists who will be making use of the INCPM **protein profiling**, or proteomics, platform. His team will be using proteomics tools to reveal how communications between various proteins manage the nerves' response to injury and to identify novel proteins involved in nerve regeneration. These may lead to new treatments for spinal cord injury, peripheral neuropathy and neurodegenerative diseases.

Bioinformatics – the third section of the INCPM – is essential for analyzing the vast datasets generated by the experiments. Scientists also apply its methods in combination with others to identify biomarkers – physical "evidence" for physiological states. Such biomarkers are crucial for diagnosis and the development of effective, non-invasive means of assessing treatment options, as well as monitoring preclinical and clinical trials.

The fourth INCPM unit – small-molecule, high-throughput screening – is commonly referred to as "**drug discovery**." Here, researchers will search for molecules that block or modify the activities of biological factors to reveal potential drug compounds. Such studies can also further basic research on biological malfunctions.

The INCPM in a nutshell

The INCPM will be located on the Weizmann Institute campus and is governed by a scientific advisory committee of representatives from Israeli universities, hospitals, and industry; the committee is headed by 2004 Nobel laureate Prof. Aaron Ciechanover of the Technion – Israel Institute of Technology. Dr. Berta Strulovici took up the director's post in the spring. INCPM research will range from basic studies of biological systems to biomedical research for industry to medical research on specific diseases and drugs, and may touch on everything from neurodegenerative diseases to autism, from cancer to rare genetic disorders.

Putting personalized medicine into practice

Even though we humans share almost all of our DNA, there can be up to 10 million differences in the gene code among individuals, not to mention the numerous variations in protein composition and other components of our bodies. Some of those differences translate into disparities in predisposition to diseases, in the ways our bodies metabolize sugars, fats and other nutrients, and in responses to various drugs. "Personalized medicine," says Prof. Zvi Livneh, the Maxwell Ellis Professor in Biomedical Research and Dean of the Faculty of Biochemistry, "is all about finding new ways to identify the predispositions of each individual so that measures can be taken to prevent disease, and determining his or her reaction to drugs so that the best therapy can be used in case of disease."

Prevention

For Livneh, the INCPM will provide cutting-edge tools that will enable him to build on his previous cancer prevention research. For instance, he and Dr. Tamar Paz-Elizur of the Biological Chemistry Department, together with colleagues, discovered that reduced activity of the DNA repair enzyme OGG1 confers a greater risk for lung, and head and neck cancers. OGG1 works to repair DNA injury – especially that caused by cigarette smoke – replacing the damaged bits with new segments. Now, they are extending the scope of their research to additional DNA repair enzymes, with the goal of establishing a panel of DNA repair enzymes that will provide a reliable score of lung cancer risk. Of course smoking can still lead to cancer, emphysema and other complications no matter how effective one's DNA repair mechanisms. But a blood test for lung cancer risk could enable those at high risk to be better informed, hopefully, quit smoking sooner and, importantly, undergo early testing for lung cancer – which greatly improves the success of therapy. The technology developed for the DNA repair tests can be applied to the discovery of novel drugs for improving DNA repair, thus potentially actively preventing cancer.

A Scientific Dream Come True

Nobel laureate Prof. Aaron Ciechanover, Chairman of the Scientific Advisory Committee for the Israel National Center for Personalized Medicine, recently discussed his views on the initiative: "The personalized medicine revolution is not far in the future. In some sense it is already here. Every study, every new tool and insight adds up to create a new medical reality. But the road to completing that revolution is long and winding. We must first understand the general process – for instance interactions between genes, proteins and molecules. Then we can try to predict how the various treatments will affect the course of the disease in small patient groups. Finally, we can begin building personal profiles that will take into account those tiny differences that make each outcome unique.

"For me the National Institute for Personalized Medicine is a dream that is coming true. While it is a fascinating scientific adventure, the Institute will also shorten the distance between the lab and the medicine cabinet. I am also delighted that this is a national undertaking. The Weizmann Institute has taken the initiative to establish a research center that will serve scientists and doctors from all over the country, based on a rare spirit of cooperation. We can only hope that others will follow the Weizmann Institute's example."

Prof. Aaron Ciechanover

INCPM Director Dr. Berta Strulovici on the Challenge Ahead

Dr. Berta Strulovici says that her return to the Weizmann Institute feels like coming home. Strulovici immigrated to Israel in 1974 from Romania, and she received her Ph.D. from the Weizmann Institute in 1982. Moving to the US for postdoctoral research at the Howard Hughes Medical Institute at Duke University, she later served as Vice President of Basic Research at Merck Worldwide and for the last three years was Founding Chief Technology Officer at a biotech startup called iPierian in the San Francisco Bay Area. She recently described her vision for the INCPM and her role in making that vision a reality:

"Already here at Weizmann, I am receiving impressive resumes from around the world from scientists eager to get involved in the INCPM. I do believe that the quality of the people is the most important facet of building a successful organization. A major side benefit of the Center will be to address Israel's brain drain by attracting young scientists back to Israel.

"In the INCPM, scientists with specific questions will come to us and, together, we will put their questions in a larger context, enabling bigger questions to be tackled, bigger experiments to be planned and executed. So, for instance, instead of simply investigating the actions of "protein X" involved in autism, we will have huge data sets at our fingertips of a variety of genes involved in autism, and we can then search for drug-like compounds that modulate the system. We can do this because advances in technology have allowed us to do bigger experiments faster and more cheaply.

"The biggest challenge for me is this: How do you take the free thinking of academia, which is essential to maintain, and channel it in a way that has greater discipline and certain goals?

"I envision that there will be a more robust pipeline of breakthroughs to license. I think scientists will take pride that something they discovered resulted in a 'bigger' outcome than they originally expected."

A Major Gift from the de Botton Family for Personalized Medicine

A major gift to support the Institute for Protein Profiling has been received in memory of the legendary Egyptian-born Swiss financier Gilbert de Botton, who died in 2000 at age 65.

Gilbert and his second wife, Janet, were members of the International Board of the Weizmann Institute, and they endowed a professorial chair, the Gilbert de Botton Chair for Plant Sciences. The Gilbert de Botton Building recognizes his role in helping the Institute to establish its technology transfer arm, Yeda Research and Development Co.

The de Botton legacy

Gilbert de Botton was born in Alexandria, Egypt, in 1935. His mother, Yolande Gabbai de Botton, circulated among the Egyptian government social elite, but she served time in an Egyptian jail for spying for David Ben Gurion.

Today, there is a square in Jerusalem named in her honor.

He left Egypt following Gamal Abdel Nasser's seizure of power in 1952, studying economics at the Hebrew University of Jerusalem and Columbia University in New York. An accomplished economist and businessman, he spoke seven languages. Eventually, he went to work for the Rothschild family, setting up a bank in Zurich. Gilbert married Janet – daughter of Lord Wolfson and granddaughter of Sir Isaac Wolfson – in 1990, cementing his ties to Israel and the Weizmann Institute.

Miel de Botton, who studied law at Oxford University and psychology in Paris, and her brother, writer and philosopher Alain de Botton, are Gilbert's children from his first marriage to Jacqueline Burgauer. They share his visionary commitment to the Weizmann Institute.

Gilbert de Botton

Miel de Botton

A New Home on Landmark Site

The Israel National Center for Personalized Medicine (INCPM) will be headquartered in the the Canadian Institute for the Energies and Applied Research on the Weizmann campus, better known as the "solar tower." Completed in 1987, the iconic solar tower – with its lofty façade and mirror field – was the centerpiece of large-scale, advanced research in concentrated solar thermal energy; for more than two decades it played a key role in solar thermal energy development in Israel.

Using the tower's concentrated solar energy, Weizmann scientists pioneered chemistry to refine zinc for fuel cells from zinc oxide, and demonstrated solar-thermal conversion of methane and other hydrocarbons into clean-burning synthetic fuels. These and other research successes have been translated to industry. Commercial-scale solar towers have been built in China, Israel and Spain based on Weizmann Institute designs, with more on the drawing boards. Basic research in alternative energy is now done on a smaller scale in the lab, freeing the solar tower for new research needs.

Now, with the blessing of Weizmann Canada, the solar tower will become the central hub for an even more ambitious national program. Renovations are set to start in early 2013. Once again, this unique building will serve as a national facility in which research promises to benefit humanity on a grand scale.

A Philanthropic Way of Life

When Vivien Clore stepped off the plane on her first visit to Israel as a child in the 1950s, her first glimpse was of "an amazing man with white hair flowing everywhere, jabbering to us as he went up the stairs of the plane to greet us." That man was Meyer Weisgal, the personal assistant of Dr. Chaim Weizmann and a driving force in the creation of the Weizmann Institute. He was there to escort Sir Charles Clore and his two children, Vivien and Alan, to the Institute campus in Rehovot, where they would spend their first of many Passovers.

Indeed, the Clore family relationship with Weizmann is unique – one of deep commitment to Israel, science and science education. "No link is as strong as with the Weizmann Institute," says Dame Vivien. Her story is of a young girl's exposure to the Institute and some of its earliest founders leading to a life-long friendship – one that has benefited generations of scientists, students and members of the Israeli public, as well as the advancement of science and education in Israel.

The fragrance of oranges

Sir Charles Clore (1904-1979) was a successful London businessman, "an entrepreneurial genius" according to the *Independent*. He owned the British Shoe Corporation, Selfridges department store and the Clore Shipping Company, and he invested in real estate. Vivien's mother, Francine Halphen, was related to the Sassoon and the Rothschild families; she had been a heroine of the French resistance in World War II. When not traveling for work, Sir Charles went to Palestine. His first trip, in the 1920s, was fueled by curiosity about the place in which his friends Sir Isaac Wolfson and Lord Israel Sieff were becoming increasingly involved.

Sir Charles witnessed Israel Sieff's support of Chaim Weizmann in laying the groundwork for the Balfour Declaration of 1917. He, himself, supported Israel and Rebecca Sieff in establishing the Daniel Sieff Research Institute in 1934 in memory of their son; in 1949 and with the blessing of the Sieff family, it would be renamed the Weizmann Institute of Science. The highly philanthropic Sir Isaac Wolfson established the Wolfson Charitable Trust and the Wolfson Foundation, giving generously to causes in Israel and in particular to the Weizmann Institute.

> ***"Philanthropy was just part of our life; especially so in Israel"***
> ***Dame Vivien Duffield***

Dame Vivien recalls her first trip to Israel in 1956, at age 11: "I felt tremendous excitement. It was the biggest event of my life." With no direct flights to Israel, they stopped in Paris, Rome, Athens and Cyprus before arriving in Tel Aviv. The family stayed for two weeks at the home of Abba Eban on the Weizmann campus – steps away from the private residences of the Wolfsons and Weisgals. (At the time, Eban was away serving as Israel's ambassador to the US and its permanent representative in the UN.) Dame Vivien and her family spent the next eight Passovers on the Weizmann campus, celebrating with the Sieff, Wolfson and Weisgal families. She also came to know the scientists and their families, including Profs. David Samuel, Leo Sachs and Aharon Katzir.

Dame Vivien loved the campus' grassy open spaces and its rural surroundings, particularly "the wonderful smell of the orange groves – something we didn't have in England." When Israel Sieff's son Marcus warned her about the jackals that howled at night, she was terrified. (Marcus and his son David became close friends of the Institute and held various key leadership positions; Marcus was chairman of the Board and the Institute's only chancellor).

