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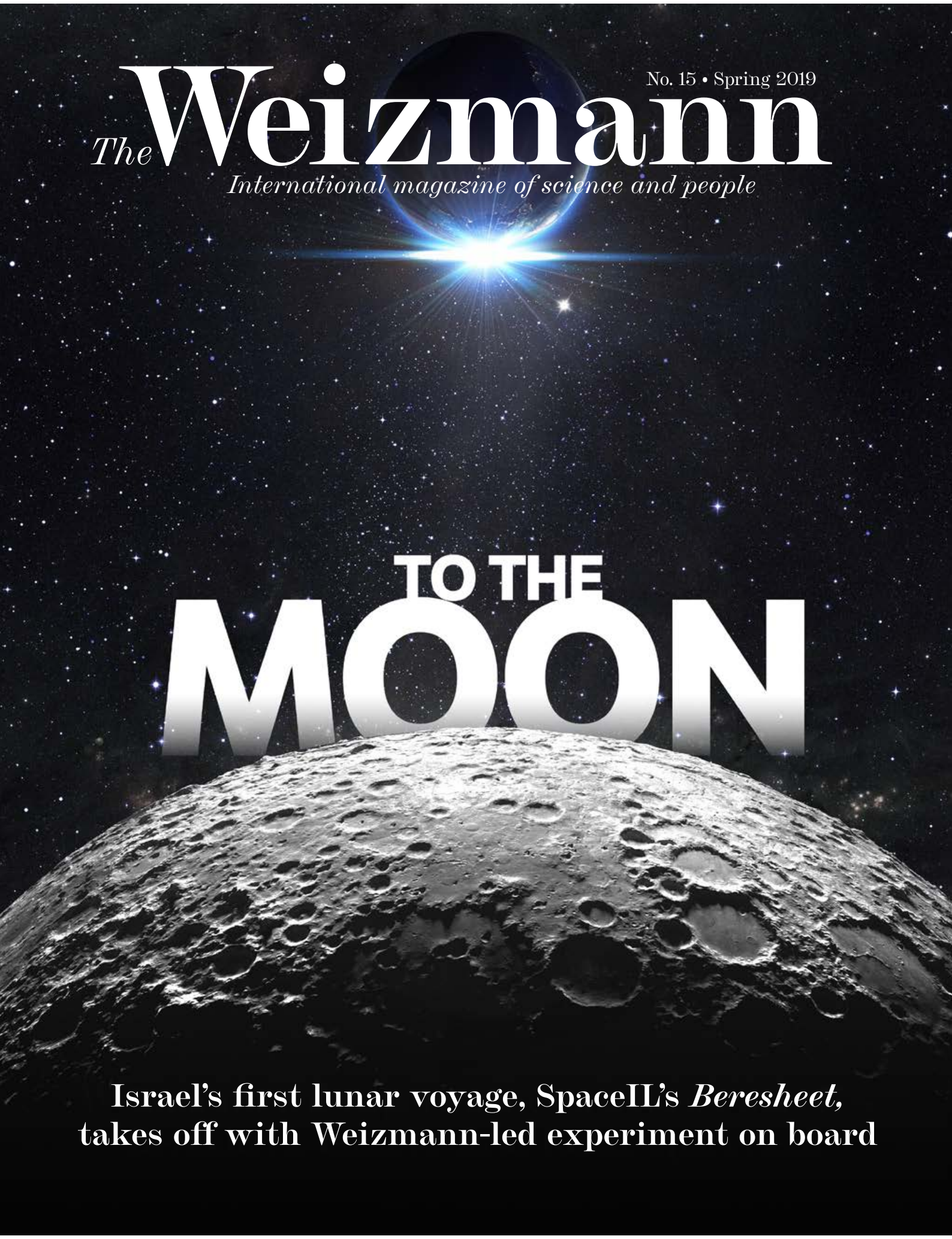

TO THE MOON

Israel's first lunar voyage, SpaceIL's *Beresheet,* takes off with Weizmann-led experiment on board

Credits

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From the President

Dear Friends,

Science is a global enterprise. Today, scientists rely on the input of colleagues in other countries—in an interconnected web of knowledge—to bring good ideas to the point of discovery. In other words, science moves forward by leveraging the expertise of many individuals. For this reason, the Weizmann Institute has entered into formal collaborations with a series of leading research institutions, building on years of organic collaborations between scientists.

This is one way in which the Institute has expanded its international reach, but there are others. In these pages, you'll read about our new Gershon Kekst International Office, which assists our many foreign students and scientists and their families.

You can read here about the Weizmann research taking place on the exciting and extraordinary SpaceIL mission to the Moon; breakthroughs in identifying the biological players underlying anxiety; new ways to leverage bacteria to solve pressing health challenges; and, in one particularly important story, the identification of multiple myeloma well before the disease is symptomatic. And much more.

We had a delightful and productive meeting of the International Board in November, and celebrated a very special group of individuals in our honorary doctorate ceremony. I believe the breadth and depth of our global community of scientists, students, supporters, and friends comes alive in these pages. But of course, it is a mere sampling of the science and activities on campus and around the world.

I want to thank all of you for being a part of this rich and vibrant international tapestry that enables our scientists to pursue innovative and groundbreaking science.

Sincerely,

Prof. Daniel Zajfman
President, Weizmann Institute of Science

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Passing the torch

Prof. Alon Chen elected next Weizmann Institute President

Prof. Alon Chen, a neuroscientist who has made major strides in elucidating the brain's activity in stress and anxiety, will take office as the next President of the Weizmann Institute of Science on December 1, 2019. He will replace Prof. Daniel Zajfman, who has served as President since 2006. The Institute's Executive Board announced Prof. Chen's election at the 70th Annual General Meeting of the International Board in November.

Head of the Department of Neurobiology, Prof. Chen is also a director of the Max Planck Institute of Psychiatry in Munich, Germany. He also heads a joint Weizmann-Max Planck lab for experimental neuropsychiatry and behavioral neurogenetics, and is an adjunct professor at the Ludwig Maximilian University Faculty of Medicine in Munich. At the Weizmann Institute, he leads four donor-funded multidisciplinary centers in brain research. He is a committed proponent of science education and literacy.

Born in 1970, Prof. Chen received his BSc *magna cum laude* from Ben-Gurion University in 1995 and his PhD *magna cum laude* from the Weizmann Institute in 2001. He also received an MBA from Ben-Gurion University. He conducted his postdoctoral research at the Salk Institute for Biological Studies in San Diego, California, during which time he was a Rothschild Scholar and a Fulbright Scholar. It was at the Salk Institute that he began to investigate the neurological processes that regulate stress and anxiety, and was hired by the Weizmann Institute in 2005. He became an associate professor in 2012 and a full professor in 2017.

"I would like to thank the members of the Presidential Search Committee, the Weizmann Institute of Science International Board, the Institute scientists, and its staff and friends for giving me this unique opportunity to lead this world-renowned institution, and to reach new heights of scientific and educational excellence," said Prof. Chen following his election.

A gene for calm

Everyone experiences anxiety—but we all know that some people are more naturally anxious than others. Now, researchers at the Weizmann Institute of Science have revealed a previously unknown molecular mechanism underlying anxiety. The discovery could aid in the search for new classes of drugs capable of alleviating the symptoms of anxiety disorders.

Dr. Nicolas Panayotis, a postdoctoral fellow in the lab of Prof. Mike Fainzilber in the Department of Biomolecular Sciences, was curious about the role of importins—proteins that shuttle molecules into the nucleus from other areas in the cell. Seeking to understand the role these proteins play in the brain and spinal cord, Dr. Panayotis and his colleagues examined mice that had been engineered to lack genes from a particular importin subfamily. They discovered that one gene—the one encoding the protein called importin alpha-5—had a major effect on anxiety levels. Mice missing this gene were far less anxious than the controls.

Examining gene expression in the brains of these "calm" mice, the scientists found that, in the absence of importin alpha-5, a protein called MeCP2 did not enter the nucleus of neurons in the hippocampus. Then, like a machine set into motion, this process modified expression of certain genes, including one involved in the production of a molecule called S1P—an exciting finding since drugs that modulate S1P signaling already exist.

Science Briefs

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Breaking through the clouds

Prof. Ilan Koren

Could data mining shed light on climate change? A new strategy for getting big data out of small clouds—based on the research of three investigators including the Weizmann Institute's Prof. Ilan Koren—was recently awarded €14 million by the European Research Council Synergy program. As clouds play a key role in Earth's energy balance and water cycle, this strategy is expected to help scientists gather information that could help shed light on the changing climate.

The approach, called cloud tomography, uses medically inspired CT algorithms to enable a coordinated fleet of 10 tiny satellites, each the size of a shoebox, to gather images of clouds' external and internal 3D structures, as well as the size and concentration of water droplets within them. The scientific space mission—called CloudCT—will target small cloud fields that are often missed by remote-sensing technologies and, it is hoped, will resolve some of the unknowns surrounding climate prediction.

The project is being led by Prof. Koren, a member of the Department of Earth and Planetary Sciences, together with Prof. Yoav Schechner of the Technion and Prof. Klaus Schilling of Germany's Center for Telematics in Würzburg.

After the satellites are launched into orbit, they will adopt the formation of a continuously moving and networked satellite "swarm" spread over hundreds of kilometers. The satellites will gather images from various points within cloud fields simultaneously, and transmit these images to the ground, allowing scientists to derive 3D information about how such clouds influence, and respond to, changing environmental conditions.

"Remote sensing satellites study large cloud structures, but lack the resolution to observe the small clouds that temper the climate and can also be very sensitive to climate change," says Prof. Koren. "That is why there is a critical need to measure these small clouds properly—to understand their nature and their interplay with changing environmental conditions. CloudCT can pave the way to this understanding."

The Fainzilber group treated normal mice with a multiple sclerosis (MS) drug known to affect S1P signaling, and found that the drug produced a calming effect—something that had been reported before as an unexpected side-effect of MS treatment. This indicates that S1P targeting could potentially be built into new anti-anxiety medications.

The discovery of importin alpha-5 as a key anxiety regulator may have significant implications for future medical treatments. "In follow-up research, we have already identified a number of drug candidates that might someday be employed for treating anxiety in human patients," says Prof. Fainzilber.

To the Moon

Weizmann-led experiment on board Israel's first lunar spacecraft

Israel's first unmanned interplanetary spacecraft launched on February 22 aboard a SpaceX Falcon 9 rocket from the Kennedy Space Station in Cape Canaveral, Florida. If it lands on the Moon on April 11, as expected, Israel will join an exclusive club of countries—the U.S., Russia, and China—that have landed spacecraft on the surface of Earth's nearest planetary neighbor. The spacecraft is named *Beresheet*, the Hebrew word for Genesis, the first book of the Old Testament.

The Moon mission, spearheaded by the nonprofit organization SpaceIL, is meant to both swell national pride and create an 'Apollo effect'—to inspire future generations to pursue studies in fields of science and technology. The phrase was coined after the first humans landed on the Moon in 1969 as part of the U.S. Apollo program, which led to a surge of interest in science in the 1970s. But the Israeli mission has an additional purpose: to better understand the Moon's magnetic field, This is the mission's central research project, led by the Weizmann Institute's Prof. Oded Aharonson, who is the Mission Scientist for SpaceIL.

Prof. Aharonson, a member of the Department of Earth and Planetary Sciences, not only helped the SpaceIL team determine where on the Moon to land (Mare Serenitatis, in the northern hemisphere), but is also using the opportunity to measure the Moon's magnetic field in a way that has not been attempted to date.

The Earth has two magnetic fields: one 'global', that emanates from the Earth's hot core and serves to protect the planet's atmosphere, and one 'local', a magnetism found in surface rocks, which was inherited from the global field as the hot magma cooled. But the Moon only has a local field.

"The big puzzle is, if there is no global magnetic field on the Moon, how and when did the Moon's rocks acquire their magnetism?" asks Prof. Aharonson.

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"The big puzzle is, if there is no global magnetic field on the Moon, how, and when, did the Moon's rocks acquire their magnetism? This is the question we're trying to answer," says Prof. Aharonson.

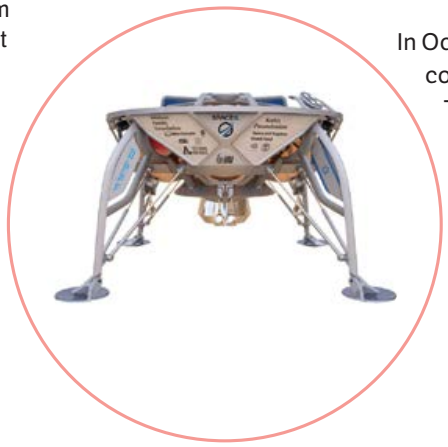
This is not the first time that the Moon's magnetic field will be measured, but it would be the most ambitious in terms of the resolution of data the mission plans to acquire. Prof. Aharonson's lunar magnetometer, built at the University of California, Los Angeles and installed aboard the spacecraft, will take measurements as it is approaching the Moon and after it lands, so "we'll have more accurate data, about more magnetic anomalies, and at higher resolution," he says. "Our ultimate aim is to create a profile of the magnetic field of the Moon and understand its origin."

That information will allow him and other planetary scientists on his international team to figure out how long ago the Moon's magnetization process began, and bring scientists one small step—borrowing from Neil Armstrong's famous words—closer to understanding the Moon's birth and evolution.

A liftoff grounded in partnership

Beresheet s journey is risky, as is the landing. But the momentum behind the Space IL project has galvanized important players who feel the sky is no longer the limit when it comes to the prowess and promise of Israeli science and technology.

SpaceIL began as a hopeful contender in the Google Lunar XPRIZE Competition to land an unmanned spacecraft on the Moon, and was one of five finalists. When Google announced it had ended the competition and cancelled its $30 million cash prize, SpaceIL decided to nevertheless do what it set out to do.

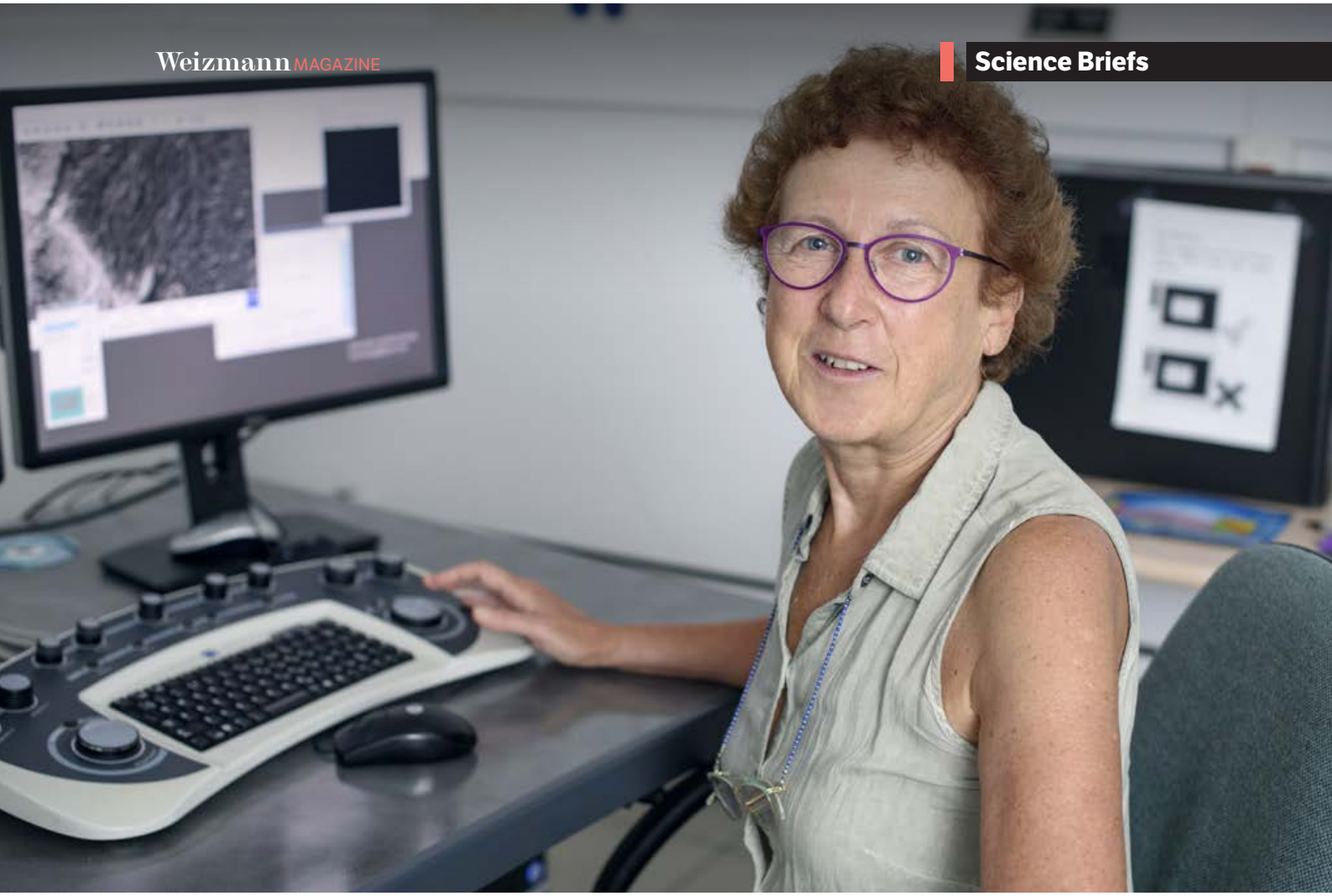


SpaceIL's Beresheet spacecraft

The project, a partnership with Israel Aerospace Industries, is privately funded, mostly by Morris Kahn (who is also SpaceIL's President), Dr. Miriam and Sheldon Adelson, Sami Sagol, Nancy and Stephen Grand (all Weizmann Institute donors as well), Sylvan Adams, the Charles and Lynn Schusterman Family Foundation, and others. SpaceIL is also supported by the Ministry of Science and Technology, the Israel Space Agency, and Bezeq.

SpaceIL's Mission Scientist, Prof. Oded Aharonson

In October, NASA became a partner, offering to contribute two components to the mission. The first is usage of its Deep Space Network for mission communication that will receive data from the spacecraft and from Prof. Aharonson's lunar magnetometer, which would be made publicly available. The second is a 'Laser Retroreflector Array'—a series of small, carefully arranged mirrors that will enable fined-tuned measurements of the distance to the Moon. If the reflector array proves useful, NASA plans to use similar ones in the future to measure distances between various objects and planets in space.



Leading the wonder women: Prof. Lia Addadi is the new President's Advisor for Advancing Women in Science

The next mentor for women in science

Prof. Lia Addadi from the Department of Structural Biology has replaced Prof. Daniella Goldfarb as the newest President's Advisor for Advancing Women in Science. The President's Advisor administers a broad range of programs to help promote female students and scientists at the Weizmann Institute. These include a mentorship program for women PhD students, and forums for graduate students and postdocs to assist them in achieving their academic and career goals.

The Institute's flagship program in this arena is the Israel National Postdoctoral Award Program for Advancing Women in Science. It offers merit-based grants to outstanding women PhD graduates in the exact and natural sciences from all Israeli institutions of higher learning to pursue their postdoctoral research abroad. The grant supplements the typically low postdoctoral salaries of the host institutions, with the ultimate goal of increasing the number of female Israeli researchers working in academia.

The program, which provides 10 fellowships a year, is bearing fruit, which can perhaps best be measured by the percentage of recipients who have gone on to attain faculty-track positions in Israel: about 63%. More than a dozen awardees of the program have become faculty members at the Weizmann Institute.

Another important program launched by the Weizmann Institute is the Combined Weizmann-Abroad Postdoctoral Program for Advancing Women in Science. This program enables combining research in a Weizmann Institute laboratory with a leading laboratory in another country for female PhD graduates who are unable to relocate for a conventional postdoctoral fellowship abroad.

The 50th anniversary celebration brought together international leaders in science education.

A half century of science teaching

Science teaching experts from Israel and around the world convened at The David Lopatie Conference Centre on campus in January to mark the 50th anniversary of the Department of Science Teaching. The conference, organized by department head Prof. Anat Yarden, Dr. Ronnie Karsenty, Dr. Bat-Shahar Dorfman, and Shani Partush, highlighted the department's pioneering role in advancing science pedagogy at a national level, and the science education research field around the world.

Among the keynote speakers was Prof. Helen Quinn of Stanford University, former Chair of the U.S. National Academy of Sciences Board on Science Education, and a world-leading science education expert.

Participants invoked the vision of the late Prof. Amos de-Shalit, which he articulated to the Institute's Executive Council in 1968 in a proposal to establish the department. He talked about the central role science teachers play in developing and revising teaching and learning materials and thereby continually advancing and enhancing school learning.

Says Prof. Yarden: "We always keep in mind one particular thing that he said: 'I have always felt a deep need to respond, in any way I could, to younger people who had an urge and curiosity to understand nature better.'"

Dr. Michal Rivlin and Prof. Erez Berg

Young, innovative, and Israeli

Blavatnik awards go to Prof. Erez Berg and Dr. Michal Rivlin

Prof. Erez Berg of the Department of Condensed Matter Physics and Dr. Michal Rivlin of the Department of Neurobiology have each received the Blavatnik Award for Young Scientists in Israel, an annual prize awarded by the Blavatnik Family Foundation, the New York Academy of Sciences, and the Israel Academy of Sciences and Humanities.

The award, which comes with unrestricted research funding, is given to three promising scientists and engineers in Israel aged 42 and younger in three categories: life sciences, chemistry, and physical sciences and engineering. Dr. Rivlin received the life sciences award and Prof. Berg won the physical sciences and engineering award; the chemistry prize went to Prof. Moran Bercovici at the Technion.

Dr. Rivlin's research is making major strides in understanding sight, in particular the retina, the part of the eye where all visual processing begins. She has found that retinal cells, rather than being fixed and hardwired, are malleable and can dramatically change their properties in response to stimuli like light and motion. Her work has implications for retinal disease and blindness, and the development of computer vision technologies.

Prof. Berg has conducted creative and influential studies to gain insights into quantum materials—materials whose electronic properties cannot be characterized by traditional physics. His research holds major promise for devising new ways of storing and manipulating quantum information, with implications for a new computing age, next-generation electronics, superconducting power lines, and MRI technologies.

"For over 70 years, Israeli innovation has led to groundbreaking discoveries in science and technology," said Len Blavatnik, Founder and Chairman of Access Industries and Head of the Blavatnik Family Foundation. "These exceptional researchers demonstrate the immense potential of the new generation of scientists in shaping the future. It is imperative to recognize and support leading innovators early in their careers to maximize impactful scientific breakthroughs."

The awards will be conferred at a ceremony in Jerusalem on April 7.

Zuckerman STEM @ three years

Since its establishment in 2016, the Mortimer B. Zuckerman STEM Leadership Program has funded three new principal investigators (PIs) at the Weizmann Institute and more than a dozen postdoctoral fellows from overseas doing research on campus. The program represents a large-scale effort to cultivate deeper scientific ties between North America and Israel and helps ensure that Israeli institutions of higher education can effectively compete with top North American institutions in science.

The most recent Weizmann PI to become a Zuckerman Scholar is Dr. Baran Eren of the Department of Chemical and Biological Physics, who is researching how catalysts speed up chemical reactions at the atomic and molecular level. The previous Zuckerman Scholars were Dr. Ivo Spiegel of the Department of Neurobiology and Dr. Itay Tirosh of the Department of Molecular Cell Biology.

Program funding is split evenly between the Weizmann Institute, the Technion, Tel Aviv University, and the Hebrew University.

Dr. Eren's scientific journey has taken him from his native Turkey to Switzerland, California, and now Rehovot—a journey which is the essence of the Zuckerman Program. To reveal the details of catalysts in action, Dr. Eren has worked with specialized microscopy and spectroscopy equipment, and has experimented with new techniques to observe the changes in the molecules and reaction surfaces involved in chemical reactions.

Dr. Baran Eren

His research has already led to new insights into the reactivity of the copper-based catalysts used in a variety of catalytic conversion reactions, including carbon dioxide reduction, and oxidation reactions for methanol and carbon monoxide.

But that's not all he's good at: Dr. Eren is also a U.S. National Master in chess, and a former member of the Turkish national chess team.

The architecture of proteins

Introducing Dr. Moran Shalev-Benami

New Scientists

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Proteins residing within our cells mediate every aspect of human physiology in health and disease. These proteins adopt complicated three-dimensional structures critical for their function. For Dr. Moran Shalev-Benami, the key to understanding how these miniature machines work is to find the right lens through which we can visualize their fascinating architecture—capturing these molecules in action.

A new hire in the Department of Structural Biology, Dr. Shalev-Benami uses electron microscopy to study the 3D structure of proteins: the complex molecules underlying the healthy function of the body's organs and tissues. Her goal? To determine how the complicated architecture of these miniature machines enables them to perform their designated cellular tasks.

Dr. Shalev-Benami received her BA in molecular biochemistry from the Technion–Israel Institute of Technology and her MSc in biochemistry from the Hebrew University of Jerusalem. She returned to the Technion to complete her PhD in chemistry with a focus on structural biology. She became the first recipient of the Combined Weizmann-Abroad Postdoctoral Program for Advancing Women in Science, which finances female scientists performing a postdoctoral fellowship in Israel and abroad.

While working with Nobel laureate Prof. Ada Yonath, during her postdoctoral fellowship, Dr. Shalev-Benami used cryogenic electron microscopy (cryo-EM)—a state-of-the-art technology capable of visualizing biological molecules with near-atomic resolution—to visualize cellular targets residing within the parasitic protozoa *Leishmania*, a deadly pathogen afflicting millions around the globe. Atomic-level images obtained in this study revealed how anti-leishmanial drugs kill the parasite, and are helping the researchers identify hotspots in the parasitic cell that could be targeted by new therapies.

During her further postdoctoral studies at Stanford University and at the University of Michigan, Dr. Shalev-Benami developed her expertise in cryo-EM. Using this tool, she studied the structure of proteins responsible for regulating processes in the human central nervous system. This work has shed light on fascinating mechanisms that govern communication between brain cells.

"What I like most about cryo-EM is that it allows you to capture direct snapshots of molecules in action—snapshots that when put together, tell the story of how molecules work," she says.

In her new lab at the Weizmann Institute, Dr. Shalev-Benami aims to investigate the structure of protein machineries that are expressed on cell surfaces, and which are in charge of cellular communication throughout the body. By combining cryo-EM with biochemistry, molecular biology, and mass spectroscopy techniques, she aims to inform the understanding of how these proteins work to maintain proper communication between cells, and how their malfunction contributes to the development of a variety of diseases and disorders. Importantly, her research will help to identify miscommunication hotspots for the development of novel, targeted therapeutics.

While studying physics at the Weizmann Institute, Dr. Yaron Antebi became captivated by exciting developments in biology. Radically changing course towards the end of his graduate work, he began to apply the strengths he developed in understanding string theory and physics to the challenges of deciphering how cells communicate.

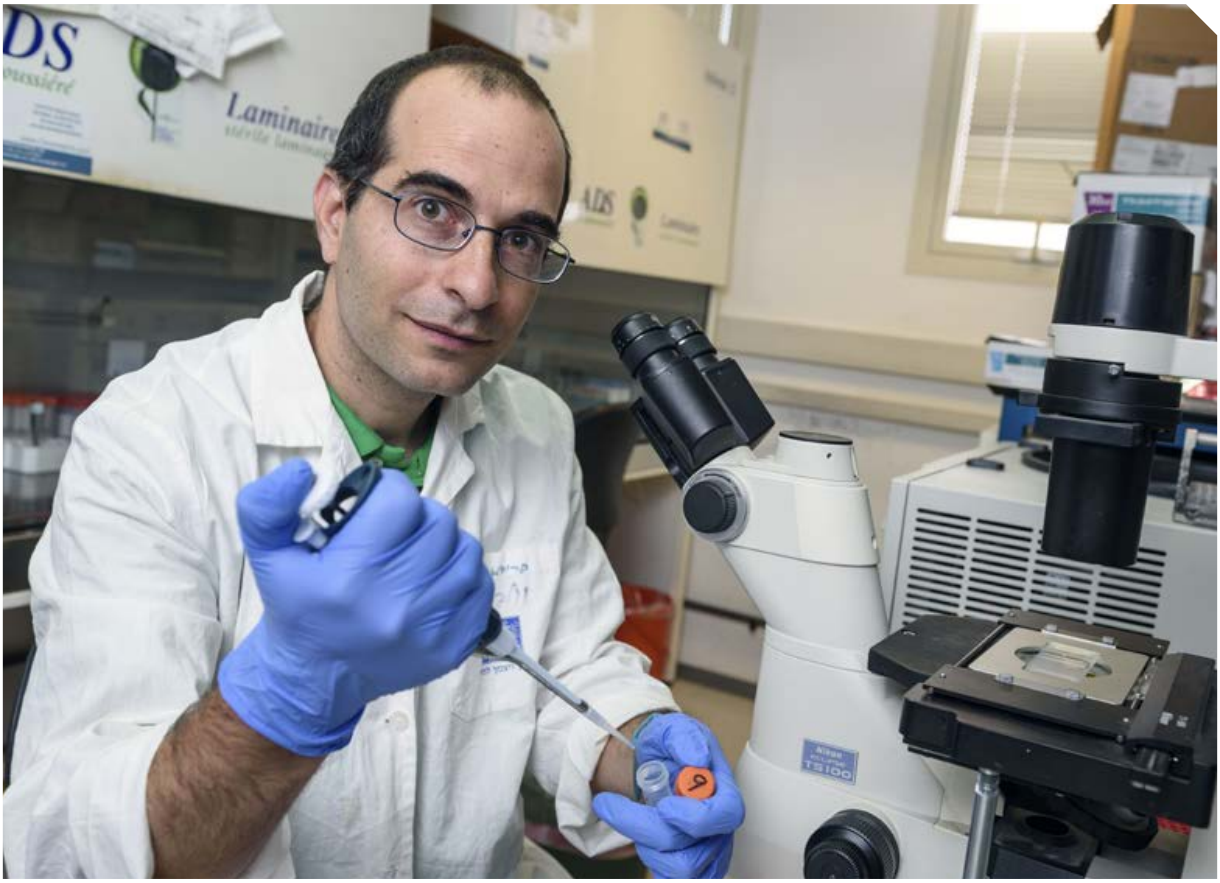
A new recruit to the Department of Molecular Genetics, Dr. Antebi is the latest Weizmann scientist to bring to bear his training and expertise in physics to the life sciences.

It turns out that cells talk—in their own way. Just as humans use letters to create words and messages, cells release molecules called ligands into the environment to send information to their neighbors. These ligands bind to receptors on the surface of other cells, which interpret the messages and trigger the appropriate response.

Under traditional models of cellular communications, each ligand was thought to serve as a key to opening a specific receptor lock. However, scientists realized that it is not that simple. In fact, it is a bit of mayhem: many different ligands appear to interact with many different receptors. In this way, communication between cells is like a conversation in a crowded

CELLULAR

Dr. Yaron Antebi is unlocking the mystery of how cells communicate



"I was fascinated about the many things cells can become in our body: bone, muscle, brain and much more, and how a cell knows which path to choose," says Dr. Yaron Antebi.

room with everyone talking at once. This seems to complicate the ability of individual cells being able to properly interpret and respond to specific signals.

After studying as an undergraduate for a year at the Massachusetts Institute of Technology, Dr. Antebi completed a BSc in physics and mathematics *magna cum laude* at Tel Aviv University in 1998. During his PhD studies in high-energy theoretical physics at the Weizmann Institute with Profs. Ofer Aharony and Micha Berkooz in the Department of Particle Physics and Astrophysics, he was drawn to the study of string theory and supersymmetry. In a radical shift after completing his PhD in 2008, he focused his attention on cell biology.