"The jackals were howling away indeed," she recalls. "But it was a peaceful place. We used to walk to synagogue. Rehovot was like a village in those days. We came because of our friends, and it was a wonderful small community of English Jews who helped build the Institute, together with its earliest American donors."

(l-r) Meyer Weisgal and Sir Charles Clore review plans for the Charles Clore International House

Dame Vivien Clore Duffield at the inauguration of the Clore Prize, 1981

Sir Charles Clore with grandchildren George and Arabella

Giving and building

Sir Charles became a member of Weizmann's Board of Governors, giving his first major gift to the Institute in 1964 for the construction of the Charles Clore International House. This building housed 80 graduate students; the top floor was originally a flat for the Clore family. (Now a historic preservation site, it is undergoing extensive renovation.) In addition to Weizmann, Jerusalem became a major focus of his giving, an outgrowth of Clore's close friendship with the city's late mayor Teddy Kollek. Dame Vivien continues to contribute to both through the Clore Israel Foundation, which her father established in 1965. By the time Sir Charles' father died, the family ties to Israel had grown so close, he was buried in Petah Tikva.

Dame Vivien's father had great respect for Israeli ingenuity and tenacity. At a 1962 dinner held by the Weizmann Institute in his honor in London, he said: "The Israelis, with their very limited resources, have ways of doing things, which, by all the rules, can be shown to be technically impossible. It is a country which must live by the quality of its men and women and not by its raw materials, and it has shown that the dividends are enormous when a nation beset by difficulties faces its problems without fear."

Sir Charles never taught his children philanthropy, says Dame Vivien. She learned by example: "Philanthropy was just part of our life; especially so in Israel. When we landed, hoards of people would try to get in the plane and grab Dad to ask him for money before others could talk to him. He couldn't stay in the country for more than two or three weeks because he would go broke."

When she turned 21, her father gave her a present of £100,000. She used it to establish her own foundation.

Sir Charles passed away in 1979. Since then, Dame Vivien has run the Clore Israel Foundation, which has given so widely that the Clore name is known to every Israeli. She also runs the Clore Duffield Foundation in the UK, which focuses on children and the arts. She is a long-time member of the Institute's International and Executive Boards and its committees, and a former Deputy Chairman of the International Board. In May, she was inducted into the President's Circle in recognition of her long history of service and generosity to the Institute.

While Clore philanthropy has touched every corner of the Institute, Dame Vivien has some favorites: the restoration of the Chaim Weizmann house on the occasion of her father's 75th birthday in 1974, the establishment of the prestigious Clore Prize for outstanding scientists – which originally funded non-science projects as well as scientific ones – and the Clore Garden of Science, the Institute's outdoor science museum.

Her foundation has also funded the School of Contemporary Science at the Davidson Institute of Science Education; the Clore Center for Biological Physics; the Clore Scholarships and Clore Postdoctoral Scholarships, which have gone to hundreds of recipients; and more.

Philanthropy is her life's passion and purpose. It is her career and the focus of most of her outsized energies, so that her beneficiaries not only benefit from her financial generosity but her engagement and involvement in their causes.

"I've absorbed the science over the years, but I am most interested in the sacrifices scientists make and the education they must attain to get to where they are," she says.

One of her recent, ongoing gifts is to the National Postdoctoral Award Institute for Advancing Women in Science (see p. 38). The foundation has supported 10 such fellowships so far. "In my generation, having a husband, children, and a career was a rarity," says Dame Vivien. "In this generation, if a woman chooses to have it all, then I believe every bit of encouragement should be given to her."

Dame Vivien's daughter and son have taken up the Clore legacy: Arabella, who recently joined the International Board, spent 20 years in Africa working on children's welfare and health, and George runs a foundation dedicated to preserving marine life and reversing over-fishing. He is also making an IMAX movie about Jerusalem. Like their mother, the two first came as small children to Weizmann. Arabella spent a teenage summer on campus in the Bessie Lawrence International Summer Science Institute.

Dame Vivien is optimistic that philanthropy in Israel and to Weizmann will only increase – especially as wealthy Israelis begin to give more. "Weizmann stands out through luck, foresight and the talent of its scientists, and it is a beacon of light to the world," she says. "But Weizmann's future is also dependent on the state of affairs in Israel, and that is also something I'm optimistic about."

Pairing Up Proteins

Dr. Maya Schuldiner in her robotic lab

No one has yet invented a robot that sorts through piles of unmatched socks. But in the lab of Dr. Maya Schuldiner, robots have been programmed to do an equivalent task – assuming there are thousands of socks and they are all microscopic.

Schuldiner and her team are searching for protein pairs. The first half of each pair is a protein molecule that has been folded into shape and quality tested within a cellular organelle called the endoplasmic reticulum (ER). The second is an "escort" that helps the ready protein molecule exit the ER, sorted and packaged, on its way to its next destination. Scientists are interested in finding these matches because many of the proteins that pass through the ER are those manufactured for export to other cells and organs – hormones, growth factors and various other signaling molecules. Since these proteins are often important players in metabolic and autoimmune diseases, not to mention cancer, understanding how they are processed in the cell could help researchers find ways to regulate them.

But until now, searches for pairs were like trying to match socks by hand: Only ten escorts had been identified and these were matched to only a handful of proteins. So Schuldiner and her team developed a system called PAIRS to automatically create thousands of protein-protein combinations and then robotically scan them for matches.

In their experiment, the team focused on the ten known escorts, looking for the proteins they assist in exiting the ER. Every escort turned out to have a small group of proteins that use its services and the team managed to identify the common traits or functions that tie each group together. All except one: An escort called Erv14 seemed to engage with a particularly large and diverse group of proteins. After a series of experiments ruled out all the obvious factors, the team hit upon the one thing they all share – an extra-long domain that enables them to be displayed on the cell membrane. One of the proteins using the Erv14 escort is the EGF receptor protein, which is involved in both proper embryonic development and cancer growth.

Schuldiner and her team plan to continue this investigation, hoping to uncover new escorts and, eventually, to match the entire pile of proteins with the helpers that speed them on their way.

A rewarding life

Dr. Maya Schuldiner grew up in Jerusalem and in London, where her father was Israel's cultural attaché. She is married to Dr. Oren Schuldiner of the Institute's Molecular Cell Biology Department, and the couple has two – soon to be three – sons. "Oren and I work as a team and make all of our decisions together," says Schuldiner. "There are advantages to both of us being scientists, but there is no nine-to-five workday. I often work into the night."

In addition to lab work, family and pastimes, Schuldiner is involved in the advancement of women in science. "As women and mothers, we bring something unique to science. You might not have a lot of free time, but it is a rich, rewarding life."

Designed to Match

Dr. Sarel Fleishman

Ever wish for the perfect mate? Dr. Sarel Fleishman is working on creating them – for proteins. A perfect mate for a viral protein, for example, should be the smothering type – one that binds tightly and holds the virus back from "expressing itself" in its usual virus way.

How does one go about designing a mate for a protein molecule? In his recent postdoctoral research, Fleishman helped to develop innovative methods for this new research field. The first step is theoretical computation to figure out the molecular structure the ideal mate will need to bind to its significant other. Then, one searches databases of existing protein structures (including the pioneering ones developed at the Weizmann Institute) to find some that might be fiddled with to insert that extra bit of protein. After that, it is off to the lab to alter the selected proteins and try them out. Finally, one must see if any of those proteins not only bind to their target site, but have the desired effect.

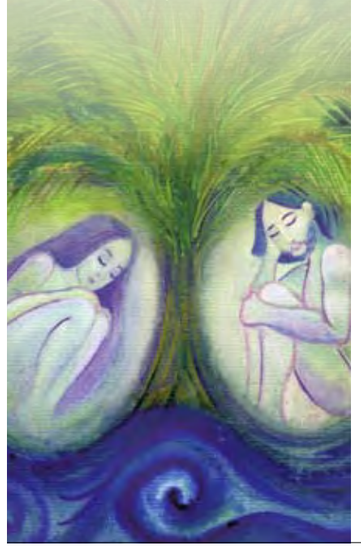
Fleishman and his colleagues used this method to design an ideal mate for a flu virus. Out of several dozen proteins they adapted to include the designer site, five bound to the target proteins in the lab, and one of those blocked the flu viruses' ability to spread. The active site to which the designed protein binds has been conserved throughout the evolution of the flu, so it is found in many strains, including bird and swine flu. The new molecules' therapeutic potential is currently being investigated.

"Basically," says Fleishman, "by combining our computational tools with an experimental approach, we were able to create molecules that don't exist in nature. Such programmed molecules could give us the ability to direct molecular activities, and they might have a wide range of uses in medicine, diagnostic tools and biotechnology." In other words, nearly ideal mates – even if they don't exist in nature – can now be produced with a computer and a biology lab. The method might be used, in the future, to design new drugs. For emerging diseases, for instance, the ability to design matches for a new pathogen might be a potential shortcut that could get effective treatments to the clinic faster.

Combining math and biology

Dr. Sarel Fleishman grew up near the Institute, in Ness Ziona, and he attended Tel Aviv University in a multidisciplinary program that enabled him to combine math and biology. His doctoral work on computational studies of membrane structures earned him a prestigious *Science* Magazine and GE Healthcare Award for Young Life Scientists. His postdoctoral research was conducted in the lab of Prof. David Baker at the University of Washington (Seattle). There, says Fleishman, he had the opportunity not just to predict the actions of existing proteins, but to design new proteins and to combine lab work with computer modeling.

Fleishman lives in Rehovot with his wife Dana, their three children and their dog Tuka. In his spare time he enjoys jogging, hiking, reading, classical music and the never-changing blue sky of Israel.



Unveiling the Excitement: The New Barbara and Morris Levinson Visitors Center

What is life like for a scientist at the Weizmann Institute? What childhood experiences led certain people to devote their lives to understanding the world around them or exploring ways to eradicate disease? How does a healthy cell become a cancerous one?

For the curious visitor, the newly remodeled, state-of-the-art Barbara and Morris Levinson Visitors Center will satisfy such questions and more, thanks to a generous donation from the Morris Levinson Foundation. The renovated Center will be inaugurated at the International Board in November.

The Levinson Visitors Center is situated at the entrance to the campus in the David Lopatie Conference Centre. Visitors range from VIPs – dignitaries, Institute friends and supporters, and business delegations – to participants in scientific conferences and the public at large. In 2011 alone, there were 33,500 visitors to the Weizmann Institute.

A Weizmann Institute introductory video can be viewed while scientific visuals are projected onto the glass floor below

The remodeled Center will contain technologically advanced exhibits that will take the visitor on a journey of learning and discovery. For example, an interactive lab will reveal the different scales of measurement from parsecs all the way down to nanometers, a day in the life of a scientist, and a Weizmann Institute introductory video that can be viewed while scientific visuals are projected onto the glass floor below.

"The new Visitors Center will enable guests to become closely acquainted with the fascinating world of scientists," says Navit Kopelis, Head of the Levinson Visitors Center. "It is an exciting experience that creates a feeling of pride and elation." Kopelis describes the Visitors Center as the "gateway" to the green and beautiful campus of the Institute.