It was then, as a postdoctoral fellow in Prof. Nir Friedman's lab in the Department of Immunology, that he began learning the basic tools of immunology research in order to try to understand how conflicting signals are processed by the body's T-cells. During this time, he also collaborated with another physicist-turned-biologist, Prof. Uri Alon of the Department of Molecular Cell Biology, contributing new insights into the study of the control circuits governing cell population size.

It was clear to him by this point that his chief interest was tackling the complexity of intercellular communication.

Continuing his postdoctoral research at the California Institute of Technology in biology and biological engineering, he eventually came to the surprising conclusion that cells aren't communicating with individual ligands, but rather combinations of ligands. That understanding has given rise to a radical new paradigm for understanding how cells talk with each other.

Digging deeper, Dr. Antebi fused all of his areas of expertise, combining experimental biology with the mathematical modeling learned in his physics training. He has succeeded in showing something incredibly insightful: that cells respond to complex combinations of different ligands, rather than a single message, and also that different cell types can interpret the same set of signals in different ways. This view is a major departure from the conventional understanding of how cells communicate with each other—and provides a new foundation for understanding how information is communicated inherently through combinations of signaling molecules and their receptors.

"I was fascinated about the many things cells can become in our body: bone, muscle, brain, and much more, and how a cell knows which path to choose," says Dr. Antebi. "It turns out that they can talk, in a language yet to be fully understood. When we get to the point where we understand how to construct 'words' in cellular language, we could potentially direct their behavior and thus correct undesired processes, construct specific tissues, or even create new synthetic cellular structures."

Counter-culture

New research on bacteria is refining—and overturning—assumptions

מכון ויצמן למדע

Science Feature

14–15

Increasing antimicrobial resistance threatens the lives of millions of people in Europe, North America, and Australia. In November 2018, the Organization for Economic Co-operation and Development (OECD) announced a five-part campaign to prevent the emergence and spread of antimicrobial resistance, including calling for better hygiene, ending over-prescription of antibiotics, rapid testing for viral versus bacterial infections, and delayed prescribing of antibiotics. This is an all-out, international assault on one of the biggest threats to modern medicine.

Certainly superbugs must be stopped. But there is more to bacteria than the bug-versus-drug war of attrition.

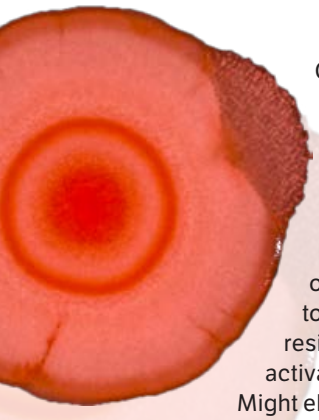
While the community of bacteria, fungi, viruses, and other microorganisms found in all multicellular organisms—known as the microbiome—generates a common cause for worry about infection and disease, the truth is that microbiota are actually an asset that can solve many health and environmental challenges. The new Knell Center for Microbiology—recently established thanks to the generosity of the Knell family of Los Angeles—will support Weizmann scientists as they explore this avenue and work to harness the power of 'good' microbial diversity to develop new medicines, understand trends in global ecology, and more.

Bacterial lessons in self-defense

One of the many things we can learn from bacteria, for instance, is how to defend and define the genome. Prof. Rotem Sorek, from the Department of Molecular Genetics, who heads the new Knell Center, is investigating destructive microbial warfare—the mechanisms by which microorganisms attack one another, and defend themselves against such attacks.

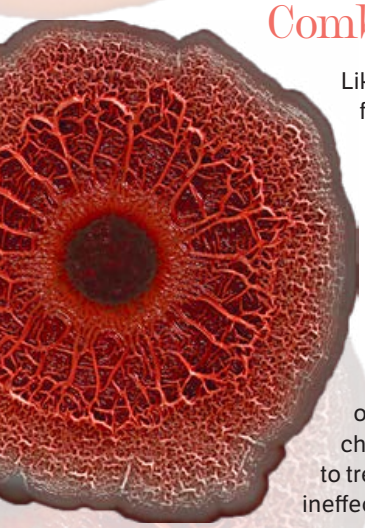
His subject is CRISPR-Cas, the adaptive immune system that bacteria use to defend themselves against viruses. CRISPR is a configuration of short, repetitive segments of DNA separated by unique sequences, which a bacterium acquires after having battled a particular virus—a kind of souvenir collection of viral DNA code for launching a defense the next time that virus attacks. The 'Cas' part of the name—i.e., CRISPR-associated proteins—helps CRISPR slice and dice a putative viral invader's DNA to pieces.

Prof. Rotem Sorek



CRISPR-Cas is an incredibly precise molecular scalpel with extraordinary therapeutic potential. The Sorek team recently discovered that antibiotic-resistant genes in disease-causing bacteria are controlled by special RNA elements that sense the presence of the antibiotic molecule and respond to it. The genes that confer antibiotic resistance are usually inactive, and are only activated by these special RNA elements. Might eliminating such elements be a job for CRISPR-Cas? The discovery offers new modalities of targeting and cancelling antibiotic resistance in pathogens.

Combatting cancer



Like Prof. Sorek, Dr. Ravid Straussman, from the Department of Molecular Cell Biology, is working to leverage the therapeutic potential of microbiota. Using novel methods developed in his lab to characterize and visualize bacteria found in tumor cells, he discovered that an enzyme expressed by bacteria in human pancreatic tumors was capable of metabolizing gemcitabine, the chemotherapy medication often used to treat pancreatic cancer—rendering it ineffective.

The discovery could be a major step forward for helping people with pancreatic cancer. Dr. Straussman and his team are now addressing whether such bacteria are found in other cancer types, and if so, what effects they might have on sensitivity to anti-cancer drugs.

Solving the global food crisis

Bacteria may also be poised to play a role in overcoming food scarcity in the face of a burgeoning global population. What if microorganisms could be manipulated to become energy sources?

Dr. Ravid Straussman

This is the research question that drove Prof. Ron Milo and his team in the Department of Plant and Environmental Sciences to engineer bacteria that would create sugar from the greenhouse gas carbon dioxide. The scientists were able to insert the metabolic pathway for carbon fixation and sugar production into the bacterium *E. coli*. Carbon fixation is a natural process by which plants, algae, and certain bacteria (but not *E. coli*) pump carbon dioxide from the environment, add energy to it, and transform it into the sugars that are the essential starting points for life processes.

Remarkably, the Milo lab was able to reprogram *E. coli* using specially designed incubator tanks, in which they gradually nudged the bacteria into developing an appetite for carbon dioxide.

The ability to train *E. coli* to fix carbon could provide researchers with a new pathway for improving a basic but essential microbiological process. Although the bacteria currently release the gas back into

the atmosphere, Prof. Milo hopes that in the future, these insights might help scientists manipulate microorganisms into soaking up atmospheric carbon dioxide and converting it into stored energy. This tool could also be instrumental in engineering new crops with carbon-fixing pathways, to ensure higher yields and improved adaptability.

Dr. Einat Segev

See our climate, save our sea

Bacteria may also provide clues to the Earth's climate history—and help in the understanding of climate change. Dr. Einat Segev and Prof. Assaf Vardi, also from the Department of Plant and Environmental Sciences, are investigating the unique behaviors of single-celled microorganisms and their interactions with their microenvironments. Both scientists study microscopic, single-celled algae known as coccolithophore. Inhabiting vast territories of the ocean, these algae gather into massive seasonal "blooms" that can cover hundreds of thousands of square kilometers in a matter of weeks. Within a few days, however, these algae meet their death—and the chalky platelets once covering their tiny bodies aggregate on the ocean floor, forming sediments and rocks. Annual blooms are frequently terminated by the infection of a specific large virus termed EhV.

Dr. Segev's research has shown that a complex relationship between bacteria and these marine algae may be one of the driving factors behind their incredible growth and rapid bust. Moreover, the tug of war between bacteria and marine algae leaves traces in the geologic record that she believes can provide clues to our past climate conditions.

Meanwhile, Prof. Vardi is conducting research on how EhV infects algal cells, manipulates the host's metabolism, and hijacks its cellular machinery—leading, eventually, to algal cell death. Understanding such mechanisms on the microscale may help clarify the large-scale impact of marine viruses on the demise of blooms. Given that algal blooms are responsible for half of the photosynthetic activity on Earth, EhV activity may serve as a kind of metabolic

Prof. Ron Milo

valve for the gigantic flux in organic carbon levels that affects all forms of marine life.

A healthy gut for a healthy life

The composition of a person's gut microbiome has a significant impact on the development of obesity, insulin resistance, and liver inflammation. Weizmann Institute investigators Prof. Eran Elinav, of the Department of Immunology, and Prof. Eran Segal, of the Department of Computer Science and Applied Mathematics and the Department of Molecular Cell Biology, are exploring the connections among intestinal microbiota, the immune system, and human health. They have shown that a gut microbiome unbalanced by poor eating habits needs time to adjust, or else it can exacerbate post-dieting weight gain. At the same time, they have shown that diet and lifestyle are by far the most dominant factors shaping our microbiome composition—not our genes. For example, changes in sleep and feeding schedules have a marked effect on the microbiome and the normal daily cyclic behavior of gut bacteria populations. In other words, there is a lot that we can do right now to improve our health, by learning more about and improving what's in our guts.

The missing 99%

"Bacteria have been around, adapting to life on Earth, since the dawn of our planet," says Prof. Sorek. But while scientists have effectively harnessed the powers of microbes to solve many global challenges, recent data shows that only about 1% of the world's microbial diversity has thus far been accessible to researchers. An astounding 99% of bacteria cannot grow in laboratory conditions, creating an enormous untapped field of microbiological diversity. Scientists at the Weizmann Institute—such as those highlighted here—are now studying this "missing 99%"—a vast opportunity for more groundbreaking discoveries.

"The more time we spend with Weizmann scientists, the more we appreciate the brilliance that goes into their research," says Dr. Ellen Knell.

Inaugurating the Knell Center, L-R: Harvey and Dr. Ellen Knell, Prof. Rotem Sorek, Prof. Daniel Zajfman

Harvey and Ellen Knell and the gift of giving

Dr. Ellen and Harvey Knell are dedicated friends and advocates for the Weizmann Institute of Science. Harvey serves on the American Committee's Board of Directors, and is the Vice Chair for Financial Resource Development. In addition, he served as the chair for the American Committee's 75th anniversary 'Transforming Tomorrow' campaign.

Ellen and Harvey established the Knell Family Professorial Chair in 2013, of which Prof. Yardena Samuels is the first incumbent. Prof. Samuels, of the Department of Molecular Cell Biology, is making headlines with her research on ultra-personalized treatments for melanoma. The Knells have also made substantial development gifts in support of the Weizmann UK Building for Biocomplexity Research.

Their most recent donation established the Knell Family Center for Microbiology, which will be headed by Prof. Rotem Sorek from the Department of Molecular Genetics. The new center will support a multidisciplinary group of researchers, as they unearth the basic tools necessary to improve human health and build sustainable environments.

"At first we thought to make our donation to Weizmann anonymously," says Harvey Knell. "On reflection, we decided it would be better to act so as to encourage others to do so, too. We're making 'giving' a value to our children, giving them the 'gift' of giving, the opportunity to make a difference."

"The more time we spend with Weizmann scientists, the more we appreciate the brilliance that goes into their research," says Ellen Knell. "We want to help alleviate the burden of grant writing, and get them collaborating."

As for why the Knells chose to support the field of microbiology, Ellen and Harvey agree: "The potential benefits are limitless—increased food production, and many other possibilities."

The Kekst family legacy

A commitment to science, and sharing Weizmann with others

מכון ויצמן למדע

Spotlight On

The new Gershon Kekst International Office opened its doors in the fall to offer a bevy of essential services to visiting faculty, postdoctoral fellows, and students from overseas, responding to a dramatic rise in the number of international guests at the Weizmann Institute in recent years. The Kekst Office was inaugurated in a special ceremony at the 2018 International Board.

It is a fitting tribute to the late Gershon Kekst, the New York public relations executive and philanthropist who dedicated himself to globalizing the Weizmann Institute name and reputation until he passed away in 2017 at age 82.

The new Kekst Office is located in the former home of the late Prof. Ephraim Katzir, a renowned biophysicist at the Weizmann Institute who served as the fourth President of Israel. It will serve the growing community of international students, postdocs, and visiting scientists—making them feel at home away from home. At any given time, nearly 100 visiting faculty members are on campus, and about 800 per year. The number of international students and postdocs has more than doubled in the last 10 years. The International Office offers assistance with visas, medical insurance, arranging ulpan courses to learn Hebrew, navigating the housing market, registering children for school, and offering job search support for spouses.

Prof. Haim Harari, President Emeritus of the Weizmann Institute, and Prof. Irit Sagi, Dean of the Feinberg Graduate School, both spoke at the opening event, as did Prof. Daniel Zajfman, President of the Weizmann Institute.

All-star introduction

When Gershon Kekst walked into the Waldorf Astoria Hotel in New York in the 1970s to attend a gala event of the American Committee for the Weizmann Institute of Science—his first introduction to the Institute—he was struck by the scientists who were either faculty at Weizmann or affiliated with Weizmann, as they walked onto the dais.

"He took notice that many of the scientists were Nobel laureates and winners of other scientific prizes, and they took their seats like an all-star basketball team," recalls his wife, Carol Kekst. "He couldn't get over it. He talked about it all the time. He said it was like going to the Washington Monument on the Fourth of July and seeing the fireworks display. This was the start of what became a long relationship with the Weizmann Institute."

Gershon Kekst was born and raised in Salem, Massachusetts, and founded the public relations firm Kekst & Company, a corporate and financial communications firm. His Jewish identity, and in particular the Jewish directive of repairing the world—*tikkun olam*—was a driving force in his life, and it became the backbone of his philanthropic activity. It led him to become a board member of Brandeis University and a Chairman of the Board of the Jewish Theological Seminary. It also led him to Weizmann.

"Gershon aimed to attract people from all over the world to lend their energies and provide the financial resources to make it possible for the scientists to accomplish their mission," recalls Carol. "He did this by sharing worldwide the profound achievements and new discoveries of Weizmann scientists, from water and environment to agricultural production, disease control, and genetics."

For both Carol and Gershon, philanthropy was naturally at the center of their lives. Carol Schapiro Kekst was born and raised in Baltimore by parents who were deeply involved in Jewish communal life. She lived in Jerusalem for a time, working at the Guttman Israel Institute of Applied Social Research and the Jewish Agency.

Back in New York in the 1970s, she was active in the movement to free Soviet Jewry. She received a masters degree from Columbia University's Teachers College. She went on to serve on the boards of various Jewish schools and community foundations, and is a longtime Board member of the Jewish Museum of New York. She has been recognized for her leadership and philanthropy by JTS and Brandeis, and she followed Sara Lee Schupf as the

chair of the Women in Science lecture series, a program sponsored by the New York region of the American Committee of the Weizmann Institute and held at Rockefeller University.

A PR maestro who was never in the limelight

Gershon Kekst became a co-chair of the American Committee in the 1980s, and went on to serve as Chairman of the Institute's Board of Governors (the precursor of the International Board) from 1993-2002. He and Carol made a series of generous gifts, including one that established the Kekst Family Institute for Medical Genetics, headed by Prof. Yoram Groner of the Department of Molecular Genetics. Gershon had a brother who died of Gaucher's disease, and he wanted to fund basic research that might help in finding a cure for genetic diseases. Then, in the 1990s, together with then-President Prof. Haim Harari, he helped the Institute strategically navigate its way back to financial security after a period of instability. Gershon saw the imperative from the point of view of the State of Israel—that a financially healthy and strong Weizmann Institute was essential to the country.

Gershon and Carol Kekst

Gershon also helped broaden the Institute's community of friends, using his professional network to open doors in other countries and publicize the research discoveries emerging from its labs.

"As a public relations leader, he felt that the Weizmann Institute was under-publicized to the world," recalls Carol. "He felt that its breakthroughs should be shown to the world, and so as Chair of the Board of Governors he did his best to spread the word about Weizmann."

Leading up to the turn of the millennium, he worked with Prof. Harari to launch the Jubilee Endowment Drive, with a goal of doubling the Institute's endowment. He and Carol contributed their own funds to help reach this goal. He received a PhD *honoris causa* from the Institute in 1995, and the Keksts were inducted into the President's Circle in 1999. The Institute established the Gershon Kekst Professorial Chair in his honor, whose incumbent is Prof. Sergei Yakovenko from the Department of Mathematics.