Celebrating with well-wishers Galia Maor, former CEO of Bank Leumi

....and actress Gila Almagor

A Grand Birthday Celebration

On March 6, more than 250 friends and colleagues gathered to celebrate the 88th birthday of former Weizmann Institute President, Institute Prof. Michael Sela, the W. Garfield Weston Professor of Immunology, at the David Lopatie Conference Centre on campus. In addition to congratulating Prof. Sela on his decades of accomplishment as a scientist and leader, the event shone a spotlight on the Yeda-Sela Center for Basic Research, to which he and his wife Sara contributed generously when it was launched it in 2008.

"Michael has spent his life exploring, creating and inventing for the greater benefit of this world," said Prof. Zajfman at the birthday celebration, which was emceed by Executive Board Chairman Avraham Ben-Naftali.

Prof. Sela, an immunologist, served as President of the Institute from 1975 to 1985; he received the Israel Prize in the Life Sciences in 1959 and the Wolf Prize in Medicine in 1998. He is a co-inventor of two blockbuster drugs, Copaxone and Erbitux, for the treatment of multiple sclerosis and cancer, respectively.

The Selas' contribution to the establishment of the Yeda-Sela Center was in keeping with Prof. Sela's life-long advocacy of basic research. In its short history, the Center has advanced the research of 31 scientists throughout the five faculties, touching nearly every corner of the campus. The Vice President of the Weizmann Institute, Prof. Haim Garty, serves as its director. The Center was established following the Institute's success in commercializing Erbitux, whose underlying intellectual property rights were based on research at the Institute by Prof. Sela and his colleagues Drs. Esther Hurwitz and Esther Aboud-Pirak. The Selas' generous contribution from the royalties was matched by Institute funds.

In appreciation for Sara and Michael Sela's passionate patronage of the arts, the event was enriched by performances by maestro Zubin Mehta and the Bat-Sheva Dance Company.

Prof. Michael and Sara Sela (fourth and fifth from left) and family

Friendship, Italian Style

The Sergio Lombroso Program is helping build Israeli-Italian connections for the benefit of science

One day in 1988, the Weizmann Institute found that it was the beneficiary of a large estate from an unknown donor in Italy who, in his will, had requested his gift be devoted to cancer research. The mystery legator turned out to be Sergio Lombroso.

Lombroso, a Jewish lawyer, had been formally barred from practice in Fascist Italy in 1940. Returning to his home in Rovereto, near Verona, at the end of the war, he pursued a distinguished legal career and never married.

Over the years, Lombroso developed a keen interest in science, seeing its potential to benefit humanity. He was devoted to Israel and was deeply impressed by the rapid achievements of Israelis in so many fields. During one trip, he visited the Weizmann Institute and decided to include it in his will, describing it as "a jewel of humanity."

Lombroso died in a car accident in 1988 at age 77. In 2011, the Lawyers Association of Rovereto officially cancelled the racist resolution of 1940 that ousted Lombroso from the legal profession.

(l-r) Profs. Avigdor Scherz and Yoram Salomon

The program

Lombroso's legacy created an endowed fund with two distinct purposes.

The prestigious Sergio Lombroso Award in Cancer Research is given annually to a prominent cancer researcher – every other year to a Weizmann scientist and the alternate year to an international figure. The prize committee is headed by the Institute's Vice President and includes leading researchers and clinicians from within and outside the Institute.

The Institute's Profs. Avigdor Scherz, Robert and Yadelle Sklare Professor in Biochemistry, and Yoram Salomon, the Charles W. and Tillie K. Lubin Professor of Hormone Research, received the award in 2012; past Weizmann recipients include Profs. Yosef Yarden, Moshe Oren, Adi Kimchi, Varda Rotter and Eli Canaani. Past international winners include Profs. Steven Rosenberg of the U.S. National Institutes of Health and Axel Ullrich of the Max-Planck Institute of Biochemistry in Germany.

The endowment also awards around five fellowships a year for Italian students and postdoctoral fellows to focus on cancer research at the Institute. This creative use of the legacy is administered by Institute staff in coordination with Daniela di Segni, Lombroso's niece in Rome, who promotes the program at Italian universities.

"For the Italians, Israel has the advantages of being relatively close to home, with a good climate and similar mentality," she says. "Weizmann offers the highest standard of science, conducted in an egalitarian and free atmosphere – the Italians love it."

The benefits are equally important to the Institute, as contacts in the early stages of these young scientists' careers lay the foundation for future scientific relations.

Major Grant from the Thompson Foundation

The Weizmann Institute of Science and Memorial Sloan Kettering Cancer Center (MSKCC) in New York are joining forces in unique translational research that may provide a viable treatment option for prostate cancer, thanks to a major, visionary grant by the Thompson Family Foundation of New York.

The collaboration arose from the therapy devised by plant scientist Prof. Avigdor Scherz and biologist Prof. Yoram Salomon, which utilizes chlorophyll derivatives. Intravenous injection of these compounds followed by near-infrared illumination of the tumors results in the restriction of blood flow around the tumor, ultimately destroying it. The derivative is called Tookad-Soluable (TS) and the method is termed vascular-targeted photodynamic therapy (VTP).

In clinical trials for prostate cancer, TS-VTP was shown to safely and effectively eradicate diseased tissue without the difficult side effects often seen with other therapies.

The research funded by the Thompson Foundation will explore the application of TS-VTP for more advanced prostate cancers. The Weizmann groups, together with Drs. Jonathan Coleman and Peter Scardino of MSKCC, will focus TS-VTP as stand-alone therapy and in combination with other treatments.

Scherz: "This joint research should have an impact on all stages of prostate cancer, providing safe and effective treatment options to men with this disease."

Global Gathering 2012:

Science and Savoir Faire

Some 420 donors and friends of the Weizmann Institute of Science gathered on May 6-9 in Montreal for an event that combined the best in entertainment with opportunities to hear first-hand from scientists about Weizmann research. The Global Gathering, which has become a biennial tradition for the Institute, was previously held in Washington D.C. and Paris.

"The Global Gathering is a celebration of all the hard work and dedication of our worldwide community of friends and supporters – a chance for the Weizmann Institute to say thank you, to continue to deepen friendships and widen our circle, and talk about some of the Institute's major priorities for moving forward," said Prof. Daniel Zajfman, President of the Weizmann Institute. This year's event "acknowledges the groundswell of support from our Canadian friends in recent years, building on a long-time tradition of philanthropy from Canada."

President's Circle

Eleven new members were inducted into the President's Circle in recognition of these donors' special level of commitment and generosity. The President's Circle was started by the American Friends of the Weizmann Institute of Science (ACWIS), but it has since widened its reach to include Weizmann friends from around the globe. The induction ceremony has become a highlight of the Global Gathering.

"The Weizmann Institute of Science helps present Israel as a healer in the world – one that applies extraordinary intellect, research, and energy in solving seemingly impossible challenges," said Arlyn J. Imberman of New York, one of the President's Circle inductees.

Other inductees are: David Azrieli of Montreal; Lorna Greenberg Scherzer of Montreal; Jay Alan Smith and Laura Rapp of Toronto; Leslie and Anna Dan of Toronto; Murray and Marvelle Koffler of Toronto; Tova and Sami Sagol of Ramat Hasharon, Israel; Prof. Ruth and Dr. Uri Arnon of Rehovot; David Lopatie of Saxonwold, South Africa; Dame Vivien Duffield of London; and Lord Mitchell and Lady Lowy-Mitchell of London.

"It is an honor for the Weizmann Institute to bestow this award on such an outstanding group of close friends, who value the contribution of science to the improvement of humanity and, in particular, the special nature of the Weizmann Institute," said Prof. Zajfman.

The induction ceremony, which was followed by a festive dinner, was also attended by Cathy Beck, President of Weizmann Canada; Larry Blumberg, Chair of ACWIS, Ido Dissentshik, Chair of the Executive Board of the Weizmann Institute (representing Israel in the absence of Shimshon Harel, Chair of the Israeli Friends) and Bob Drake, Vice Chair of the Executive Board of the Institute (and also representing the European Committee in the absence of Maurice Dwek, its Chair).

Personalized Medicine

The event provided a platform for informing the Institute's friends about the Israel National Center for Personalized Medicine, its uniqueness and its expected impact on human health (see cover story p. 10).

President Prof. Daniel Zajfman described the new center, saying it "will enhance the efficacy of medical treatment for many diseases and disorders through the use of the most advanced research tools and unprecedented cooperation between the basic research and clinical setting."

Prof. Zvi Livneh, the Maxwell Ellis Professor in Biomedical Research, Dean of the Biological Chemistry Faculty, and a key figure in establishing the Center added: "Sophisticated high-throughput technologies that will be established in the INCPM will provide, in collaboration with clinical centers, a broad database for identifying biomolecular differences between people and how they are

(l-r) Prof. Daniel Zajfman, Arlyn Imberman and Larry Blumberg, Chair of ACWIS

(l-r) Prof. Ruth Arnon and Shelley Ortved

(l-r) Prof. Daniel Zajfman, Weizmann Canada President Cathy Beck and Lorna Greenberg Scherzer

Guy Laliberte, founder of Cirque du Soleil

altered in disease. However, it is only through basic research such as that being done at Weizmann that we will be able to reach an understanding of what biological processes in our bodies have gone wrong and how we can find cures for those 'malfunctions.'"

In addition to Livneh, audience members heard from a series of presenters who outlined the structure, function and goals of the INCPM, including Prof. Doron Lancet, the Ralph D. and Lois R. Silver Professor of Human Genomics and INCPM Director Dr. Berta Strulovici (see p. 12). Dr. Nahum Sonnenberg of McGill University moderated the session, and panel discussion led by Montreal CTV News reporter Cindy Sherwin followed.

Women in Science breakfast

In a particularly moving event, members interested in the advance of women in science gathered to hear Prof. Ruth Arnon describe the highlights of her career (see p. 38 and p. 56). Arnon discussed her part in the discovery that led to the creation of Copaxone, the blockbuster drug for the treatment of multiple sclerosis.

Shelley Ortved, an MS patient who traveled to Israel in 1992 to participate in a clinical trial for Copaxone, said that the drug had changed her life, and she described meeting Arnon at the end of the trial: "To my surprise, on the last day, the resident physician told me I couldn't be discharged until Prof. Arnon had met me… and then Prof. Arnon thanked me for being part of the study," said Ortved, visibly moved. "Now it is my turn to thank you for being such a compassionate researcher."

A.J. Hutchings, who had been a participant in the Bessie Lawrence International Summer Institute, said that "because of women like Prof. Arnon, I am no longer classified as a 'women in science,' but simply as a scientist. Someone had to break the taboo, and my generation is thankful to those who have carved the way to allow us to follow our dreams."

The breakfast was hosted by Francie Klein and Claudia Litvak Polachek, cochairs of the Women and Science Committee for Weizmann Canada, and sponsored by Stuart Klein.

Spotlight on sustainability, young scientists

Guy Laliberte, founder of Cirque de Soleil, opened a scientific session on environmental sustainability with a talk about his One Drop Foundation, which develops access-to-water and sanitation projects in places where they are most needed. "I am part of your group: I'm also trying to build a better world and my goal is to inspire more and more people to support the environment." Global Gathering participants also had the opportunity to attend a Cirque du Soleil performance and hear personal opening remarks by Laliberte.

Dr. Ron Milo, incumbent of the Anna and Maurice Boukstein Career Development Chair in Perpetuity, talked about greenhouse gas emissions, testing the audience on their knowledge of the most polluting human activities and surprising them by describing the quantities of water needed for food production and the central role played by photosynthesis. Prof. Oded Aharonson (see p. 44) discussed his planetary research. The session was led by Dr. Vicky Kaspi of McGill University.

In a session on the importance of recruiting young scientists to the Institute, Institute Vice President Prof. Haim Garty emphasized that the best science can only happen with a continuous infusion of young talent – brilliant scientists who have done postdoctoral studies abroad and bring their ideas, ingenuity and energy to the Institute. Drs. Lilach Gilboa, incumbent of the Skirball Chair in New Scientists, and Jacob Hanna – two relatively new recruits – discussed their respective research on stem cells.

"The brain gain is vital to Israel's future and Weizmann plays a key role in developing Israel's scientific brain power," said Pennie Abramson, ACWIS President, who with her husband, established the Abramson Center for Young Scientists to provide start-up funding for new recruits.

European Committee:

Building on Strength

(l-r) Israel's ambassador to Germany Yaacov Hadas-Handelsman, Prof. Daniel Zajfman and German-Israeli Economic Association (DIW) Chair, Hildegard Müller

In Heidelberg, (l-r) Prof. Daniel Zajfman and Klaus Tschira

(l-r) Prof. Daniel Zajfman with Aleksander Gudzowaty on the Weizmann campus

At the Weizmann Science & Business Club event (l-r) Guy Spier, Prof. Nava Dekel and Beyla Ziv Guest

The European Committee for the Weizmann Institute of Science is strengthening its existing committees throughout Europe and building a bigger or new presence in other countries, Poland, Spain and Sweden.

At a May 29 event in Warsaw, President Prof. Daniel Zajfman was hosted in the home of Aleksander Gudzowaty, a prominent Polish businessman. The event followed a visit to the Museum of the History of the Polish Jews, now under construction on the grounds of the former Warsaw Ghetto. The evening event included a dinner attended by Polish dignitaries and Israel's ambassador to Poland, Zvi Ravner, followed by a Chopin concert. In June, Prof. Zajfman hosted Gudzowaty and his wife, Danuta, on the Weizmann campus.

30th anniversary for German Friends

This year marks the 30th anniversary of the German Association of Friends of the Weizmann Institute. As part of a series of events celebrating this milestone, the Association held two meetings in June – in Heidelberg and Berlin – sponsored by the German-Israeli Economic Association (DIW). These events, chaired by Hildegard Müller and BioRN (the Biotech Cluster Rhine-Neckar), focused on advancing life science hubs in Cambridge (UK), Leuven (Belgium) and Heidelberg, as well as the Weizmann Institute's participation in these research efforts.

The Berlin event took place at BDEW – the German Association of Energy and Water Industries, in the presence of Israel's ambassador to Germany, Yaacov Hadas-Handelsman.

Institute President Prof. Zajfman, who is an external member and director of the Max Planck Institute of Nuclear Physics in Heidelberg, spoke there about the importance of academic freedom in research. "We should view scientists as musicians or artists whose talents emerge when given the freedom to explore as they see fit," he said.

The meeting was followed by a gala dinner at Heidelberg Castle with distinguished guests from industry, academia and government, including Theresia Bauer, Science Minister of the Federal State of Baden-Wuerttemberg, and Tibor Shalev Schlosser, Israel's consul general.

Swiss science and business

On April 15 in Zurich, the Swiss Friends of the Weizmann Institute launched the Weizmann Science & Business Club – young business professionals who meet for science lectures and special events. The WSBC is cochaired by Guy Spier and Beyla Ziv Guest, both passionate advocates of the Weizmann Institute. Eric Stupp, chairman of the Swiss Friends, said he was happy to see a growing community of young professionals eager to learn more about Weizmann and cutting-edge science, and wished the group success in its future activities. Keynote speaker Prof. Nava Dekel, the Philip M. Klutznick Professor of Developmental Biology, talked about her research on infertility in women.

The following day Prof. Dekel was the keynote speaker at an event in Geneva hosted by Alex Dembitz and Robert Equey of Weizmann France-Europe.

Visiting delegations

A steady stream of European visitors has passed through the Institute campus in recent months, including delegations from Germany and Switzerland this past March. While the Swiss groups have regular visitors in recent years, for the Germans it was a new experience – the first in a series of events to mark the German Friends' 30th anniversary.

In June, a Spanish delegation from Spain of professors from the IESE business school at the University of Navarra came, led by Ruben Lerner. The group intends to write a case study on the Institute focusing on managing innovation. The visit precedes the planned launch of a new Weizmann friends association in Spain.

What's ahead

On November 9, Prof. Zajfman will be the keynote speaker at the prestigious Falling Walls Conference, held every year on the anniversary of the fall of the Berlin Wall in 1989. The conference brings together 20 distinguished speakers, in addition to some 600 leaders in business, politics and science from 75 countries, to discuss "which walls will fall next." Prof. David Harel, the William Sussman Professor of Mathematics, will also be among the 20 speakers.

In January, a research partnership between the Karolinska Institute in Stockholm and the Weizmann Institute will kick off with a visit by several Swedish scientists to the Institute and a scientific conference on the subject of cancer stem cells.

It Takes Two

Weizmann UK's Making Connections Programme has funded more than 20 scientific collaborations between the UK and Rehovot

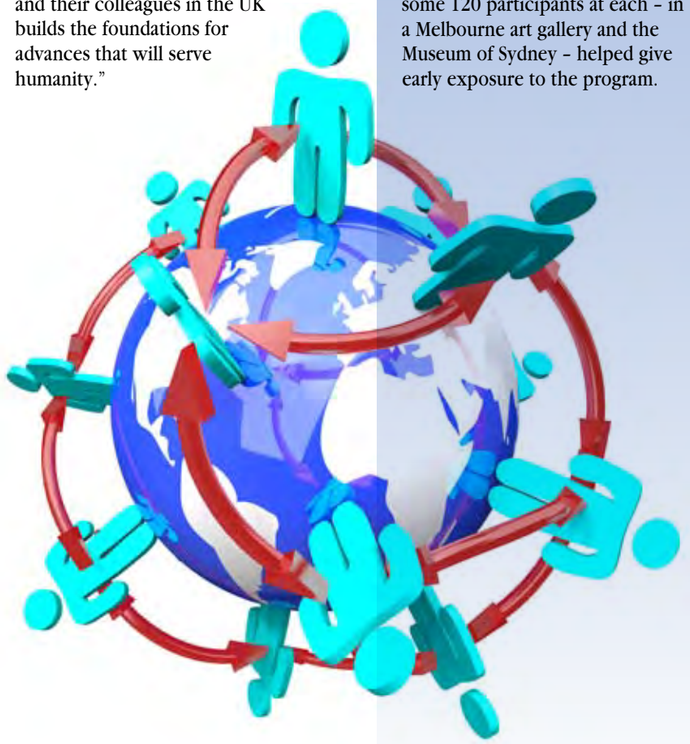
Do memories succumb to peer pressure? With help from the Making Connections Programme of Weizmann UK, Weizmann Institute neurobiologist Prof. Yadin Dudai, the Sara and Michael Sela Professor of Neurobiology, and Ph.D. student Micah Edelson teamed up with two scientists from University College London, Prof. Raymond Dolan and Dr. Tali Sharot, to investigate this question.

The study found that peppering subjects with false information from their "peers" about an event they experienced with their own eyes – in this case a film – resulted in altered memories. Functional MRI brain scans provided biological evidence of the alterations, demonstrating how and why memory is inherently malleable.

The collaboration is just one of many facilitated through the Making Connections Programme. The idea arose in 2007, in the wake of threats by European academics to boycott Israeli universities. Lord Mitchell, Vice President of Weizmann UK, suggested raising funds to support collaborations between Weizmann scientists and their colleagues in Britain. "I thought it was all well and good writing letters and making speeches denouncing such an insidious threat – all of which I and many others did to great effect – but more needed to be done," he recalls. He turned to Prof. Benjamin Chain, who provided the scientific impetus to launch the program.

Five years later, more than £1.5 million has been raised from generous UK donors, funding 21 projects in a breadth of scientific disciplines involving 11 UK universities and 52 scientists. In addition, Weizmann UK has hosted three scientific symposia in London: on systems biology, astrophysics and alternative energy.

Israel's President Shimon Peres weighed in on the importance of the program at its launch in 2008 at London's Science Museum: "The cooperation between Israeli scientists and their colleagues in the UK builds the foundations for advances that will serve humanity."



Making Connections in Australia

The success of the Weizmann UK program gave the impetus to Weizmann Australia to implement its own Making Connections. The program's kickoff was in May, when Weizmann Australia and Monash University hosted a symposium in Sydney that brought together Australian and Weizmann scientists on the topic of metabolic syndrome, obesity and diabetes. Two other launch events with some 120 participants at each – in a Melbourne art gallery and the Museum of Sydney – helped give early exposure to the program.

Weizmann UK Celebrates the Wonders

(l-r) The Hon. Sir David Sieff, Lady Sieff, Lord Puttnam of Queensgate CBE and Martin Paisner, CBE

In March, Weizmann UK hosted a gala dinner at the St. Pancras Renaissance Hotel in London, dubbed WOW! in celebration of the wonders of the Weizmann Institute of Science: scientific breakthroughs that have emerged from the Institute's labs.

More than 280 guests attended, and the event raised significant funding for scientific research at the Weizmann Institute.

Lord Puttnam of Queensgate CBE delivered the keynote address, in which he focused on the importance of science education: "The Weizmann Institute of Science is founded on the concept of excellence measured in the very broadest sense: excellence of experience for those working there, of output as a reward for perseverance and, most important of all, of intent – because that is the quality that will, over time, sustain the soul and the vision of this increasingly vital institution."

Institute President Prof. Daniel Zajfman spoke about the Institute's mission to pursue scientific questions wherever they may lead. Baroness Helena Kennedy QC addressed the need for continued support to maintain the quest for scientific truth.

To close the evening, guests enjoyed a cabaret – a treat from special guest and Weizmann friend and supporter Miel de Botton (see p. 14).

Science on Tap

Science on Tap, held for the past several years in Tel Aviv bars, coffee shops and restaurants, was bigger and better than ever this year. Fifty-five scientific talks were delivered in 55 different venues by professors, scientists and research students. The response was overwhelmingly positive, and those who neglected to make reservations early were left straining to hear on the sidewalk. The scientists all volunteer to speak for a free drink or two and the chance to share the excitement of their research with others. Pub-goers and restaurant patrons find that learning something new in a relaxed setting only increases the enjoyment of an evening out.

One measure of the event's success was the number of copy cat events the project has spawned. Not only are other Israeli academic institutions sponsoring similar public outreach events, but several outside the country have approached the Science on Tap organizers about bringing the idea to other cities.