"Gershon was able to ask deep questions and then listen, and listen, and listen," recalled President Prof. Daniel Zajfman at the International Board in 2017. "For Gershon, the connection to Israel and to the Weizmann Institute was a very important one, as was his interest in creating a bridge between the international community and the Institute. And this is why we decided to establish the new international office that will carry his name."

Friends of the Keksts at the Kekst Office dedication: L-R: Marshall Levin, Prof. Haim Harari, Prof. Michael Sela, Prof. Daniel Zajfman

Prof. Harari, who worked hand-in-hand with Kekst over many years, emotionally memorialized his late colleague and friend.

"Gershon was a great friend of the State of Israel and a great friend of the Weizmann Institute. He was also a magician: He made things happen through very hard work, but it all appeared effortless. He was a great master of public relations, but he was never in the limelight."

"He used to say that he was in the business of 'sekhel'*—the Hebrew word that's a mélange of being smart, clever, wise, witty, and always one step ahead of the competition. And that was exactly what he was," said Prof. Haim Harari.*

In his professional work, Gershon counseled some of the world's best-known companies, while always remaining behind the scenes. He took the same approach with Weizmann, Prof. Harari noted.

"He used to say that he was in the business of *'sekhel'*—the Hebrew word that's a mélange of being smart, clever, wise, witty, and always one step ahead of the competition. And that was exactly what he was."

Prof. Groner remembers how he and Gershon began their work in Prof. Harari's presidency on the same day: Gershon as Board Chairman and he as Institute Vice President. The two became instant friends and developed a close relationship that lasted until Gershon's death. "Gershon was a profound thinker and master of phrasing questions," Prof. Groner recalls.

Gershon and Carol also cared deeply about transmitting their love for the Institute and the importance of philanthropy to their children—Joseph and David—and their grandchildren. Once, when asked about his family's tradition of philanthropy, Gershon said that giving "is also a statement to your family... to the next generations. They have the benefit of knowing that this is a value—that this is a serious priority in life. I hope what I have done leaves them with an understanding of what it means in terms of their own interests and obligations."

At the 2002 International Board meeting, Gershon used the podium to speak to his sons, saying: "Weizmann must be reenergized with young, talented, caring people ... so you are charged with being full-fledged members of the Weizmann Institute family and to transmit that charge in time to your own children, *m'dor l'dor*—from generation to generation."

Foreign student body on the rise

The foreign student body of the Feinberg Graduate School has grown dramatically in recent years, almost double the size of what it was five years ago. About 100 out of the approximately 700 PhD students on campus are international students, which FGS Dean Prof. Irit Sagi attributes to increased awareness of the Weizmann Institute abroad, as well as targeted efforts to attract students.

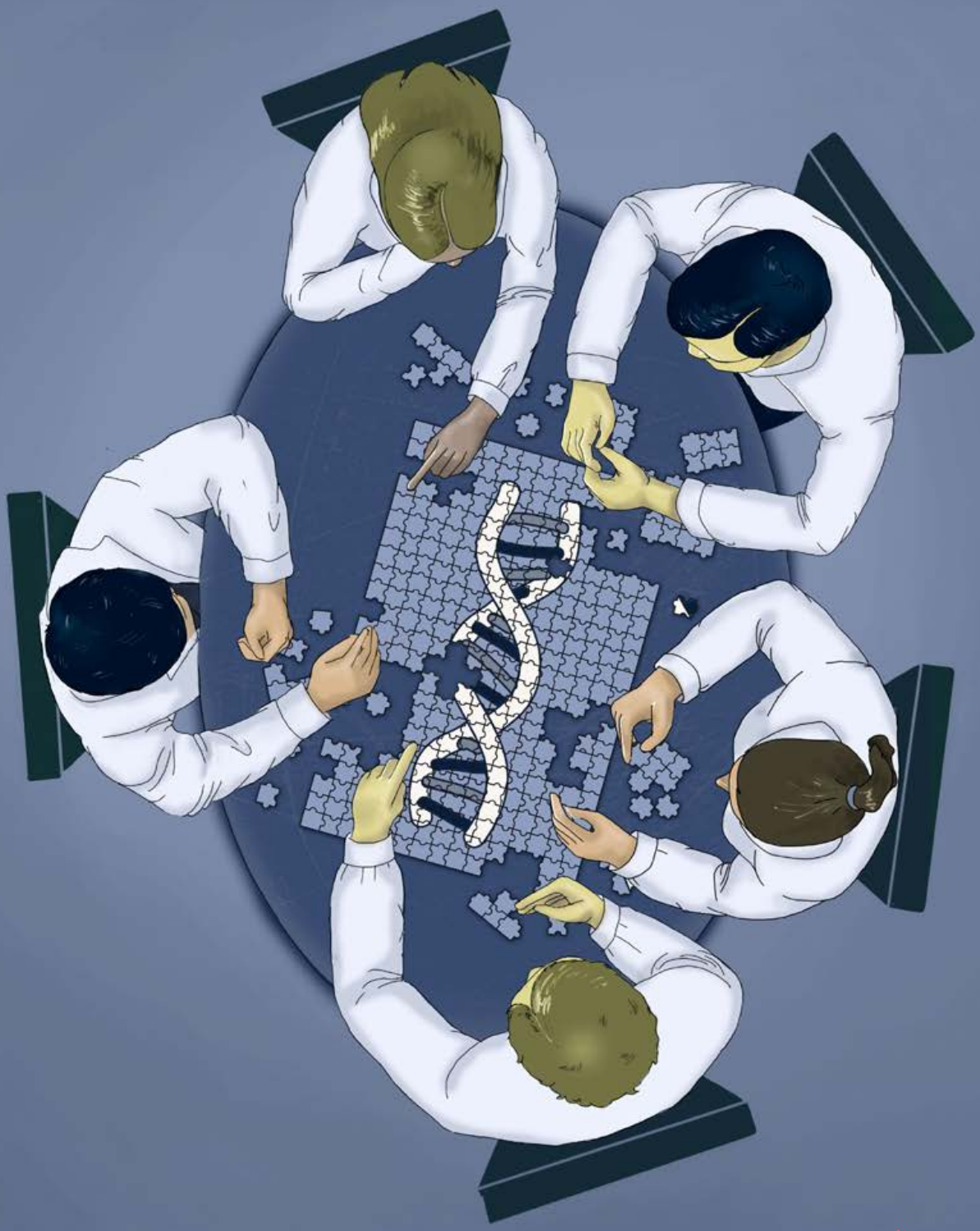
Another factor is the increased exposure of international labs to Weizmann science through the now 70-plus conferences held annually at The David Lopatie Conference Centre and other facilities.

Among them was the first-ever Joint Prague-Weizmann Winter School on Drug Discovery, convened in December. The Winter School follows four successful summer programs organized by the University of Chemistry and Technology Prague and the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences, attended by FGS students. This year's Winter School drew more than 120 students and seasoned scientists from around the world, including 25 participants from the Czech Republic. The program also included lectures by representatives of pharmaceutical companies Merck, AstraZeneca, Pfizer, and Roche.

"Weizmann Institute research activities in the field of medicinal chemistry and drug discovery can benefit from such interactions, and we are looking forward to continuing this tradition of winter and summer schools," says Prof. Sagi.

Stronger together

Weizmann collaborates with the world's best



Science Feature

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When leading scientists partner with colleagues from academic and biomedical institutions around the world, each group can apply its distinctive strengths to make a collective impact on critical challenges that no individual, institution, or country can accomplish on its own.

Collaboration has a long pedigree at the Weizmann Institute. Beginning in the late 1950s, connections to Germany's Max Planck Society led to a historic 1964 agreement whereby the Minerva Foundation for Research channeled German government funding to Weizmann Institute research projects—an initiative that set the stage for diplomatic relations between the two countries. A decades-long collaboration with the Pasteur Institute in France has borne much scientific fruit. Expanding on these and other established partnerships, the Weizmann Institute recently launched a series of new collaborative programs.

The Michigan-Israel bond

A new agreement is creating a framework for scientific and biomedical progress, by triangulating the strengths of the University of Michigan, the Technion, and the Weizmann Institute. The Michigan-Israel Partnership for Research and Education, launched in 2011, has already supported nearly 50 projects involving joint teams with representatives from each of these three institutions. Now, a magnanimous $20 million gift from the D. Dan and Betty Kahn Foundation of Detroit will expand the program and increase its impact, through grants supporting projects in two targeted areas: robotics and precision medicine.

"The success of my late father-in-law in the business world allowed him to be active in philanthropy, but he was always 'Mr. Anonymous,'" says Larry Wolfe (see box on page 29), who took over management of the Foundation after the passing of Betty Kahn in 2004, and her husband D. Dan Kahn in 2012. "That we are lucky enough to have three great institutions working together is a tribute to him."

"Excellent science starts with getting researchers to talk with one another," says Prof. Zvi Livneh of the Department of Biomolecular Sciences, who, in the earliest years of the program, headed the Weizmann committee charged with choosing projects for Kahn Foundation funding. "It is a reflection of the program's impact that the Kahn Symposium—a meeting established in 2011 where researchers from all three institutions gather every 18 months—was attended by the University of Michigan's President."

The upcoming symposium—chaired by current head of the Institute's coordinating committee, Prof. Avi Levy of the Department of Plant and Environmental Sciences and Dean of the Faculty of Biochemistry—will take place on the Weizmann campus in late 2019.

International scientific conferences enable innovative ideas to take root and deepen ties.

California currents

Also recently, the Weizmann Institute signed a collaborative agreement with the California Institute of Technology. Made possible by a generous grant from Gerry Schwartz and Heather Reisman of Toronto, this initiative will support research projects in which Weizmann and Caltech investigators join forces for the advancement of all areas of science.

Last year, Caltech hosted a symposium on the subject of new materials, featuring nine principal investigators from each institution. The Weizmann delegation was headed by Prof. Milko van der Boom of the Department of Organic Chemistry. The Weizmann Institute hosted a similar meeting, focusing on the intersection between systems biology and neuroscience. Chair of this symposium was Prof. Eitan Reuveny of the Institute's Department of Biomolecular Sciences.

These developments enhance what was already a strong relationship. Projects linking Weizmann and Caltech scientists include investigations of condensed matter theory (a necessary step toward tomorrow's quantum computers), and the creation of models that explain wind and weather patterns on Jupiter and Saturn. Also in the realm of astrophysics, Caltech and the Weizmann Institute have designed world-leading technologies capable of catching young supernovas—and other transient celestial events—in the act. Including ground-based optical surveys and satellite platforms for wide-field observation of the heavens, this Caltech-Weizmann collaboration is the most advanced of its kind.

Making Connections UK

In its 10 years of operation, the Making Connections UK program—a framework sponsored by Weizmann UK donors and spearheaded by Weizmann UK—has awarded $4.2 million in grants to 116 researchers from the Weizmann Institute and their partners at British research institutions, enabling the launch of more than 50 collaborative projects across all areas of science.

Among the projects funded through the UK program is one led jointly by Prof. Jean-Paul Vincent, of London's Francis Crick Institute, and the Weizmann Institute's Prof. Benny Shilo of the Department of Molecular Genetics.

"We like to think that science is a pure process, but we're heavily influenced by culture," Prof. Vincent says. "Exchanging ideas with people who have a slightly different cultural outlook, and who see things differently, is enough to produce progress that might not happen otherwise."

"Exchanging ideas with people who have a slightly different cultural outlook, and who see things differently, is enough to produce progress that might not happen otherwise," says Prof. Jean-Paul Vincent of the Francis Crick Institute in London.

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L-R: Prof. Bela Novak, of the University of Oxford, and Prof. Benny Chain, of University College London, at the Making Connections UK gala and symposium in September. Prof. Chain is a member of the Weizmann UK Board and the International Board.

The Shilo-Vincent project focuses on how signaling molecules guide tissue organization during embryonic development, and Prof. Shilo believes that the collaborative framework brought their research to a new and highly productive level.

"The Making Connections UK grant provided a golden opportunity to combine the expertise found in our two labs, and move forward in a very powerful way," he says.

Forward to France

The success of Making Connections can be measured by the degree to which this UK program is emulated elsewhere. Now, the French Committee for the Weizmann Institute is preparing to solicit proposals for joint projects, with the goal of selecting 10 projects annually.

"The launch of this initiative realizes the dream of the late Simone Veil, who, during her time as France's Minister of Health, founded an important collaboration between Institut Pasteur and the Weizmann Institute," says David Weizmann, Director General of the French Committee. "Ms. Veil recognized the scientific potential of such a partnership, and also its symbolic value. In retrospect, that project became a model for countless other international collaborations undertaken by Weizmann Institute scientists."

This initiative will add to exciting projects already linking Weizmann researchers to leading labs in France. A new collaboration is soon to be launched with Institut Marie Curie, a major research and clinical care enterprise focused on cancer.

The Weizmann Institute's Prof. Rotem Sorek of the Department of Molecular Genetics is partnering with Prof. Pascale Cossart of the Institut Pasteur to unravel the problem of antibiotic resistance. Prof. Elisha Moses from the Department of Physics of Complex Systems, an expert in experimental physics of the brain, actively collaborates with researchers from Université Paris Diderot on network analysis in the context of neural activity. And Prof. Victor Malka from the same department, who earned his PhD in atomic and plasma physics at École Polytechnique in Palaiseau, recently co-organized a conference to promote interactions among laser scientists from the Weizmann Institute, École Polytechnique, and the Centre National de la Recherche Scientifique. Both Prof. Moses and Prof. Samuel Safran, in the Department of Chemical and Biological Physics, work with counterparts at Institut Curie on a series of projects.

The MIT alliance

More than 40 years ago, professors at the Massachusetts Institute of Technology worked with Weizmann's Prof. Adi Shamir of the Department of Computer Sciences and Applied Mathematics to develop RSA, the first public-key cryptosystem. In the 1980s, Prof. Shafi Goldwasser—who holds appointments at both institutions—joined Weizmann and MIT scientists in developing what is now the gold standard for enabling secure transactions on the Internet. And the Weizmann Institute also has a growing partnership with MIT's Center for Brains, Minds, and Machines, particularly

The Garvan-Weizmann Centre for Cellular Genomics in Sydney, Australia.

as Weizmann prepares for the launch of its Artificial Intelligence Center for Scientific Exploration.

Now, thanks to a generous gift from Tova and Sami Sagol of Israel, the two institutions are embarking on yet another joint project. The new Weizmann-MIT program will select three collaborative research programs annually, and support each partnership over a period of three years.

The gift was announced at MIT during the 2018 Global Gathering of the Weizmann Institute, which was held in Boston. "This gift will not only seed joint research between these two great institutions. I hope that this partnership will mark the beginning of a wider trend, in which Israel develops a deeper connection with Massachusetts—and when we've accomplished that, the sky's the limit," Mr. Sagol said at the event.

Collaborations in cancer research

As opposed to partnerships launched on the institutional level—top-down—some of the most exciting partnerships developed organically from activity in Weizmann labs. Such is the case with the pioneering work of Prof. Avigdor Scherz and the late Prof. Yoram Salomon, who created a revolutionary and highly successful approach to treating and curing certain types of cancer.

Vascular Targeted Photodynamic Therapy, or VTP, involves Tookad®-Soluble (TS), an anti-cancer drug based on Prof. Scherz and Prof. Salomon's research that activates when it encounters a certain wavelength of laser light. Shown to completely cure early-stage prostate cancer in a 90-minute outpatient procedure, the TS-VTP treatment protocol has achieved regulatory approval, and is now being tested in other tumor types.

Today, Prof. Scherz is working with clinical colleagues at Memorial Sloan Kettering Cancer Center, examining the use of TS-VTP to combat esophageal, urothelial and breast cancer, as well as with pancreatic cancer researchers at Cold Spring Harbor Laboratory in New York. The scientists are also investigating how modulation of the immune response, alongside TS-VTP therapy, may improve clinical outcomes.