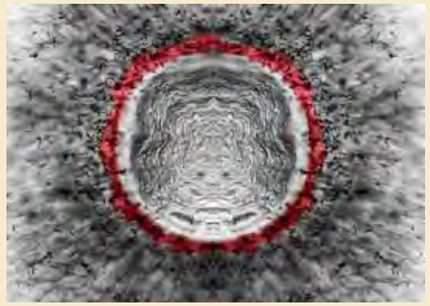
Top: Science on Tap around the city. Bottom: Signs overlooking the main entrance to Tel Aviv advertised the event

Picture Perfect

The Weizmann Institute's Prof. Ben-Zion Shilo, the Hilda and Cecil Lewis Professor of Molecular Genetics, recently completed a year-long fellowship at the Radcliffe Institute for Advanced Study at Harvard University. From his Harvard Square location, he studied and practiced using photography to convey science. An amateur photographer who has traditionally documented the work in his lab and even his lab team's hiking trips and picnics, Shilo has compiled hundreds of photographs in the last year.

This image, for instance, juxtaposing stem cells with yeasted bread dough, illustrates the concept in stem cell biology in which the source is maintained while a final product is continually produced from that source.

Shilo has displayed his work as a traveling exhibit, which has been shown at Radcliffe and several other places in Boston and the surrounding area. His exhibit, "The Wonders of Embryonic Development," was also the focus of a May 24 donor event hosted by the American Committee for the Weizmann Institute of Science.

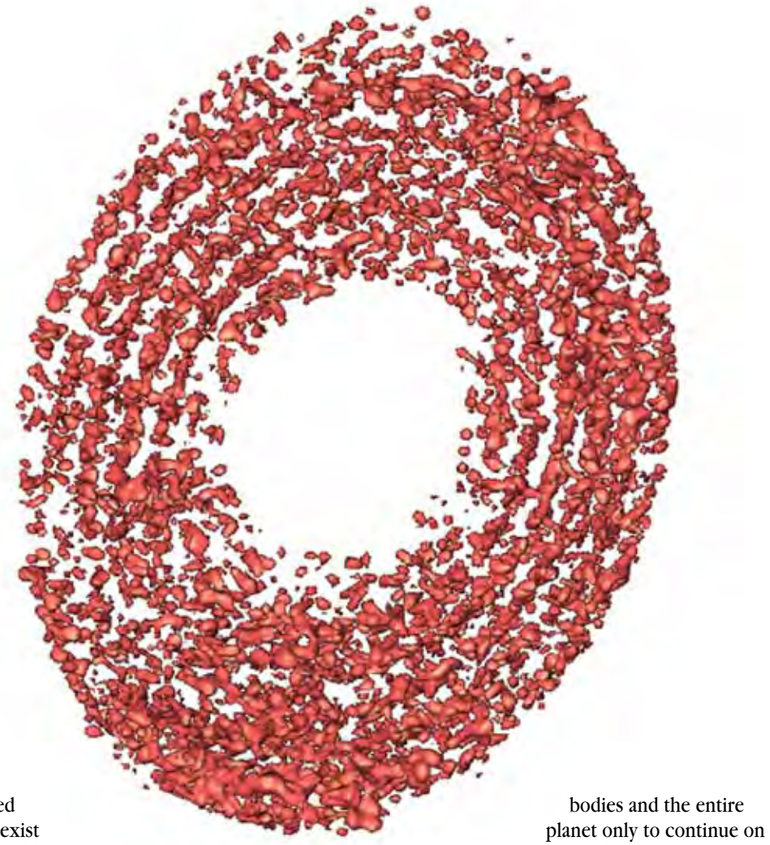


Retinal stem cells in a zebrafish eye (red) are maintained in a special niche throughout the animal's life (C. Cerveny and S. Wilson).

In Hi Rise Bakery, Cambridge, MA, a balance is kept between the "mother" stock and the yeast that goes into the bread dough

Parallel Worlds

An exhibit of scientific images in Tel Aviv brings the unseen to life



The world that is visible to the naked eye is just one of many worlds that exist in parallel. To bring these parallel worlds into focus, we must observe them at the right depth, at the right magnitude, at the right speed, in the right wavelengths, at the right temperature.

In an exhibit that opened in Tel Aviv in conjunction with Science on Tap, Weizmann Institute scientists invited us to get in touch with a wealth of separate, yet parallel, worlds – the ones that are all around us, even if we normally don't give them a second thought. The nerve cells in the brain that transmit our feelings and thoughts know nothing of the intricate quantum interplay between light and matter. The physical laws governing atmospheric turbulence don't figure in the world of the genes, which have their own complex networks. Plant cells use the sun's energy and produce the oxygen we breathe, living in a completely different world from the subatomic particles that stream to the earth from the edges of the universe, passing through them, our bodies and the entire planet only to continue on out through space.

In the *Parallel Worlds* exhibit, Institute scientists presented images from unknown worlds, brought together for the first time in a single time-place-context framework that enabled viewers to get acquainted with them.

Above: **Hunger/** *Prof. Avi Minsky, his research group and colleagues*

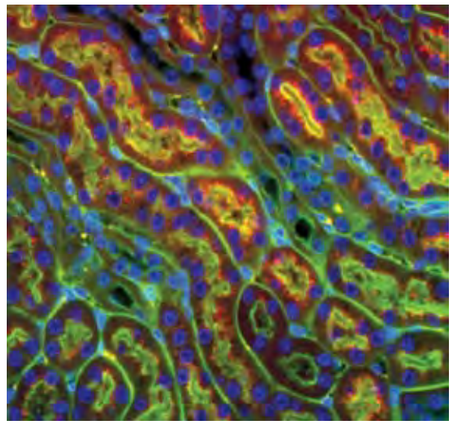
Hard times can sometimes bring out the best in people. In this image, the proteins and DNA of a bacterium are organized for starvation conditions. This compact, highly organized structure protects the genetic material by shielding it from the cellular environment.

Right, top: **It's Getting Hot/** *Prof. Elisha Moses and his research group*

This phenomenon takes place in every electric kettle. Structures like this wave erupt from the surface (here of water) due to temperature differences between the layers of liquid.

Right, bottom: **Tracking Blood Flow/** *Prof. Michal Neeman and her research group*

The albumin protein (in red) is absorbed in epithelial cells in the kidney as the avidin protein (green) is expelled from the kidney.



A Woman's Place Is in the Lab

A program to support Israeli women in postdoctoral research abroad is bearing fruit

For 14 years, Israelis woke up to Dr. Liad Mudrik's 6 a.m. talk show on Israel Army Radio. By 8 a.m., Mudrik was already at Tel Aviv University. She completed a Ph.D. in neuroscience in 2011 while studying towards a second Ph.D. in philosophy. In that time, she also worked at Israel's television channels 1 and 2, married and gave birth to two children.

Last year she was offered a postdoctoral fellowship at the California Institute of Technology to work with world-renowned brain scientist Prof. Christof Koch. But "the thought of picking up the family and relocating far away from our families, and the financial risk involved, was really scary," she says.

She applied for funding through the Israel National Postdoctoral Award Program for Women in Science; Mudrik was one of 10 recipients this year. Her grant, which came from the Rowland and Sylvia Schaefer Foundation, "has helped us as a family dramatically," she said in an interview from Pasadena. "It has given us air to breathe, so that we could make this big leap and afford proper day care for the kids. I don't think we could have done it otherwise."

At Caltech, she's researching the neural basis of consciousness and will.

Dr. Liad Mudrik

"Above and beyond the financial benefit, the award was a vote of confidence in me – that I can pursue this important step and then come back to an academic career, I hope, in Israel," says Mudrik.

A Weizmann priority

The program was launched in 2007 as an outgrowth of Institute President Prof. Daniel Zajfman's stated priority to enlarge the ranks of women in science. The Institute administers the program, though outstanding female Ph.D.s from all Israeli institutions of higher learning are eligible.

With the help of dozens of donors worldwide, the fellowship program awards competitive grants of $40,000 over two years to outstanding Israeli women scientists, over and above their basic grants for postdoctoral research abroad. "Additional funding for Israeli women is critical since their postdoctoral fellowships tend to be inadequate and most are relocating to expensive places like Boston, New York or San Francisco," says Prof. Varda Rotter, the Norman and Helen Asher Professor of Cancer Research, who heads the program as the President's Advisor for Advancing Women in Science. "We are already witnessing results, only five years into the program."

"Above and beyond the financial benefit, the award was a vote of confidence in me — that I can pursue this important step and then come back to an academic career, I hope, in Israel" *Dr. Liad Mudrik*

"We are delighted to support this groundbreaking award, which Revson trustee Dr. Cliff Tabin introduced to the Foundation," says Julie Sandorf, president of the Charles H. Revson Foundation. "The brilliant young women who receive it are not only excellent scientists who will make important contributions to Israel, but superb ambassadors of their country's greatest asset, the talent of its citizens." More than 50 women scientists have been funded so far; each year, the Institute receives about 60 applications for 10 slots.

Signs of success

To date, 14 awardees have returned to Israel after completing postdocs, 12 of them to faculty positions in academia and two to prestigious positions in industry. Two are at the Weizmann Institute: Drs. Anat Levin (Computer Science and Applied Mathematics) and Ilana Kolodkin-Gal (Molecular Genetics).

Two of the recipients have been awarded the prestigious UNESCO L'Oréal Prize for Women in Science. Revson Fellow Dr. Naama Geva-Zatorsky received the award in 2012 (see box), and Clore Fellow Dr. Hagar Gelbard-Sagiv in 2011.

Revson Fellow Receives Prestigious International Award

Dr. Naama Geva-Zatorsky

At a ceremony in Paris in March, Dr. Naama Geva-Zatorsky received a 2012 L'Oréal-UNESCO International Fellowship, given by the United Nation's Education and Science Organization and dubbed the award for "Europe's top young researcher."

The award committee cited the "excellence and originality of her work."

Geva-Zatorsky, who received her Ph.D. from the Institute in 2011, where she focused on systems biology, is now at Harvard University. She and her husband Amnon Zatorsky have two sons, Yonatan, 6, and Uri, 2. Her National Postdoctoral Program for Women in Science award came from the Charles E. Revson Foundation.

The award, she says, "encouraged me tremendously to continue to pursue an academic career, and it strengthened my belief in myself. It also gave us the opportunity to move to Boston; to settle down here and look for a job for my husband during the first year of my postdoc." Geva-Zatorsky's research focuses on probiotics, commonly known as "good bacteria" that reside in human intestines and protect our bodies by stimulating the immune system. She believes that a better understanding of these bacteria could lead to treatments for such diseases as inflammatory bowel disease and multiple sclerosis, and possibly even obesity and mood disorders.

Math Around the World

Above: Math challenge in Ghana; right, top: Arabic-speaking Math by Mail participants in Israel; bottom: and in Canada

This year marks the 30th anniversary of the Weizmann Institute's Math by Mail program. In those days, of course, the mail came in an envelope; the problems were filled out in pencil and returned by post. Yet the idea has remained the same: Offer fun math activities. Rather than teach long division or geometry, try to develop mathematical thinking. Give personal feedback and make solving problems rewarding.

That formula proved itself for many years in Israel, leading to additional Math by Mail programs for adults and children, as well as a spin-off: Science by Mail.

Dr. Yossi Elran and his wife, Michal, have run Math by Mail since 2000. In that time, they have seen the program, now offered through the Davidson Institute of Science Education, spread around the world. Along with the move to more web-based activity, the program is now offered in four languages: Hebrew, Arabic, English and Spanish.

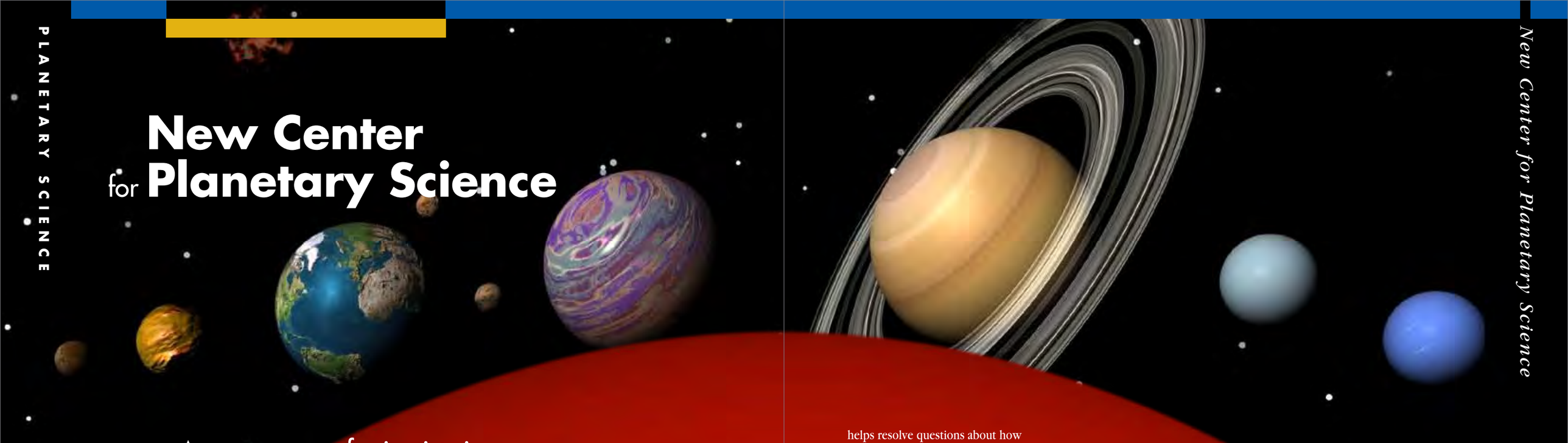
The first outside Israel to adopt Math by Mail were schools in Toronto. Elran was there with his family in 2003, conducting postdoctoral research. (His field is theoretical physics. Michal's degrees are in computer science.) When Dr. Moshe Rishpon, one of the originators of Math by Mail and then Head of the Clore Garden of Science, came to Toronto as the guest of the Canadian Society for the Weizmann Institute of Science (now Weizmann Canada), Elran contacted the group in order meet with Rishpon. But it was his meeting with the Institute's Canadian friends that was auspicious. After he described Math by Mail to them, they decided to try the program in several of the city's Jewish schools. From there, the program spread across Canada, in cities from Montreal to Vancouver.

In fact, says Elran, the international committees for the Weizmann Institute have been instrumental in bringing Math by Mail to schools in their countries. Today, these include Australia, Romania, Mexico, Brazil and the United States. In the past, Math by Mail programs were also undertaken on a smaller scale in Russia, South Korea and Germany. Math by Mail even made it to Ghana several years ago, as part of a program for outstanding students.

The most recent additions to the Math-by-Mail family are schools in the Philadelphia area. Once again, the personal connection was key: Dr. Irene Eizen, a professor of education at Temple University, visited the Davidson Institute, spoke to the Elrans and brought the program back with her. "I received one of the Math by Mail workbooks and was intrigued – I spent the rest of the trip working through the problems," she says. The program began in one Jewish day school; now four schools in the city offer the program, three of them in after-school clubs where the kids can work together online and later, at home with their parents. "Math by Mail enriches the regular school program, and it teaches the kids problem solving," says Eizen. "I don't know why we didn't have anything like it before."

As the program has grown, so has the staff. Today Math by Mail has an international section. But individual attention and personal connections are still an important part of the program philosophy, and the Elrans and the rest of the staff remain committed to keeping it that way.

New Center for Planetary Science



A new group of scientists is expanding Weizmann's frontiers

The challenges of planetary science are extraordinary – among them the vast distances, extreme conditions, limited opportunities for observation, and long time scales between launching probes and reaping the first data.

These challenges attract some of the most creative and inventive thinkers in science. Together with respected planetary scientist Prof. Oded Aharonson, who heads the Institute's new Center for Planetary Science, a handful of new scientists bring expertise in planetary surface geology and geophysics, planetary geochemistry and exobiology, planetary atmospheres and climate. While exploring the planets of our solar system and exoplanets in distant solar systems, their research will bring new perspectives on our own world and such issues as climate change. Establishing the Center and recruiting this group of scientists elevates the Weizmann Institute to the forefront of the field of planetary science, says President Prof. Daniel Zajfman. It enables the establishment of a graduate studies program in planetary sciences, and paves the way for the Institute to take a leading role in national space research initiatives.

The geochemistry of planets

The rugged beauty of Israel's Negev desert led to a love of geology – on a planetary scale – for Dr. Itay Halevy. His work as a planetary scientist has him delving into "deep time" questions about the origins of planets, and examining their present-day climate and geology using lab experiments and the latest data from spacecraft.

Geochemistry and climate are intimately linked. Images and data from spacecraft such as Voyager and Cassini have added new information about the outer planets and their exotic moons and satellites. By solving intriguing mysteries concerning their geochemistry, Halevy helps resolve questions about how Earth's climate is expected to evolve.

Wind and climate on a planetary scale

When NASA's Juno mission reaches Jupiter in 2016, Dr. Yohai Kaspi, as a member of its scientific team here on Earth, will be poised to dive into the first microwave and gravity measurements from its orbit around the giant gaseous planet. Already today, he is preparing to receive data on the stormy atmosphere that lies below Jupiter's dense clouds.

Kaspi uses a combination of fluid dynamics models, theory, and observation to study the basic mechanisms controlling the atmospheric dynamics of Earth and other planets. Based on these, he recently published a paper predicting what the Jupiter orbiter can be expected to find.

He also published an analysis utilizing data from Earth-orbiting satellites of wave dynamics in storm systems, proposing a theory to explain why the northeastern parts of North America and Asia appear to be cooled in winter due to atmospheric waves emerging from heat released from warm ocean currents just off their coasts.

On the hunt for supernovae

Supernovae have much to teach us about planets, including our own. Most of the elements comprising the planets, for instance, were produced in these massive stellar explosions. Dr. Eran Ofek, incumbent of the Arye Dissentshik Career Development Chair, has been part of a recent scientific explosion in knowledge about supernovae – the processes leading up to the detonation, the types of stars that end up as supernovae and the physics of the event itself. He brings to the Institute years of expertise in creating robotic telescopes that autonomously assess cosmic phenomena.

Ofek, together with Dr. Avishay Gal-Yam of the Particle Physics and Astrophysics Department, is active in the Palomar Transient Factory based at Caltech, a consortium that searches for supernova events. So when they spotted a supernova just a half a day into the explosion process – the closest supernova of its type seen in the last 25 years – a wealth of scientific observations ensued about the birth and death of stars, and the creation of the elements of the periodic table.

Around the Planets

Prof. Oded Aharonson's desk is in the Weizmann Institute of Science, but his work takes him all over the solar system. Some days, he is part of an international team giving orders to rovers on the surface of Mars. Others, he is taking measurements in some of the darkest, coldest corners of the moon or peering below the cloud cover of Saturn's largest moon, Titan. Aharonson recently left a position at Caltech to head the Weizmann Institute's new Center for Planetary Science, in the Environmental Sciences and Energy Research Department.

Life on Mars

Could Mars have supported life in its distant past? One of the requirements, many think, would have been liquid water, but today, there is only a small amount of ice buried under the soil and a bit more at the poles. Aharonson would like to understand the history of that ice – how it got there, whether there was more or less of it in the past, and how and when it froze. To help answer these questions, he and his team run experiments inside a vacuum chamber simulating a mini Martian environment. In parallel, they work with computer models tracking how the ice evolves over time. They believe that Mars, which undergoes slow changes in its tilt toward the sun, may have had "ice ages" in which the ice cover crept toward and receded away from the equator.

Aharonson is a member of the Mars rover team. Each day they meet to plan the next day's exploration, and several times a month Aharonson takes his turn as the Science and Operations Working Group Chair.

Man in the Moon

Ice is also present on the Moon, in small quantities hidden in craters near the poles – places where sunshine never reaches and are hence so cold that a molecule of water can never get free. Aharonson is a member of teams who operate experiments on the Lunar Reconnaissance Orbiter to measure the topography and temperature of those areas in an attempt to understand the nature of the ice.

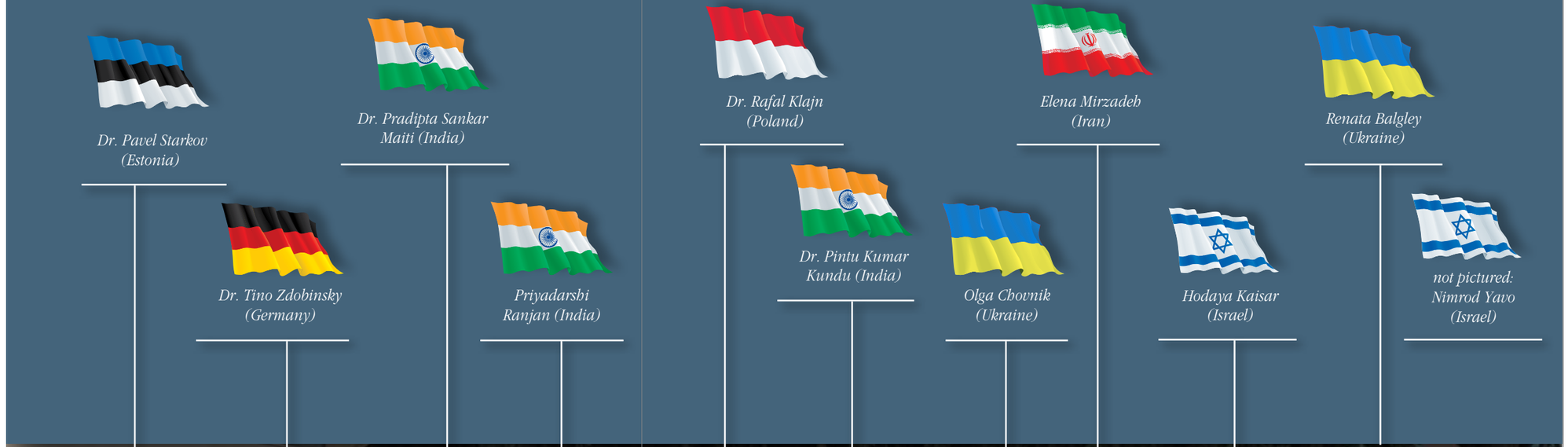
He has also revealed the secret of the "man in the moon" – why he always looks down on us. We know that the moon rotates in lockstep with its orbit around the earth, but why does that particular side face us? A computer model showed that differences in mass distribution between the moon's two hemispheres make the present situation the likely one.