The MD Anderson Cancer Center at the University of Texas is another institution that—under the auspices of the Weizmann Institute's flagship cancer research framework, the Moross Integrated Cancer Center—maintains a collaborative relationship with Weizmann researchers. Recent joint projects have focused on why some cancer patients acquire resistance to particular cancer drugs and therapeutic procedures, and have set forward new strategies for circumventing this resistance.

Science and design Down Under

Diseases can be complex targets, with specific characteristics unique to certain organs and tissues, and symptoms that may change over the course of the patient's lifetime. Cellular genomics provides a powerful way to manage the comprehensive set of data points that make up this big biological picture.

In 2016, the Weizmann Institute established a new center for cellular genomics in partnership with Australia's Garvan Institute of Medical Research. The new Garvan-Weizmann Centre for Cellular Genomics will help clarify how gene expression patterns of individual cells in the brain, the immune system, and other organs change over the course of a lifetime. This, in turn, will provide a dynamic "fingerprint" indicating how cancers, autoimmune diseases, and other conditions develop.

The Garvan-Weizmann partnership is also advancing the art of effective science communication. Two Weizmann Institute doctoral students, both with a solid background in basic research, as well as proven excellence in art and design, were accepted to the

"There are tremendous, specific strengths in each of these institutions, and a common vision of what they want to accomplish," says Larry Wolfe of the Kahn Foundation.

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inaugural Garvan-Weizmann training program in scientific animation—an emerging must-have skill needed to communicate scientific stories clearly and quickly to today's digital audience.

After they complete the year-long training program in Australia, the participants will return to the Weizmann Institute, where they will collaborate with Weizmann faculty to produce accurate, compelling videos designed to help non-scientists understand and appreciate complex discoveries. This will not only help Weizmann scientists publicize their work, it will also build bridges to like-minded colleagues who will clamor to sign on to their next collaborative projects.

Michigan-Technion-Weizmann partnership fueled by the Kahn Foundation

The philanthropic journey culminating in the D. Dan and Betty Kahn Foundation's establishment of the Michigan-Israel Partnership for Research and Education began in a hospital room. The tenderness with which doctors at the University of Michigan took care of his ailing wife inspired D. Dan Kahn to make a major gift to the University of Michigan Cardiovascular Center. Later, he would pair his admiration for the University of Michigan's clinical experts with another passion: support for science in the State of Israel.

"Dan moved to Michigan after his parents died when he was still a very young child," says Larry Wolfe, Dan's son-in-law, who manages the Kahn Foundation. "He was a self-made man, whose success in business allowed him to become quietly active in philanthropy."

Dan, who had never been religious, was inspired to strengthen his connection to Judaism after he met his wife, Betty. He became active in the Detroit Jewish community, and traveled to Israel as a tourist. He was so impressed with what he saw, particularly in Israel's science and engineering community, that this became a turning point in his giving.

Larry Wolfe

"Dan realized that, by strengthening the connection between world-class institutions in Israel and the United States, he could set something in motion that would be really world-changing," Wolfe says. In 2011, Dan established grants for joint research, as well as the Kahn Symposium, an academic summit held every 18 months, where investigators from the Weizmann Institute, the Technion, and the University of Michigan gather to share their findings about topics of scientific, industrial, and biomedical interest.

Dan Kahn passed away soon after the inaugural Kahn Symposium, but his dream lives on. In tribute to his memory, the Foundation recently expanded the program with a magnanimous $20 million gift to support Weizmann-Technion-Michigan research related to robotics and precision medicine.

"There are tremendous, specific strengths in each of these institutions, and a common vision of what they want to accomplish moving forward," Wolfe says. "This has gone well beyond Dan's expectations, but not beyond his vision. I know if he could see where this project has gone, and where it's going, he'd be *kvelling*."

Opening Night

The opening event of the 70th Annual General Meeting of the International Board kicked off an intensive week by celebrating a year of global partnerships between the Weizmann Institute and other academic institutions. Israeli friends Tova and Sami Sagol were honored for their longtime support, and specifically their most recent gift to support a research collaboration between the Weizmann Institute and the Massachusetts Institute of Technology.

Prof. Jehuda Reinharz, Chair of the International Board, delivered opening remarks, and Prof. Daniel Zajfman, President of the Weizmann Institute, spoke about the value of both scientific competition and collaboration.

The evening's theme was "Masterpieces of Mind and Spirit," and panelists traded ideas about what makes a masterpiece—in art, music, and science—as a way to celebrate how the Weizmann community of scientists has transformed dreams into reality. Panel participants included musical performer and artistic director Gil Dor; Prof. David Harel of the Department of Computer Science and Applied Mathematics; singer and artist Achinoam Nini; and author Dorit Rabinyan. The panel was hosted by veteran Israeli journalist Oren Nahari.

International Board

30–31

Bronickis give to neuroscience

At the festive Open Session of the International Board, Dita and Yehuda Bronicki of Israel were honored for their recent gift to support the research of Prof. Nachum Ulanovksy of the Department of Neurobiology. The Bronickis have played a pioneering role in making Israel a world leader in renewable energy and technological innovation for more than 50 years. They are best known as the founders, and CTO and CEO, of Ormat Industries, now the world's leading producer of geothermal power, with over a thousand employees worldwide. They won the Israel Prize for Industry in 2018, and have been called Israel's "power couple" for their unique role in developing renewable power. Yehuda is also a member of the International Board of the Institute.

The Bronickis' gift to Prof. Ulanovksy, to support his "bat tunnel," enables him to expand his research on bat brains and how bats process information to navigate the environment. His research has major implications for understanding the human brain, and for Alzheimer's disease in particular, in which patients' spatial sense is degraded.

Yehuda and Dita Bronicki, Prof. Daniel Zajfman

First Neustein AI fellow celebrated

Supporting artificial intelligence research: Robin Chemers Neustein

Robin Chemers Neustein, a member of the Executive Board and its Management Committee, was honored for her generous establishment of the Robin Neustein Artificial Intelligence Fellows Program. The program funds the salaries of two technology experts in AI, who will help develop and maintain the computing infrastructure needed for the Institute's new Artificial Intelligence Center for Scientific Exploration. The first Neustein Fellow is Dr. Daniel Harari, who has worked in industry and academia and is a member of the Department of Computer Sciences and Applied Mathematics. A second Neustein Fellow has joined since, Dr. Shai Bagon, an expert in video and image processing in the same department.

Inauguration of the Dangoor Chair of Archaeological Sciences

Shared D-REAMS: L-R, Dr. Judy Dangoor, Prof. Elisabetta Boaretto, David Dangoor

Dr. Judy and David Dangoor of the UK were honored for their major gift to fund a new professorial chair in archaeological sciences. The first incumbent is Prof. Elisabetta Boaretto of the Scientific Archaeology Unit.

In 2013, the longtime Weizmann Institute supporters established the Dangoor Research Accelerator Mass Spectrometry Laboratory (D-REAMS), in which Prof. Boaretto conducts much of her cutting-edge investigations. The lab enables scientists to analyze and date archaeological finds with unprecedented precision. The new chair deepens the Dangoors' relationship with Prof. Boaretto and will further advance her research in this field.

The next generation of Mexican friends supports cancer research

Mauricio Schwartz with Prof. Daniel Zajfman

A group of young Mexican friends came together to support the research of Dr. Itay Tirosh of the Department of Molecular Cell Biology. Mauricio Schwartz of Mexico City and a member of the Mexican Association of Friends, who spearheaded the effort, offered his remarks at the open session of the International Board.

Dr. Tirosh is a computational and systems biologist who is taking the field of single-cell genomics into new areas of discovery. He is among the pioneers applying single-cell techniques to solid human tumors who has shown, for the first time, incredible heterogeneity of cell types inside glioblastoma tumors—an aggressive form of brain cancer.

The Goodman Family Foundation's gift to enrich science teaching

Shawna Goodman Sone at the Donor Wall inscription ceremony

After a successful decade in providing science and math teachers with the knowledge and tools to become better educators, the Rothschild-Weizmann Program for Excellence in Science and Mathematics Teaching is having a formidable impact on students and teachers alike. A recent gift from the Morris and Rosalind Goodman Family Foundation, based in Canada, will further enrich the program.

The gift was celebrated at the International Board meeting in November in the presence of Shawna Goodman Sone, Chair of the Foundation's board, and her husband Todd.

Using a "teach the teachers" approach, the program empowers high school educators, providing them the tools, confidence, and the most up-to-date scientific knowhow they need for effective classroom teaching. The long-term goal is to raise the bar for science teaching across Israel. The program offers an MSc-degree track and a non-degree track.

"When I think about the Weizmann Institute, I think about excellence," says Ms. Goodman Sone. "The Rothschild-Weizmann Program aligns with our mission of promoting science, education, and capacity building, as well as a strong connection between Israel and the diaspora. The most important resource we have is our teachers and the Goodman Foundation is committed to helping them become better educators."

The program also encourages educational leadership. This embodies the values of her parents, Morris and Rosalind Goodman, who created this legacy of philanthropy for their four children and nine grandchildren through their establishment of the Foundation. The Foundation previously supported a joint research project between the Weizmann Institute and the McGill University Goodman Cancer Research Centre.

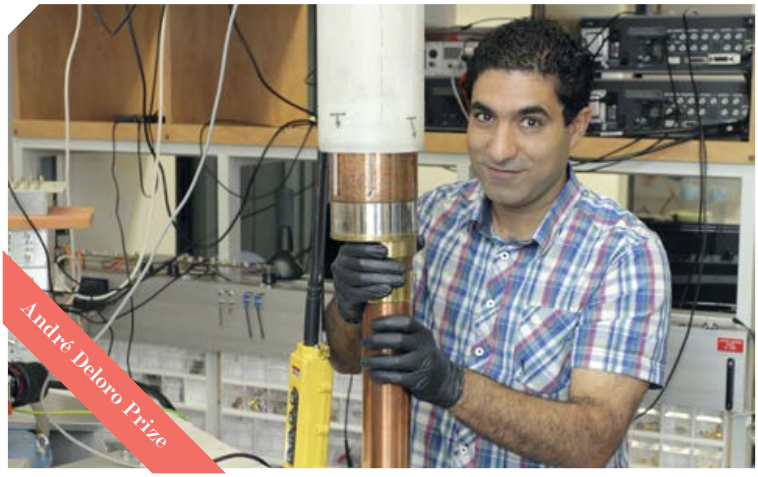
"My mother, Rosalind, believed in community and deriving strength from it," says Ms. Goodman Sone. Similarly, the Rothschild-Weizmann program builds a community by bringing teachers together from all over Israel and from all sectors of Israeli society, offering an opportunity to form bonds across geographic and cultural divides.

For Ms. Goodman Sone, this gift has particular meaning. As a parent raising her children in Israel, she has first-hand knowledge of what is needed in the education system. "There are gaps in the system, and this is what motivates us to support this project. The Foundation believes in access to quality education for all youth, especially in the STEM subjects."

The Rothschild-Weizmann Program has reached 350 teachers who now have the capability of affecting thousands more by becoming part of a dynamic, professional learning community of educators who propel Israel's educational system forward.

Quantum phenom

Prof. Shahal Ilani of the Department of Condensed Matter Physics received the André Deloro Prize, in an inaugural ceremony at the International Board meeting. Rebecca Boukhris, a trustee of the Adelis Foundation, awarded the prize. The Adelis Foundation has supported a wide range of scientific initiatives and prizes at the Institute; the Deloro Prize singles out an outstanding researcher whose investigations hold particular promise for promoting scientific advancement.



Prof. Shahal Ilani and his team study quantum phenomena in small systems and novel materials.

Prof. Nachum Ulanovsky is studying navigation systems in bats.

Navigating the brain's 'GPS'

The Hellen and Martin Kimmel Award for Innovative Investigation was bestowed upon Prof. Nachum Ulanovsky of the Department of Neurobiology at the Annual General Meeting of the International Board. Prof. Ulanovsky discussed his research on the brain's spatial navigation—its 'GPS'—which he investigates in bats, with major implications for understanding the human brain. The award is given annually to a scientist to allow him or her to develop outside-the-box ideas that might not otherwise be funded by traditional funding agencies which typically award grants to projects in later stages of development.

Stone Administration Building gets a reboot

A renovation of the Stone Administration Building, funded by the Stone and Teplow families of Boston, was celebrated at the International Board in the presence of Ted and Charlotte Teplow, their son David Teplow (President of the American Committee), and other members of the Teplow family. Shulamit Geri, Vice President for Administration and Finance, thanked the family for its generous support, which allows the administrative employees of the Weizmann Institute to function in a modern facility with all the necessary amenities.

In his remarks, David Teplow said he and his parents were grateful to carry the torch lit by his great-uncle, Dewey Stone, a founder of the American Committee and a visionary philanthropist who helped lay the groundwork for the establishment of the Weizmann Institute of Science.

L-R: David Teplow and Ted Teplow

Chemistry and the origins of life

Dame Vivien Duffield of the Clore Foundation presented the Clore Prize to Dr. Sergey Semenov from the Department of Organic Chemistry at the annual Clore Lunch. She also presented the Clore Postdoctoral Fellowships to 10 outstanding scientists.

Dr. Semenov's research sheds new light on how life emerges from its organic roots. One of his main interests is autocatalysis—how a chemical reaction can begin and be sustained on its own. He joined the Institute this year after postdoc fellowships at Harvard University and Radboud University in the Netherlands.

Nobel laureate Sir Paul Nurse, who received an honorary doctorate from the Weizmann Institute, was the keynote speaker for the lunch (see story, following page).

Dr. Sergey Semenov with Dame Vivien Duffield

"They saw me as the kid who just couldn't seem to finish school," Sir Paul Nurse said of his parents. "Oh, well. It seems to have worked out all right in the end."

A life studying life

A conversation with honorary PhD recipient Sir Paul Nurse

מכון ויצמן למדע

Nobel laureate Sir Paul Nurse was in his 30s when he discovered the gene-based mechanism that controls how organisms with nuclei divide as part of their natural life cycle. He has some surprising advice for today's young scientists: what you learn about research as an undergraduate, he says, bears no resemblance to what a life in science is really like.

"When you're a student, you're taught only the best experiments—the ones that work—but reality is completely different," Dr. Nurse said during his visit to the Weizmann Institute to receive a PhD *honoris causa* at the 2018 International Board. "During my doctoral studies, I felt like such a failure I nearly gave up. That's why I thought very hard about what I would focus on as a postdoctoral fellow."

He chose his topic—the cell cycle—and took off from there.

Dr. Nurse identified a gene, first in yeast and then in humans, that controls a particular aspect of cell division. Later, in the achievement that led to the 2001 Nobel Prize in Physiology or Medicine that he shares with fellow Brit Prof. Tim Hunt, a Weizmann Institute Board member, and American Prof. Leland Hartwell, he determined how proteins coded by these genes help to determine whether a cell has divided properly—and if it has not, to trigger molecular events that destroy the cell. This was a discovery of tremendous clinical importance because, if a cell divides incorrectly yet survives, the result can be cancer.

At the annual Clore Lunch, Dr. Nurse delivered an address in which he spoke of how science creates revolutionary change. At the same time, he says, scientists tend to be highly individualistic, so managing this change is "a bit like herding cats."

Not that Dr. Nurse has ever shied away from management. After serving as a young department head at Oxford, he merged two existing British organizations to found Cancer Research UK, now the world's largest charity devoted to supporting the scientific study of cancer. He served as President of New York's Rockefeller University for eight years, then returned to the UK to take up a five-year term as President of the Royal Society, the oldest national scientific institution in the world. Concurrently, he combined three biomedical research centers in London to create the Francis Crick Institute, where he now serves as director.

"I'm good at running things—I spend half my life doing it—but I enjoy science much more," Dr. Nurse says. "Still, I'm truly touched by the fact that society pays me to do curiosity-driven work. My administrative duties are a way to pay society back."

Essential education

The recent trip to Israel—his first—gave Dr. Nurse the opportunity to reconnect with Weizmann Institute Prof. Ruth Arnon, who was President of the Israel Academy of Science and the Humanities during the period when Dr. Nurse, then at the Royal Society, brokered an agreement between the two countries.

Academics in Israel and the UK have a long history of fruitful collaboration, with hundreds if not thousands of joint projects being pursued at any given time. The 2015 agreement between the Royal Society and the Israeli Academy of Science and Humanities marked an uptick in this activity, providing funding for research in a number of key scientific areas, as well as funding for a postdoctoral exchange program that allowed newly-minted PhDs to travel to the other country to continue their work.

Like Prof. Arnon—who together with her husband Uriel, supports programs designed to nurture the next generation of scientists—Dr. Nurse sees education as essential.

"The Crick Institute has a teaching lab that has been visited by thousands of children, and we do targeted programming for schools in disadvantaged areas of London," he says.

Himself the scion of a working-class family—all other members of his family left school before the age of 15—Dr. Nurse admits that his parents found his long years of training a bit perplexing. "They saw me as the poor kid who just couldn't seem to finish school and graduate," he quips. "Oh well. It seems to have worked out all right in the end."

Clockwise from top left: Prof. Marc van Montagu, Eric Stupp, Ido Dissentshik, Sir Paul Nurse, Ellen Merlo, Dr. Fabiola Gianotti

Celebrating excellence

The Weizmann Institute of Science was pleased to bestow its 2018 honorary doctorates upon six extraordinary individuals during the International Board.

Ido Dissentshik has combined a successful career in journalism and business with a lifetime of public service and commitment to Israeli society, most recently as Chair of the Weizmann Institute's Executive Board. A former editor-in-chief of the Israeli daily *Maariv,* Mr. Dissentshik also founded the business and economics portal Analyst Online, and he is a founder of the Davidson Institute of Science Education.

Dr. Fabiola Gianotti is a renowned particle physicist who currently serves as the Director-General of CERN (the European Organization for Nuclear Research), which operates the largest particle physics laboratory in the world. The first woman to hold the Director-General's position, Dr. Gianotti also served as project leader of the ATLAS experiment at CERN, representing this global community of scientists in the announcement of the historic 2012 discovery of the Higgs boson. (See story, following page.)

Ellen Merlo is one of the Weizmann Institute's strongest and most steadfast pillars of support. After retiring from a successful career in marketing and corporate communications, she became an energetic advocate for the Institute, galvanizing support for stem cell research and the promotion of women in science, among other areas, while promoting initiatives related to Israel and Jewish life. Ms. Merlo has served in numerous leadership roles at the American Committee for the Weizmann Institute of Science and on the Institute's Executive Board and International Board, and she is currently National Chair of the American Committee.

Sir Paul Nurse is a 2001 Nobel Prize-winning geneticist and cell biologist whose research findings on cell growth and division have broad implications for the study of cancer and other diseases. He discovered *CDC2*, a gene that plays a pivotal role in cell cycle progression. A former President of Rockefeller University, he was President of the Royal Society between 2010-2015, and is currently Director of the Executive Committee of the Francis Crick Institute. Sir Paul is an ardent supporter of advancing relations between the UK and Israel. (See story, previous page).

Eric Stupp, Chair of the Weizmann Institute's Swiss Society of Friends, is a leading financial lawyer who advises government and financial institutions in the United States and Europe. He is the Vice Chairman of the Board of Directors of Goldman Sachs Bank AG, Zurich, and serves on the boards of a number of additional industrial and financial concerns. A steadfast friend of the Weizmann Institute, Mr. Stupp has significantly expanded Swiss awareness and support of the Institute's endeavors. He sits on the Weizmann Institute's Executive Board.

Prof. Marc Van Montagu, a pioneer of plant molecular biology, has made critical scientific discoveries that form the basis of biotechnological approaches that are successfully addressing the problem of global food security. He is perhaps most renowned for identifying the tumor-inducing (Ti) plasmid and the Agrobacterium tumefaciens transformation technology used worldwide to produce genetically engineered plants. Born in Belgium, he is a Professor Emeritus at Ghent University, where he remains a tireless advocate for the transfer of plant biotechnology for the economic, environmental, and health benefits of the emerging and developing nations.

Uniting the world through science

A conversation with Dr. Fabiola Gianotti, CERN's Director-General

Particle physicist Dr. Fabiola Gianotti was at the center of a media frenzy when the news broke in the summer of 2012 that scientists at CERN had discovered the Higgs boson—a long-predicted piece of the cosmic puzzle that helps explain the origin of mass. It was an epic moment for CERN, which was then, as now, the world's biggest international scientific collaboration.

She is now Director-General of CERN, the first woman to hold that position. In the mid-90s, Dr. Gianotti was part of the team at the Large Hadron Collider (LHC) that optimized the design of the electromagnetic calorimeter, part of the ATLAS detector that measures the energy of the photons and electrons produced when proton beams collide.

"It was a fantastic time," she recalls. Today, ATLAS is a five-story-high structure, capable of capturing data derived from over a billion particle collisions per second, and transferring this data instantly to a global network of high-powered computers for analysis.

"We chose the technology and materials, designed the detector, performed tests with prototypes, and ran simulations," she continues. "It was our job to present our dream design to the engineers, and it was the engineers' job to say 'you're crazy!' The compromise we achieved—between what was sketched out in theory and what

Dr. Fabiola Gianotti. "We live in a fractured world. But at CERN, over 17,000 scientists from 22 member states and other countries, representing more than 110 nationalities, some coming from countries in conflict, work together."

eventually became the nuts and bolts of ATLAS and the LHC—led to the discovery of the Higgs boson."

Dr. Gianotti worked side-by-side with Weizmann scientists who contributed research critical to the success of ATLAS, something that made her first-ever trip to campus in November, to receive her honorary doctorate, particularly meaningful.

A native of Italy, Dr. Gianotti's relationship with CERN began when she was a doctoral student at the University of Milan. After completing a postdoctoral fellowship on site, she joined CERN's research staff, and was on hand to see the first high-energy proton beams accelerated through the LHC in 2010—something that she describes as a very emotional achievement.

"I had worked on an experiment involving CERN's smaller accelerator, the Super Proton Synchrotron," she says. "But with the LHC, we achieved much higher energies. LHC experiments involving ATLAS and CMS [another general-purpose detector] allowed us to break down protons into much smaller pieces. Particles never seen before, like the Higgs boson, could now be produced and observed. Among other things, these findings provided insight into the evolution of the universe."

Dream big

In 2009, Dr. Gianotti was named spokesperson (project leader) for the ATLAS experiment, a position previously held by Prof. Peter Jenni, a longtime friend and mentor at CERN who received an honorary doctorate from the Weizmann Institute last year. Dr. Gianotti credits Prof. Jenni with inspiring her to dream big while remaining pragmatic, and providing her with a brilliant example of how to get scientists from all over the world to work together.

"Since its discovery in 2012, we have learned a lot about the Higgs boson," she says. "But we need to improve the precision of our measurements and continue to address other outstanding questions in particle physics. The LHC will operate until 2037, but it's not too early to think about our next steps."

Dr. Gianotti will be deeply involved in the update of the European strategy for particle physics, a community effort that will articulate unified goals to guide the field into the future. As she sees it, this is an effort of global significance, and not just for science.

"We live in a fractured world. But at CERN, over 17,000 scientists from 22 member states and other countries, representing more than 110 nationalities, some coming from countries in conflict, work together, animated by the same passion for knowledge," she says. "This is one of the things that gives me the most pride—demonstrating what humanity can achieve when we set aside our differences and focus on the common good."

CERN's Large Hadron Collider

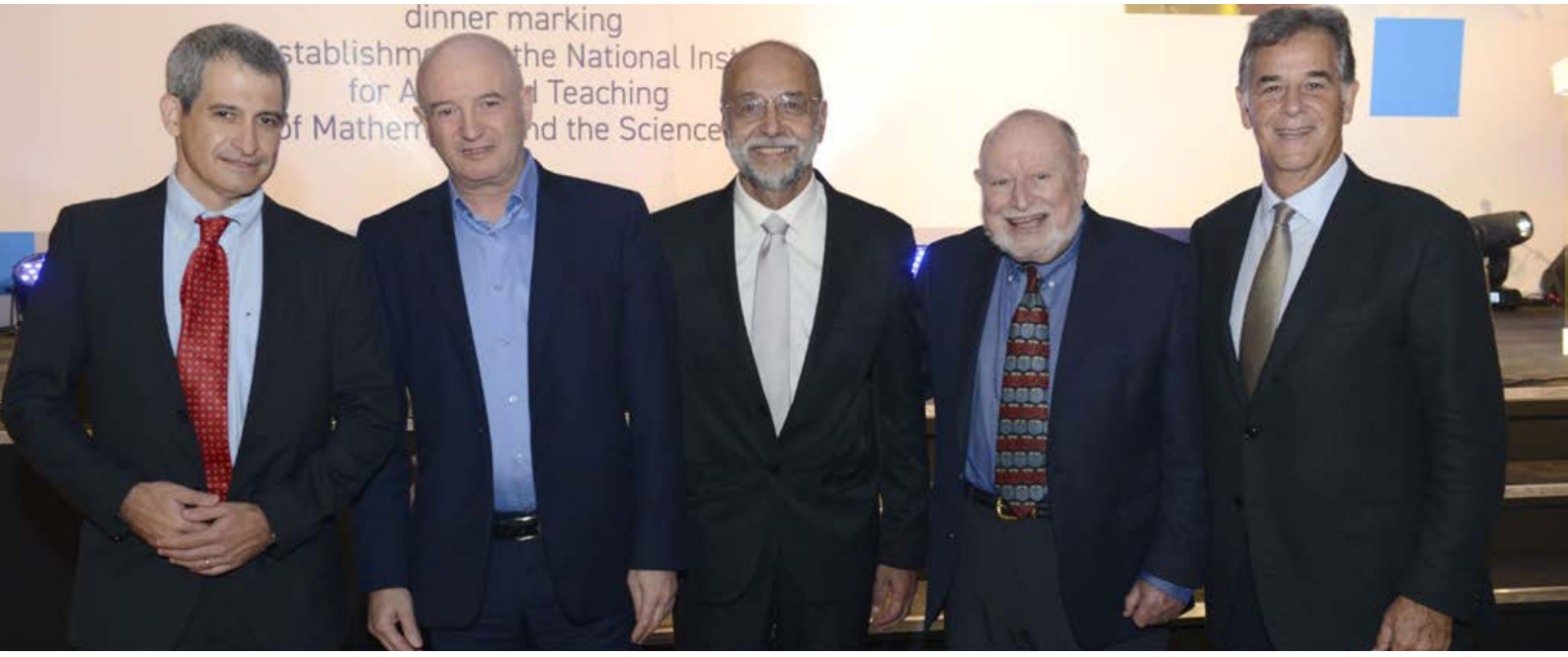
"We entrust teachers with our most valuable asset: our children," says Eli Hurvitz of the Trump Foundation.

Taking teachers to the top

The new National Institute for Advanced Teaching of Mathematics and the Sciences

The Weizmann Institute hosted a dinner at Kibbutz Ga'ash marking the launch of the National Institute for Advanced Teaching of Mathematics and the Sciences and honoring the Eddie and Jules Trump Family Foundation for its gift enabling its establishment. The keynote address was given by Prof. Lee Shulman, an advisor to the Trump Foundation and Professor Emeritus at the Stanford Graduate School of Education and past President of the Carnegie Foundation for the Advancement of Science Teaching.

Eli Hurvitz, Executive Director of the foundation, gave remarks and Prof. Israel Bar-Joseph, Vice President for Resource Development and Public Affairs and Dean of Educational Activities, described the vision of the new National Institute, which will be a hub for teacher professional development in Israel.



L-R: Eli Hurvitz, Prof. Daniel Zajfman, Prof. Israel Bar-Joseph, Prof. Lee Shulman, Marshall Levin

Future faces of science

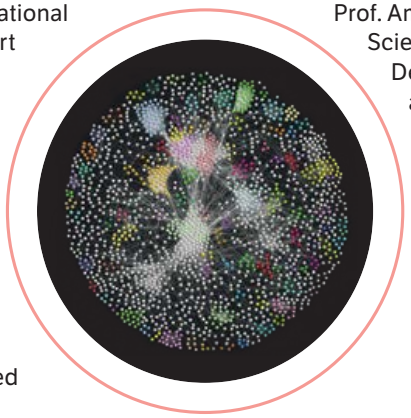
Prof. Ron Milo of the Department of Plant and Environmental Sciences hosted a panel of PhD students from the Weizmann Institute's Feinberg Graduate School, at a special session of the International Board. The students presented their research and offered the audience an inside look into graduate studies at the Institute—and the quality of candidates pursuing advanced degrees.

The students were Heli Ben Hamu from the Department of Computer Science and Applied Mathematics, Omer Karin and Julie Laffy from the Department of Molecular Cell Biology, Rafael Stern from the Department of Earth and Planetary Sciences, and Lior Pinkus from the Department of Neurobiology.

L-R: Heli Ben Hamu, Lior Pinkus, Omer Karin, Rafael Stern, Julie Laffy

The 'Big Data' revolution

On November 7 at the International Board meeting, Prof. Robert Fluhr led a session on how technology and the wealth of scientific data are transforming science, entitled 'The Revolution is Here.' Prof. Fluhr from the Department of Plant and Environmental Sciences is the new head of the Nancy and Stephen Grand Israel National Center for Personalized Medicine and head of the Life Sciences Core Facilities.



Prof. Amos Tanay of the Department of Computer Science and Applied Mathematics and the Department of Biological Regulation spoke about his research on bioinformatics and integrating genetic information and biomarkers into research on the early detection of disease.

An illustration of the complexity of protein interactions. Courtesy of Prof. Robert Fluhr

L-R: Marshall Levin and Prof. Daniel Zajfman

A fond farewell to Marshall Levin

Weizmann Institute management, International Board members, and other friends celebrated Marshall Levin at a festive dinner marking the launch of the National Institute for Advanced Teaching of Mathematics and the Sciences. Levin stepped down from his role as CEO of the American Committee after a decade of visionary leadership. A dear friend of the Institute, Marshall was celebrated for his commitment to science, dedication to Israel, his professional stewardship of the American Committee, and the wide network of friends and supporters he befriended and nurtured over his term.

Marshall and his wife Debra were both deeply thanked at the event, and the Institute established the Marshall S. Levin Fund for Science Education and the Levin Media Editing Studio in the Department of Science Teaching.

Vera and Dr. John Schwartz

Hats off to Vera and Dr. John Schwartz

A lunch honoring American friends Vera and Dr. John Schwartz of Los Angeles presented an opportunity to thank the couple for their deep commitment to the Weizmann Institute of Science, including their most recent gift establishing the Schwartz Family Center for Metabolic Biology. Headed by Prof. Asaph Aharoni of the Department of Plant and Environmental Sciences, the center explores the emerging field of metabolomics. The Schwartzes have also created a Research Fellow Chair in immunology, whose incumbent is Dr. Hagit Shapiro. Prof. Avi Levy, Dean of the Faculty of Biochemistry, thanked them for their generous support, as did Prof. Daniel Zajfman, President of the Weizmann Institute.

Academic science in the marketplace

Prof. David Mirelman

When scientific breakthroughs happen in academic research laboratories, how are they brought to the marketplace for the benefit of all? Professor Emeritus David Mirelman explores this topic in his recently released book, *Not for Profit: The Business of Academic Scientific Research*. A former Chairman of Yeda, the Weizmann Institute's technology transfer arm, and former Institute Vice President for Technology Transfer, Prof. Mirelman offers an inside look at the successes and challenges of the Institute's tech transfer process, drawing on examples from his personal experiences.

Not for Profit traces the Weizmann Institute's prowess in patenting and licensing key scientific discoveries back to Dr. Chaim Weizmann, the Institute's founder and Israel's first President. Dr. Weizmann set in motion the tech transfer process more than 80 years ago, with a two-pronged approach to nurturing basic research and enabling key discoveries to make their way to the marketplace. This approach has become a fundamental driver of the Institute's leading role in the transfer of scientific inventions.

During Prof. Mirelman's tenure at the helm of Yeda, the tech-transfer arm licensed intellectual property that enabled the development of blockbuster drugs including Copaxone®, Humira®, Rebif®, Remicade®, and Enbrel®, and encryption algorithms for satellite TV programs and secure online transactions.