Lakes on Titan

It is 10 times farther from the sun than Earth, receives 100 times less sunlight and is 200°C colder. Yet Titan is a world that is strangely familiar: Under its cloud cover, there are mountains and valleys, dunes, flowing streams and lakes. In this extreme environment, liquid methane takes the place of water on Earth. Aharonson and his colleagues recently proposed an explanation for the fact that Titan's lakes are mostly found in the Northern Hemisphere: The seasons on Titan are not symmetrical. The comparatively long, mild summers of the North are conducive to the formation of liquid lakes, while the short, intense ones in the South are not. Their model also shows that tens of thousands of years ago, that situation was reversed. Titan's orbit changes over millennia, causing a reversal in the asymmetry and the lakes to migrate from hemisphere to hemisphere. (A similar long-term fluctuation in Earth's orbit around the sun is responsible for our own ice ages.)

Prof. Oded Aharonson.
Background: Liquid lakes on Titan (Image: NASA)

United Nations of Nanoscience



Dr. Rafal Klajn, incumbent of the Robert Edward and Roselyn Rich Manson Career Development Chair, and his group want to know what changes take place at the nanoscale. They take advantage of tools offered by organic and colloidal chemistry to investigate the chemical and physical properties of matter in this intermediate scale regime – between single molecules and everyday objects.

For example, in a recently completed project the group developed a method to synthesize miniscule bowls – each approximately one million times smaller than a soup bowl – dubbed "nanobowls." These nanobowls may have uses in chemistry and materials science, which the group is now investigating. In addition, Klajn's team develops "smart" materials that are able to change their structure and function upon exposure to such stimuli as light or magnetic fields.

The group – including four students and four postdoctoral fellows – originates from seven different countries. Klajn: "Each brings something unique to the group. Ultimately, science is an international language that we all understand."

Slice of History: WEIZAC

The founder and first head of the Weizmann Institute's Applied Mathematics Department, Prof. Chaim Leib Pekeris, had a vision: the building of an electronic computer – even though it was an instrument of unclear value in those days, found in only a few high-level scientific institutions. Despite incredible economic difficulties, the Institute invested considerable resources in gathering a top team of engineers, led by Gerald Estrin, to build WEIZAC – one of the most advanced computers at the time. WEIZAC served the Institute and the Israeli scientific community from 1954 to 1964, inspired generations of scientists and sparked the development of Israel's high tech industry.

This text appears next to WEIZAC – originally constructed in the basement of the Ziskind Building and now displayed in its lobby. Below is a plaque declaring the computer – the first in the Middle East and one of the first in the world – to be a Milestone in the History of Computation, an honor bestowed by the IEEE (Institute of Electrical and Electronics Engineers).

In the late 1940s, Prof. Chaim Pekeris came to the Weizmann Institute from Princeton, where Prof. John von Neumann had recently built his famous prototype electronic computer. Pekeris understood the potential of a computer to solve problems in his field of theoretical geophysics, among others, and he insisted on building one at the Institute. Dr. Chaim Weizmann agreed, even though the project would cost $50,000 – one fifth of the Institute's budget.

Pekeris brought two colleagues from Princeton to assemble a team and construct the computer: Gerald Estrin and Ephraim Frei.

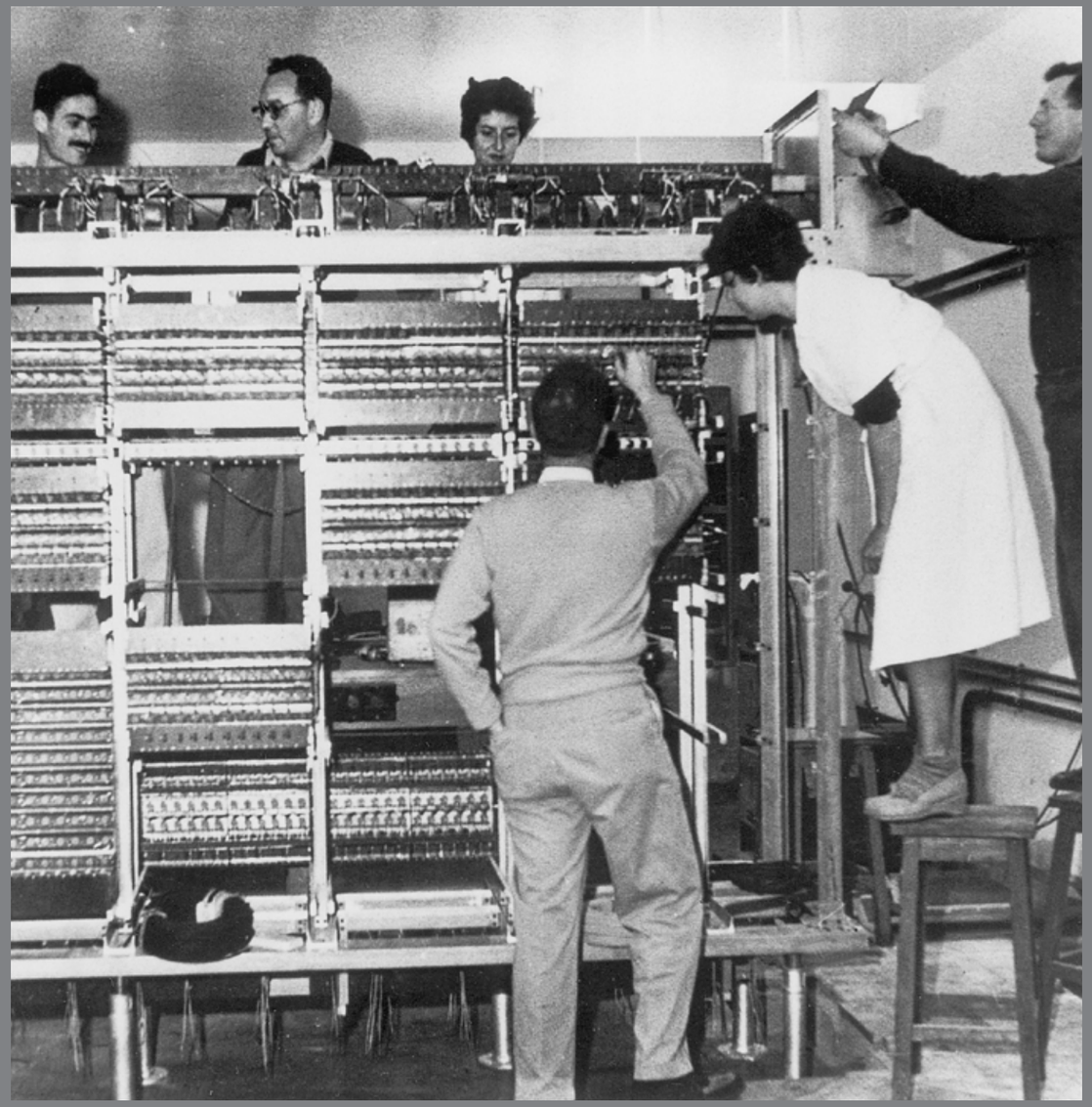
In the early 1950s, the young state was hard pressed to feed its growing population, much less undertake cutting-edge technology projects. Estrin and his team soon found that both expertise and resources were scarce, and they often had to improvise. For instance, a shop owned by Bulgarian immigrants that made parts for fans and bicycles provided precision machining when needed.

WEIZAC performed its first operation in October, 1955 – a calculation of ocean tides. But researchers from many fields – inside the Institute and out – found uses for it. Indeed, one could say that WEIZAC and its successors, the Golem computers, were the founding grandparents of today's thriving Israeli high tech industry. Not only did a generation of computer pioneers get their training on these machines, but they impelled the creation of a modern, innovation-based economy for the whole country.

Gerald Estrin 1922-2012

Prof. Gerald Estrin passed away in March this year, at age 90. After receiving his Ph.D. from Princeton and working as a research engineer in von Neumann's group there for several years, Estrin came to the Weizmann Institute to work on WEIZAC. He left Israel just before the computer became operational and joined the faculty of UCLA in 1956. Estrin was a founding member of the UCLA computer science department and its chairperson from 1979–82 and from 1985–88.

Estrin remained close to the Weizmann Institute and was a member of its Board of Governors. Of his days at the Institute, he often said: "The WEIZAC project drove me to make a contribution beyond my dreams."



Left: Building WEIZAC, 1953-54

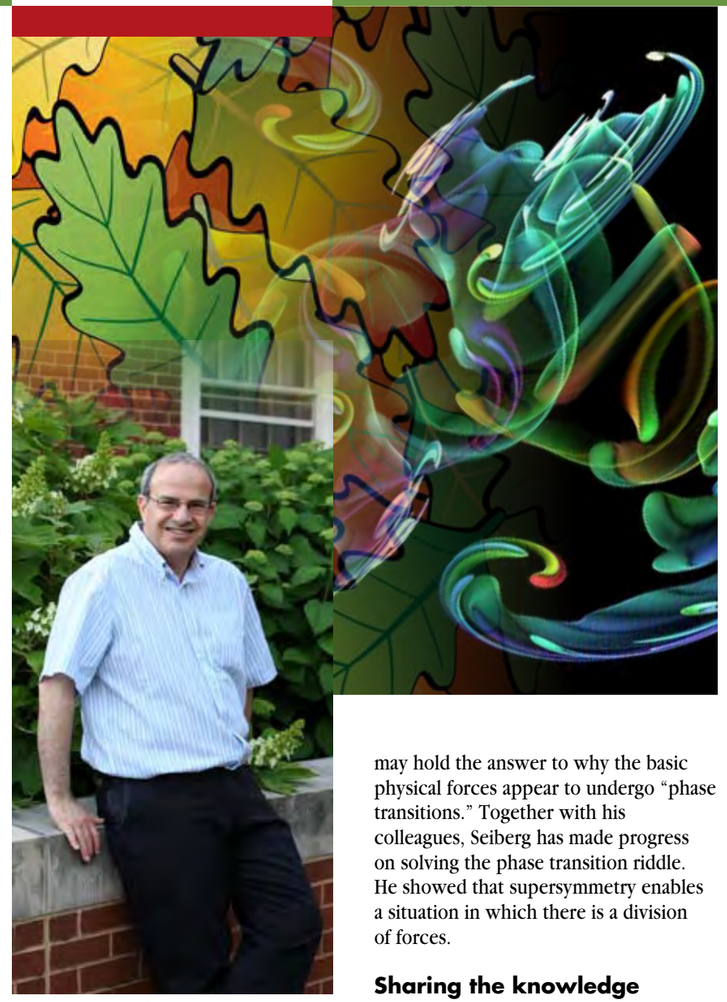
A Beautiful World

Prof. Nathan (Nati) Seiberg, a physicist at the Institute for Advanced Studies, Princeton, believes the world can be understood in terms of order, internal logic and elegance. In the most elegant version of that world view – one he is working to clarify – all the forces acting in nature and all the various particles are simply different facets of a single, basic underlying force, and all the laws of physics are aspects of one basic law.

Seiberg was born in 1956 in Tel Aviv; his mother was a teacher and his father an accountant. He came to the Weizmann Institute though an extended army study program, and he conducted his doctoral research in physics under Prof. Haim Harari, who was then president of the Institute. "Working with Harari," says Seiberg, "was an amazing experience."

In 1982, after marrying Miri, who received her Ph.D. in biology from the Institute, and completing his own Ph.D., he went to Princeton for postdoctoral research. In 1985 he returned to a position on the Weizmann Institute faculty, but several years later he was offered a position at the Institute for Advanced Study, and he has been there ever since, not far from Albert Einstein's old office.

Seiberg is the recipient of a MacArthur Foundation Fellowship; he is a member of the American Physical Society, the National Academy of Sciences and the American Academy of Arts and Sciences.



Prof. Nathan Seiberg

Superstrings and supersymmetry

One of the proposals to unite the four basic forces of nature – gravity, the weak force, the electromagnet force and the color force – is known as string theory. In a nutshell, this theory posits that all the particles in nature are manifestations of the vibrations of a smaller, one-dimensional body known as a superstring.

Superstring theory, if it is correct, requires supersymmetry, which states, among other things, that every known particle is one half of a particle pair. Scientists believe that supersymmetry may hold the answer to why the basic physical forces appear to undergo "phase transitions." Together with his colleagues, Seiberg has made progress on solving the phase transition riddle. He showed that supersymmetry enables a situation in which there is a division of forces.

Sharing the knowledge

Seiberg maintains close ties with the Weizmann Institute, and he counts several former students and postdoctoral fellows among the Institute's physics faculty: Profs. Eilam Gross, Micha Berkooz and Ofer Aharony and Dr. Zohar Komargodski. Seiberg is committed to sharing his research with the public including in Israel: "Even though the subject is complex, I find it important that people who support this research understand what it is they are supporting and why it is worth their while to continue their support."

Save the date: September 13, 2012

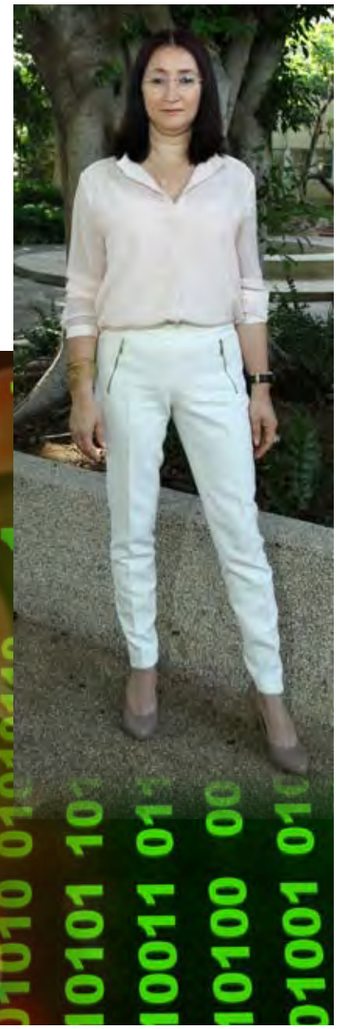
The Institute will host a reunion for physics alumni

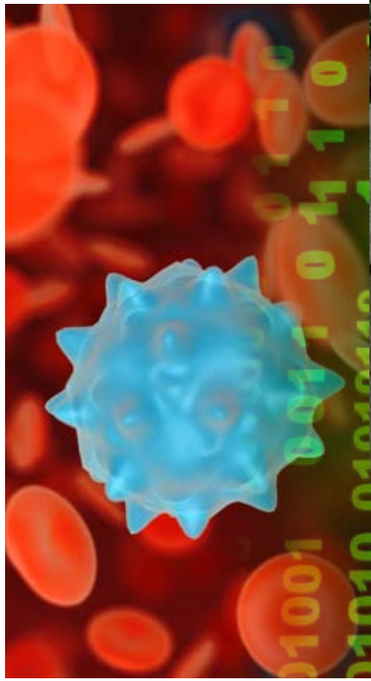
For further information and registration, write to alumni@weizmann.ac.il

Drugs by Design

"The compelling thing about Compugen," says the company's president and CEO Dr. Anat Cohen-Dayag, "is that its approach to drug discovery is 180° opposite the usual ones. This has the potential to address a major bottleneck of the drug industry – the lack of good new drugs for major clinical needs. Traditional drug discovery methods begin with experimentation and observation, and these tend to yield the low-hanging fruit, so that discovery gets harder with time. Indeed, there has been a decrease in the number of new drugs approved in the last decade. In contrast, our method utilizes computational models. Such science-based, predictive models can only improve as we continue to refine them."

In the last few years, under Cohen-Dayag's leadership, the company has both expanded and become more focused. The idea has been to employ a so-called "predictive discovery approach" to provide pharmaceutical companies with drug candidates on a systematic basis. After a decade of developing the computer models to predict new drug candidate molecules and testing these predictions to validate the models, Compugen is now focusing on specific types of drugs – therapeutic proteins and antibodies – for oncology and immunology applications. With several promising candidates, they have also sharpened their market orientation, opting to take these potential drugs to the next level of development before licensing them. Recently, Compugen opened a new facility – in South San Francisco – to develop monoclonal antibodies against drug targets identified through the computational research done in Israel.





Dr. Anat Cohen-Dayag

Cohen-Dayag came to the Weizmann Institute in 1989, first working on immune cell signaling under the guidance of Prof. Israel Pecht and then conducting Ph.D. research in the group of Prof. Michael Eisenbach, the Jack and Simon Djanogly Professor of Biochemistry, on mechanisms of sperm cell movement in fertilization. She had decided to pursue a Ph.D. while working as a technical writer for one of ICL-IP's new units. The company offered her master's studies in chemistry or business, but being surrounded by Ph.D.s in the company made Cohen-Dayag realize she wanted to be on the same level. "I first applied for doctoral studies in biology at the Weizmann Institute of Science and had the privilege of being accepted. To be surrounded by highly motivated people with endless curiosity makes the Institute the most fertile ground for young scientists," she says.

After working in R&D for the diagnostic products company Orgenics, Cohen-Dayag moved to Compugen in 2002, where she held various positions until 2010, when she was appointed company president and CEO. In this role, she works closely with Chairman and company cofounder Martin Gerstel, a member of the Weizmann Institute Board of Governors. She lives in Rehovot near the Weizmann Institute and is married and the mother of two children.

Probing the Human Condition

Always the same question:

How long will we keep speaking in the same clichés?

When will someone finally get up and say something we haven't heard before?

Hanoch Levin, from the play
Those Who Walk in the Dark

Since 2001, the Weizmann Institute's student theater group has been offering a yearly performance in Tel Aviv's Tzavta Theater. The students choose the play themselves, and the entire production – sets, costumes and ticket sales – are organized by the group. In the last few years, the group has focused on the existential, absurdist dramas of the Israeli playwright Hanoch Levin. This year's play, *Those Who Walk in the Dark*, features little action and nameless characters known only by their roles: "the walker," "the waiter," etc.

Acting in such plays becomes an intellectual and psychological challenge, as well as an artistic one, compelling the students to probe the play's philosophical observations on the human condition. Shlomi Kotler, a physics research student by day, describes it as "taking apart the things we take for granted and looking for meaning in them."

Those Who Walk in the Dark was directed by Irit Natan-Benedek. The cast of players: Adi Salomon, Amir Bar-On, Dalia Krieger, Inbal Friedler, Itamar Harel, Yitzhak Cohen, Shai Har Adir, Sharon Crook, Inbal Alaluf, Shlomi Kotler, Tamar Shahal, Tamar Zondiner, Yael Ronen, Yinnon Glickman, Yoav Lahini, Yuval Simons, Elvira Shafir and Moti Friedman.

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10 THINGS we didn't know about **Prof. Ruth Arnon**

1. Her maternal grandparents immigrated to pre-state Palestine in 1882 from Odessa (in the same year as the Biluim). They were married in Jaffa. Her grandfather was a carpenter, known for his ability to build a roof in a single night. One of his roofs graced the first synagogue in Rishon Lezion.

2. Her mother, a teacher, was in the first graduating class of the Levinsky Teachers' Seminar; teaching was her calling. Arnon's father came from a family of orange growers, but he wanted to study. After a day in the orchard, he would bike every evening to classes in Tel Aviv. He eventually studied electrical engineering in Toulouse, France, and became one of the first engineers to work for the Israel Electric Corporation.

3. She grew up in the Neve Shalom (since renamed Neve Tzedek) neighborhood in Tel Aviv. There, she would join in a neighborhood version of stickball they called "Dudes."

4. Even as a girl she loved science, and joined an after-school class in Tel Aviv's legendary Zoological Garden run by Yehoshua Margolin where the kids learned about animals, the natural life cycle and more.

5. At Hebrew University she studied chemistry in the first class after the War of Independence. Most of that class would go on to become scientists or industry leaders. They still keep in touch and meet from time to time.

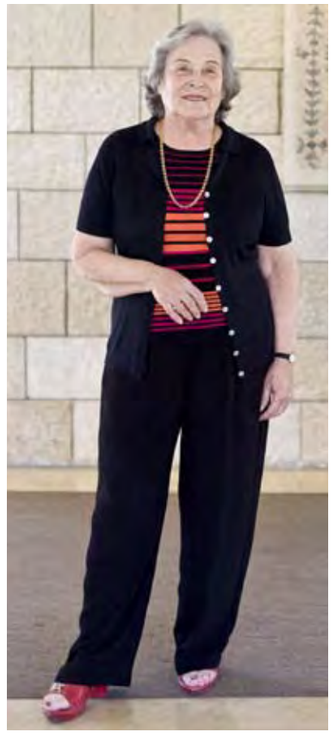
6. She served in the army in the academic reserve program. In the beginning she was in intelligence, afterward an officer in a naval lab, where her duties included checking the composition of lubricants and paints, making water softeners and checking for substances in the ships' boilers.

7. When she went abroad with her children for a sabbatical, they were ahead of their classmates in science and math. Now, when her children travel with their children, their level of education has fallen below that of the Americans. To remedy that, she and her husband, Dr. Uri Arnon, have made a significant contribution to establish a HEMDA school near the Institute.

8. Her favorite author is Jane Austen – because of the richness of the English. Her favorite poet, when she was young, was Yitzhak Shalev, father of the author Meir Shalev.

9. She makes great gefilte fish, kneidlach and jellied calves feet. She still serves these specialties on holidays.

10. The most intense moment of her life ("I was near to tears") was when the American FDA approved the use of Copaxone – a drug based on her research with Prof. Michael Sela and Dr. Dvora Teitelbaum.



Prof. Ruth Arnon, President of the Israel Academy of Science and Humanities and codeveloper of Copaxone

Things we did know about Prof. Ruth Arnon

She began her studies at the Weizmann Institute as a young immunology doctoral student under Profs. Ephraim Katzir and Aryeh Olitzki. She then became the first doctoral student of Prof. Michael Sela. Her research, among other things, has focused on the development of synthetic antigens. The crowning achievement of her career was the development of Copaxone, used to treat multiple sclerosis – work done with Prof. Sela and Dr. Dvora Teitelbaum. This drug, which took almost 30 years to reach the clinic, propelled the pharmaceutical firm Teva into the global marketplace. Today she is working on the development of another immune compound – a universal flu vaccine.

She has served in a number of important positions within the Institute: Department Head, Dean of Biology and Vice President. Outside the Institute, she has been President of the European Federation of Immunological Societies and Secretary-General of the International Union of Immunological Societies.

She is the recipient of the Israel Prize, and today is the President of the Israel Academy of Sciences and Humanities.