"While the stories describe the complex process of moving discoveries into the marketplace, I believe the book is in fact a timely reminder of the invaluable importance of basic academic research as the essential starting point of discovery," says Prof. Mirelman, of the Department of Biomolecular Sciences. "Only in academia can scientists truly cast a wide net in exploring the natural and exact sciences, and have the intellectual freedom which sometimes leads to serendipitous insights and unexpected discoveries that benefit humanity."

Not for Profit was released in Hebrew and English by Ofir Bikurim. It is also available at the Weizmann Institute Levinson Visitors Center.

Festive closing gala

The closing gala of the 70th Annual General Meeting of the International Board was held at the Suzanne Dellal Center for Dance and Theater in Tel Aviv. Dr. Filipe Natalio, a new scientist in the Scientific Archaeology Unit, discussed his research and the audience was treated to a special performance by the renowned Batsheva Young Ensemble.

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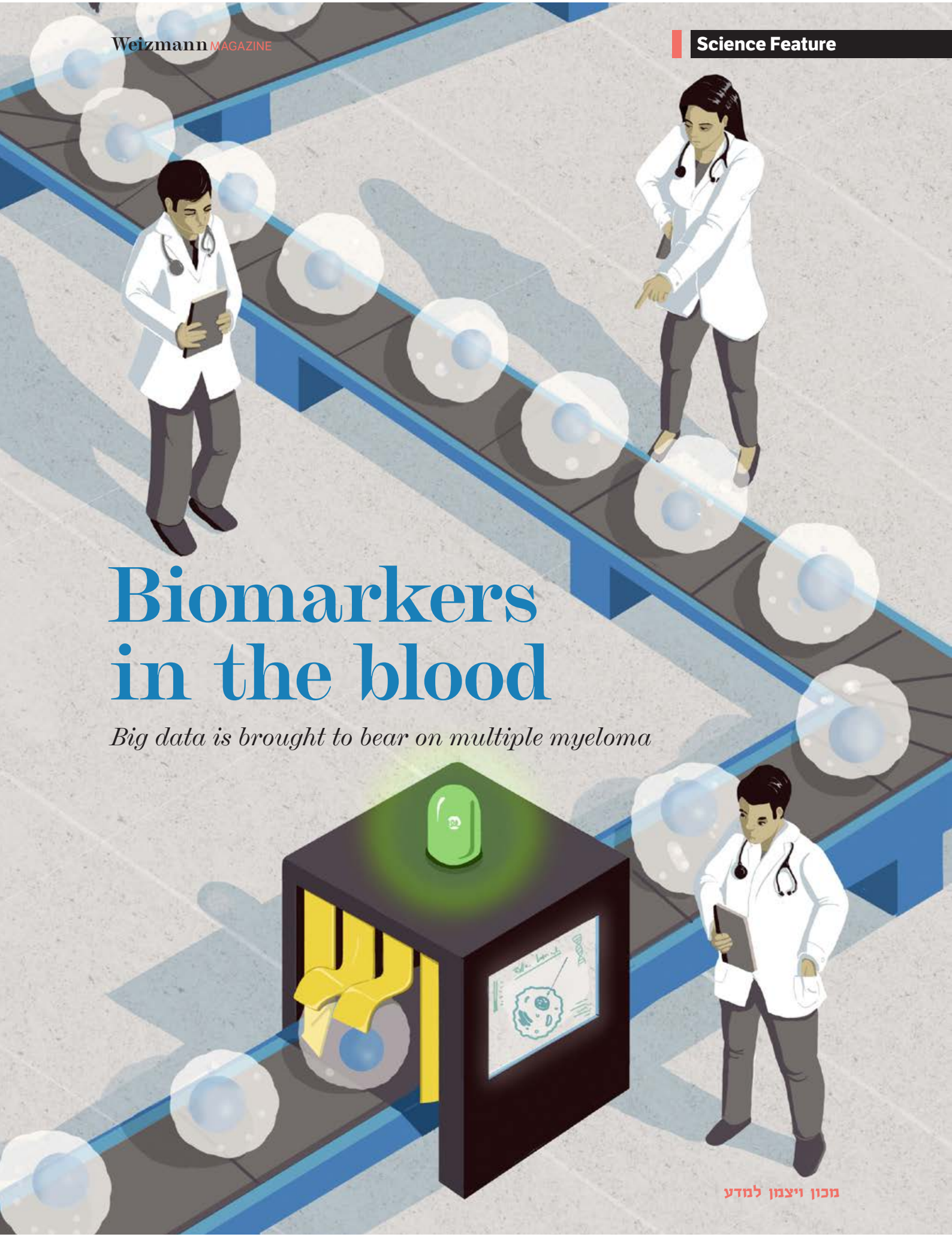

Biomarkers in the blood

Big data is brought to bear on multiple myeloma

Science Feature

Recent findings by Israeli scientists and physicians are helping to advance Israel to the forefront of the fight against multiple myeloma (MM), the second most common blood cancer worldwide.

MM is a cancer of plasma cells, a type of white blood cell normally responsible for producing antibodies and fighting infection. In this disease, the body overproduces plasma cells in the bone marrow, and these cells in turn produce abnormal antibodies that build up in the bone marrow and can thicken the blood or damage the kidneys. Although symptoms are minimal in the early stages of the disease, when advanced, MM can lead to bone pain, bleeding, frequent infections, and anemia. MM is considered treatable, but not curable.

Weizmann Institute scientists are leading efforts to understand and overcome MM. Some of their most recent findings are truly groundbreaking—paving the way not only towards more personalized monitoring of disease status, but also potentially rendering such monitoring far less painful and far more informative than ever before.

Better health through data mining

A major challenge facing multiple myeloma patients and their physicians is that the disease often persists in a pre-cancerous watch-and-wait stage for an indeterminable time; every year, one percent of these patients develop full-blown myeloma disease. However, it has been all but impossible for physicians to predict whose disease will transform using existing blood tests, leaving everyone to wait and worry.

Now, scientists are fusing number-crunching with biology to better identify MM patients—before the disease becomes symptomatic. In a project spearheaded by Weizmann Profs. Ido Amit and Amos Tanay, and in collaboration with physicians in hemato-oncology hospital departments across Israel, the scientists identified a very small number of malignant cells in what is considered a pre-malignant stage of MM, out of tens of thousands of cells surveyed in a single sample. They did this using a highly sensitive method of scanning blood and bone marrow cells at the individual cell level, using a technology called single-cell RNA sequencing.

Prof. Amit is a member of the Department of Immunology, and Prof. Tanay of the Departments of Biological Regulation and of Computer Science and Applied Mathematics. This project was facilitated by Prof. Gabi Barbash, head of the Institute's Bench-to-Bedside Program.

As a result of the team's breakthrough, it will be possible to follow and monitor patients with simple blood tests, rather than significantly more painful bone marrow biopsies. Moreover, this approach will allow for more informed, personalized, and early treatment choices, not only for MM, but potentially for other types of cancer as well. These extraordinary results were recently published in *Nature Medicine*.

"Until now, single-cell genomics was confined to a small number of research labs," says Prof. Amit. "We are constantly pushing the boundaries of the

L-R: Prof. Ido Amit and Prof. Amos Tanay: Their new approach could allow for more informed, personalized, and earlier treatment choices for multiple myeloma.

technology in ways that will make it a major clinical discovery and diagnostics tool."

The ultimate goal is to develop an accurate risk assessment of these pre-malignant presentations, create better predictive models and diagnostic markers for MM and pre-malignant states, and gain a more refined understanding of disease progression. The researchers anticipate that this work will lead to improved classifications of sub-populations of patients, and thus better target aggressive care to those patients at highest risk, while reducing unneeded treatment for those patients at lower risk.

This Weizmann Institute-led project is the first of its kind in Israel—a coordinated, multi-center clinical genomic study with a consortium of major hemato-oncology departments throughout the country. And more are on the way, including a recently established consortia of Weizmann Institute scientists and leading Israeli rheumatologists, who will join forces to investigate rheumatoid arthritis.

The breakthrough study emerged from a consortium of hemato-oncology departments in hospitals throughout the country with Weizmann scientists, the first project of its kind in Israel.

48–49

A SLAM dunk

Because bone marrow is the primary niche in which myeloma cells thrive, Prof. Idit Shachar from the Department of Immunology is examining the molecular messages passed between malignant MM cells and the surrounding environment. Her goal: to identify 'chinks in the armor' that may serve as targets for new, drug-based approaches to MM treatment.

Prof. Shachar's MM research focuses on a family of cell-surface receptors which play an essential role in the transmission of the molecular messages that promote cancer progression. This family of receptors is called **SLAM** (signaling lymphocyte activation molecule).

As demonstrated by her recent research, one receptor associated with the SLAM family is of particular importance, as it promotes the survival of the cancerous plasma cells in MM. Called CD84, this receptor may also point toward a new strategy for MM treatment. Her team's study showed that CD84 acts as a bridge between malignant cells and cells in the microenvironment, which support malignant cell survival. Therefore, CD84 is an attractive target for therapy.

"It is my hope that this research will pave the way towards treatment strategies that interrupt CD84-induced pathways that would otherwise help MM cells survive chemotherapy," says Prof. Shachar.

She plans to continue her examination of the cross-talk between MM cells and the surrounding tumor microenvironment, as well as the regulation of immune cells in this niche. With such promising results from these experiments, Prof. Shachar hopes that this work will form the basis of more targeted and less toxic therapies for this widespread and life-threatening disease.

Prof. Idit Shachar is examining the molecular messages passed between malignant multiple myeloma cells.

L-R: Marcos Lederman; Prof. Israel Bar-Joseph, Luis Stuhlberger, Mario Fleck, Dany Schmit, Dr. Ruth Scherz-Shouval, and Luis Terepins.

Latin America: Connecting minds and amigos

Recent events in Argentina, Brazil, and Mexico attracted a widening circle of Weizmann friends. At the Connecting Minds event in Brazil in October, Luis and Sonia Terepins graciously hosted an evening gathering that represented a joint effort with Luis Stuhlberger, Marcos Lederman, and the President of the Brazilian Association of Friends, Mario Fleck. Prof. Israel Bar-Joseph gave an overview of the Institute to more than 100 guests, and Dr. Ruth Scherz-Shouval from the Department of Biomolecular Sciences spoke about her research.

In Argentina, Prof. Mudi Sheves, Chairman of Yeda Research and Development Company Ltd., and Weizmann Institute Vice President for Technology Transfer, delivered the opening lecture at the fifth BioArgentina conference. The event was held in November at the Buenos Aires Exhibition and Convention Centre, with nearly 1,000 people in attendance. Prof. Sheves described the work Yeda is carrying out and how society can benefit from the Weizmann Institute's scientific developments.

BioArgentina is organized by the Argentine Chamber of Biotechnology, which is led by Dr. Hugo Sigman. Dr. Sigman also serves as President of the Argentinian Society of Friends.

Prof. Alon Chen, head of the Department of Neurobiology and the next Weizmann Institute President, spoke at various events in Mexico, including those hosted by the Mexican Association of Friends. His visit included a reception at the the home of Martha Flisser (then President of the Mexican Friends) and her husband Manuel, and a cocktail party hosted by Mauricio and Joan Schwartz and the New-Generation Mexican Friends group. Silvia Gerson will become the next President of the Mexican Association.

U.S. Midwest Gala: The power of innovative science

The Midwest Region's annual Gala Dinner took place in October at the Geraghty in Chicago with over 600 guests in attendance. Local civic and community leaders joined attendees from as far as Canada and Montana to honor Michael Polsky, founder and CEO of Invenergy. A dedicated philanthropist and energy industry pioneer, Mr. Polsky received the Weizmann Leadership Award at the gala and spoke about the three values that strengthen his personal commitment to Weizmann: the importance of education, the pursuit of new frontiers, and the power of science and innovation.

L-R: Midwest Gala Co-Chairs and President's Circle members Janet and Steven Anixter and JoAnn Anixter Silva.

University of Chicago President Robert Zimmer and Prof. Avigdor Scherz of the Department of Plant and Environmental Sciences also spoke. Chaired by Janet and Steven Anixter and JoAnn Anixter Silva, the gala raised nearly $1.3 million in support of the Weizmann Institute.

Weizmann World

L-R: Weizmann Canada friends Dr. Dan Andreae and Zach Schwartz

Weizmann Canada: Imagining the future

Weizmann Canada hosted a special evening of science and cheer at its annual Celebrating Philanthropy event in October.

National Board Chair Jeff Cohen, who served as emcee for the evening, reflected on a successful year and recognized the impact Canadian donors have made on the Weizmann Institute. Guests were taken on a journey to "imagine the future" during an exploration of the world of artificial intelligence featuring Prof. Yaron Lipman from the Department of Computer Science and Applied Mathematics, whose research will be part of an exciting new flagship initiative, the Artificial Intelligence Center for Scientific Exploration.

Dr. Daniel C. Andreae was presented with the Outstanding Leadership Award in recognition of his dedicated support and the role he plays helping to raise awareness for the Weizmann Institute. Vice Chair and Toronto Chapter President Francie Klein welcomed new members to the Vera and Chaim Weizmann Honour Society from Toronto: Judith Benattar, Sandra and Mike Florence, and Terry Rosen. Co-chairs of the Vera and Chaim Honour Society in Canada are Joanne Nemeroff and Ms. Klein.

The promise of AI at European Committee Gala

The European Committee for the Weizmann Institute of Science held its annual gala at Hotel Baur au Lac in Zurich on January 15. The focus of the event, at which Prof. Daniel Zajfman was the keynote speaker, was the promise of artificial intelligence and the Institute's planned Artificial Intelligence Center for Scientific Exploration.

מכון ויצמן למדע

L-R: Maurice Lévy, Jacqueline Frydman, and Sidney Toledano

Weizmann Frances Pasteur partnership

The Pasteur-Weizmann Council held its annual gala dinner at the Wagram Hall in Paris on November 15, celebrating the more than 40 years of active scientific collaboration between the Institut Pasteur and the Weizmann Institute of Science.

The funds raised at the gala will provide essential support for scientific research.

Following a tribute to the late Simone Veil, who initiated the collaboration, Maurice Lévy, Chairman of the Pasteur-Weizmann Council, spoke. Lévy recalled the objectives, missions, and ongoing developments of this special cooperation. Jacqueline Frydman, a member of the executive committee of Weizmann France, was also in attendance, as was Alain Grossman, the treasurer of Weizmann France.

The dinner brought together prestigious figures from the world of science—including Nobel Prize winner Prof. Claude Cohen-Tannoudji, and Institut Pasteur Scientific Director Prof. Olivier Schwartz—and the world of politics, including Jean-François Copé and Pierre Aidenbaum.

Sidney Toledano, the Chairman and CEO of LVMH Fashion Group, who was accompanied by his wife Katia, is the main sponsor of the Pasteur-Weizmann Council.

L-R: Prof. Daniel Zajfman, IDF Chief of Staff Gadi Eizenkot, and Shimshon Harel, Chair of the Weizmann Executive Board and Chair of the Israel Friends

Israel Friends: Hanukkah of heroism with hero #1

Members of the Israel Friends of the Weizmann Institute of Science gathered to light a Hanukkah candle at The David Lopatie Conference Centre on the first night of the Festival of Lights in December.

The guest of honor, IDF Chief of Staff Gadi Eizenkot, spoke about the strategic threats facing the State of Israel. Samuel Cohen Solal, a member of the WeizmannVibe Next-Gen Scientific Club, opened the event with the candle-lighting, and was accompanied by an a cappella group composed of students and postdoctoral students from the Department of Molecular Genetics. Prof. Jacob Hanna of the Department of Molecular Genetics spoke about future applications of embryonic stem cells.

Passing on the UK baton

The closing of 2018 signalled the end of an important era for Weizmann UK and also heralded the beginning of an exciting new one. After eight years in the role of Chair of Weizmann UK, Martin Paisner CBE has handed over the baton to Dr. Arabella Duffield.

A special tribute was paid to Mr. Paisner during Weizmann UK's Making Connections gala dinner in September, which honored his extraordinary commitment to the Weizmann Institute for over 40 years.

Mr. Paisner's involvement with the Institute began as a teenager when he spent time on campus, visiting the homes of Isaac and Edith Wolfson and Barnett Shine. He was deeply connected to the Institute's founding families including the Sieffs, the Clore-Duffields, the Rothschilds, and the Wolfsons.

He was appointed a trustee of Weizmann UK in 1979, taking over for his father, Leslie Paisner. He was elected to the Institute's International Board of Governors in 1996 and to the Executive Board in 1999. In 2010 he became Chairman of Weizmann UK. In 2011 Mr. Paisner was awarded an honorary doctorate from the Institute.

As a trustee of significant grant-making funds such as the Bluston Charitable Settlement, the Maurice and Vivienne Wohl Charitable Foundation, and the Dorset Foundation, Mr. Paisner has secured considerable funding to support pioneering scientific research at the Institute. These gifts are recognized across campus.

Family legacy

While Mr. Paisner will remain involved as Vice President and Trustee of Weizmann UK, and will continue to be a member of the Institute's Executive Board, Dr. Arabella Duffield has stepped into the role of Chair of Weizmann UK.

Dr. Duffield is no stranger to the Weizmann Institute. As the granddaughter of the late Sir Charles Clore and daughter of Dame Vivien Duffield, she has been coming to the Weizmann Institute since she was a child, including a memorable meeting at the age of four with Prime Minister Golda Meir in 1976, at the opening of the refurbished Weizmann House. She also attended the Dr. Bessie F. Lawrence International Summer Science Institute in 1989.

Dr. Duffield has been on the International Board since 2009 and on Weizmann UK's board since 2015. She has a PhD in public health and worked extensively in Africa and Asia for the UN and non-governmental organizations, including Save the Children.
The commitment of the Clore-Duffield family to the Weizmann Institute is evident in every aspect of campus life, from the Clore Garden of Science to the annual award ceremony of the Sir Charles Clore Prize.

Sir Martin Paisner and Dr. Arabella Duffield

Seven special women in science: L-R: Yael Gropper, Eden Yifrach, Michal Shavit, Gil Schwarts, Gil Goffer, Adi Millman, and Rosalie Lipsh

Doctoral dynamos

The Ariane de Rothschild Program champions women in science

In an effort to advance the careers of outstanding female scientists in Israel, the Edmond de Rothschild Foundation launched the Ariane de Rothschild Women's Doctoral Program—which includes a scholarship and a series of other benefits—a decade ago. The foundation brought the program to the Weizmann Institute two years ago, and it is already bearing fruit. To date, seven Weizmann doctoral students from diverse backgrounds have been selected.

In a one-of-its-kind initiative, the Ariane de Rothschild Program selects outstanding female doctoral students from a pool of candidates nominated by deans at Israel's five institutions of higher education; a steering committee chooses four recipients per institution. The women receive full tuition, a living stipend, and enrichment programming that brings together the recipients from all institutions—for networking sessions, professional development workshops, and

Education

inspiring lectures—providing a comfortable and supportive setting to discuss challenges women face in pursuing a career in science while managing motherhood and other concerns. The women also receive a grant to present their research at international conferences.

Selection is based on academic excellence, as well as a series of other factors—such as identifying candidates in scientific fields in which women are traditionally underrepresented, proven leadership experience, and engagement in the community and Israeli society. Special emphasis is placed on selecting women who come from diverse backgrounds, among them ultra-Orthodox women, new immigrants, Arab women and women from other ethnic groups, women from Israel's geographical periphery, and young mothers.

Recipients are expected to give back to the community and volunteer in educational activities during their graduate studies.

"The Ariane de Rothschild Women's Doctoral Program is a flagship project of the Edmond de Rothschild Foundation," says Ms. Vardit Gilor, who manages the program at the Foundation. "These brilliant women are the new pioneers of the 21st century. They are passionate about advancing new discoveries in the sciences and supporting underprivileged communities through their volunteer work. It is the only program in Israel named for Baroness Ariane de Rothschild, and it is a key component of her vision to support and strengthen women around the world. Our aim is to create a support system for a cadre of women who, in the future, will successfully take on meaningful positions in academia and Israeli society."

Below is a snapshot of the most recent awardees from the Weizmann Institute.

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Yael Gropper grew up in Dimona, which, she says, "was the best place to absorb and appreciate the diversity of Israeli society." She was in the Israeli scouts throughout her youth, eventually serving in leadership positions. After high school, she did a year of community service before enrolling in the IDF, and was a flight control course commander in the Israel Air Force.

She became a Hebrew teacher, and during her undergraduate studies at Ben-Gurion University, she took part in the Rothschild Foundation Ambassadors Program, where she did volunteer work and founded a local café, together with neighborhood residents.

"Although I have always been very involved in community activities and teaching, it was very clear to me since I was a teenager that I wanted to become a scientist. I fell in love with science in elementary school, when my teacher explained the basic principles of physics," Yael says.

She is conducting her doctoral research in the lab of Prof. Jakub Abramson in the Department of Immunology. Her goal is to elucidate how autoimmune disorders develop, and how this phenomenon can be exploited for cancer immunotherapy. Specifically, she is trying to isolate "auto-antibodies" from patients with autoimmune diseases. These antibodies can recognize proteins that are presented on melanoma cells; Yael aims to develop new treatments for melanoma using antibodies that were already "designed" by nature.

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Few students have arrived at the Weizmann Institute by the route **Rosalie Lipsh** took. Rosalie grew up in an ultra-orthodox community in Kfar Chabad. "Although science and technology studies are not common in our community, I chose to pursue an interesting and meaningful career," she says. She received her bachelor's degree from Machon Lev, a religious college, and enrolled in the Weizmann Institute for graduate studies. She is in the direct-PhD track in the lab of Dr. Sarel Fleishman in the Department of Biomolecular Sciences, where she is developing new methods for protein design.

Among her recent achievements were the development of methods for designing efficient enzymes to break down plant waste products into sugars and enzymes that could be used for treating poisoning by nerve agents, such as Russian VX and Sarin. She is now applying machine-learning and other methods to design efficient and selective proteins.

"There are few ultra-orthodox women at the Weizmann Institute and my first steps here were difficult for that reason," she says. "But I have learned lessons that I hope could be useful and I am trying to help other young women in my community make their first steps into the world of science with a little less uncertainty than I had coming in."

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Chess and bacteria have one thing in common—they are in a constant state of defense and offense, and the study of bacteria and the game of chess are intellectual pursuits that keep **Adi Millman** on her toes all the time. Millman completed her MSc in the lab of Prof. Rotem Sorek in the Department of Molecular Genetics, and continued on to a PhD in that lab, studying the immune system of bacteria. She lives on nearby Kibbutz Na'an and volunteers at a girls' school in Lod, where she teaches chess through an organization called Children playing Chess.

"Through chess, I try to develop their analytical thinking and help them acquire discipline and pursue excellence," says Adi, who has one child of her own.

Bacteria and the bacteriophages that infect them impose great evolutionary pressure on each other. In order to survive, bacteria must constantly develop new anti-phage defenses, while phages must continuously overcome these bacterial defenses. So they are in a constant arms race. There are a number of known anti-phage defense systems, but recent evidence suggests many new anti-phage defense systems remain to be discovered in microbial genomes.

As part of her PhD research, Adi is developing algorithms aimed at discovering new anti-phage defense systems. She is now identifying a new set of phage-resistance systems, bringing into focus the complete "immune system" of bacteria, and understanding the factors that influence the ongoing phage-bacteria conflict.

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For **Gil Goffer**, it all started with the Olympics—the national Youth Math Olympics, that is. She was 13 years old when she "fell in love with the Weizmann Institute," she says, when she came to compete in this highly prestigious annual competition. Gil grew up in Haifa and practiced Thai boxing. After high school, she spent a year as a volunteer for the Society for the Protection of Nature in Israel. She joined the prestigious 8200 Unit of the IDF intelligence. She then embarked on a volunteer program in Cambodia before starting her undergraduate degree in math at Ben-Gurion University.

In her research in the lab of Prof. Tsachik Gelander in the Department of Mathematics, Gil is studying the symmetries of objects, which, she says, is like "observing the world's beauty." She volunteers in a Davidson Institute program called First in Science, which engages girls in STEM studies, and another program called Nobel Laureates for Excellence in Education, which encourages scientific curiosity among high schoolers. She is also a member of the women's forum in her department.

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"Mathematics and education were always my two great passions," says **Gil Schwarts**, who is studying with Prof. Abraham Arcavi and Dr. Ronnie Karsenty in the mathematics education group in the Department of Science Teaching. Gil grew up on Kibbutz Ein-Hahoresh, near Netanya, and is the first member of her family to pursue an academic degree. After completing her BSc in mathematics at Ben-Gurion University, she found what she calls "the perfect place for me"—the department in which she is now studying, which allows her to combine her mathematical knowledge and experience in education to lead research that aims to impact mathematics learning in Israel.

The focus of Gil's research is on how a lead teacher in mathematics can become a successful facilitator who can foster learning among other mathematics educators. Her research is expected to make both a theoretical contribution—in capturing the evolution of the facilitators' professional repertoire—and a practical impact, in understanding how to facilitate the scale-up of educational innovations.

Gil serves on the Ariane de Rothschild scholarship steering committee, and tutors a young woman from an underrepresented background studying computer

"These brilliant women are the new pioneers of the 21st century," says Vardit Gilor, Program Manager at the Edmond de Rothschild Foundation.

science at Tel Aviv University, through the Rothschild Foundation's "Academy for Life" program.

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Michal Shavit was born in Tajikistan and made aliya with her family at the age of three. She grew up in Karney Shomron and took an early interest in math. When she was 13, she enrolled in Bar-Ilan University's prestigious math program for youth, and even took several university-level courses. At 18, she joined the Israel Air Force and served as an officer for five years, and she continues to plan and control air operations in reserve duty.

She went on to receive a bachelor's degree in math from the Technion, where she also studied architecture and was enrolled in the university's excellence program, also funded by the Rothschild Foundation.

"That program shaped my character and way of thinking as a researcher and I am grateful for that," Michal says. She volunteered in a nonprofit organization called Aluma, helping high school girls who made aliya from Russia as they prepare to join the Israel Defense Forces.

She received her MSc in particle physics at the Weizmann Institute, and is currently doing a PhD in hydrodynamics—the study of the motion of fluids—in theoretical physics, under the guidance of Prof. Gregory Falkovich in the Department of Physics of Complex Systems.

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A student in the lab of Prof. Maya Schuldiner in the Department of Molecular Genetics, **Eden Yifrach** studies a special compartment of the cell called the peroxisome, in which several key metabolic pathways reside, including the breakdown of fats and decomposition of harmful hydrogen peroxide. She has characterized nearly 40 new peroxisomal proteins, significantly expanding the current protein count of peroxisomes.

"I hope this work will fill gaps in the knowledge of the intricate network of metabolic pathways in peroxisomes, and will serve as a basis for diagnosis and treatment of patients suffering from devastating metabolic peroxisomal diseases," she says.

Eden grew up in a small community, Massad, in the lower Galilee. She attended the Kadoorie Agricultural High School, where she was introduced to environmental research for the first time.

"It was love at first sight—I felt challenged and excited to succeed," she recalls.

As a high schooler, she won a prize from the Ministry of Environmental Protection and the Ministry of Education for outstanding research. "I remember thinking that being a researcher is a dream job: you are paid to think, and to help others. Amazing!"

She served in the IDF as a tour guide at the Sde Boker Field School, where she helped high school students conduct desert ecology research.

Eden went on to receive her BSc from the Hebrew University's Faculty of Agriculture, and did her MSc at the Weizmann Institute. Last year, she worked with the Davidson Institute in the Active Science program, in collaboration with a government initiative that promotes education for school drop-outs; the program promotes self-esteem through learning science. Eden is also on the steering committee of the Ariane de Rothschild scholarship program, which organizes meetings and enrichment activities. She is also mother to a young child, with another on the way.

"One powerful motivation for my study of metabolic diseases comes from personal experience," she reveals. "My sister was diagnosed with a rare metabolic disease at age 14. She battled to live as normal a life as possible, although she became blind and physically disabled. She died five years ago at age 28. Her positive legacy is an inspiration for me to conduct research and solve biological mysteries that may one day help others."

Passion for progress

Simon and Golde Picker and Dr. Sharon Wolf

"There are two ways into the Weizmann Institute," jokes Simon Picker. "Be an excellent scientist, or lead an effort to support excellent science."

With his lifelong passion for understanding the composition of materials and innovative manufacturing processes, Simon Picker has wholeheartedly chosen the latter option by supporting Weizmann Institute research on new materials. Simon is a new member of the International Board who lives with his wife Golde in Mexico City.

Simon grew up in Tel Aviv, but he enjoyed regular visits to family in Kfar Bilu—an agricultural *moshav* not far from Rehovot—which offered him an opportunity to visit the Weizmann Institute. It was there that his interest in how things are built was first sparked. At the age of 16, he moved with his family to the U.S., where he received degrees in chemistry and chemical engineering from the University of California, Berkeley. After graduation, he focused on several related fields, including pharmaceutics, chemical industrial plants, metallurgy, electronics, and aerospace.

Shimon and Golde Picker were honored at the International Board for their support of a Research Fellow Chair for Dr. Sharon Wolf

Profile of a Pair

After marrying Olga (Golde) Schatz, the pair moved to her hometown of Mexico City, where they raised a family of three children; today they have nine grandchildren. Simon first applied his expertise in innovative engineering to the chemical industry. He founded Stainless Mexicana—a major manufacturer of specialty alloy pipes and industrial accessories for the chemical and petrochemical industries—and later Grupo Seguritech, an international high-tech consortium responsible for integrating major homeland security projects in Mexico and other Latin American countries. Grupo Seguritech, which Simon co-founded with his son Ariel, also has an aeronautics division that develops airports and aerospace industrial parks in the U.S. and Latin America.

Simon's enthusiasm for progress and technological advances led him back to the Weizmann Institute, where he and Golde found a kindred spirit in Dr. Sharon Wolf. Last year the Pickers made a major gift to support a Research Fellow Chair in electron microscopy for Dr. Wolf.

A revolution in microscopy

An American *olah*, Dr. Wolf heads the Electron Microscopy (EM) Unit within the Department of Chemical Research Support. She oversees the provision of services and in-depth, practical EM training for scientists throughout the Institute, including numerous studies on the properties and potentials of new materials. Her collaborative assistance is vital to the success of biology, chemistry, and physics experiments.

"It was a true pleasure to meet Golde and Simon," says Dr. Wolf, "and to have the opportunity to share our excitement in providing such important, advanced imaging technologies to the Weizmann community. Their interest and enthusiasm is so genuine."

Her personal area of expertise is three-dimensional cryogenic EM (3D cryo-EM) and scanning transmission EM (STEM). Cryo-EM has been referred to as 'resolution revolution'—a dramatically more powerful way to campture images of biospecimens with atomic and near-atomic sensitivity. Dr. Wolf's know-how is critical to the success of the Weizmann Institute's new flagship project, the Center for Advanced and Intelligent Materials (C-AIM). C-AIM will support groundbreaking research on advanced materials, with an eye towards possible applications in medicine, space and aeronautics, energy and sustainability, electronics and optics, and more.

In the past year alone, Dr. Wolf has overseen the EM Unit's acquisition of a new generation of cutting-edge tools that allow for the highest level of imaging and analysis in both the materials sciences and biological sciences—including the Titan microscopy system, which is capable of producing images with 0.07 nanometer resolution. The Titan system can identify atoms, measure their chemical state, and even probe the electrons that bind them together.

Dr. Sharon Wolf

"Scientists try to create masterpieces of vision, and they need the proper tools for expression," says Simon. "If a picture is worth a thousand words, a 3D image is worth a million words." With the Pickers' support, Dr. Wolf envisions the EM Unit becoming a leading imaging facility in Israel and indeed, in terms of its unique interdisciplinary approach, the world.

Eman Khatib-Massalha and her husband Dr. Hassan Massalha. "The things you get at Weizmann, you will not get anywhere else in Israel," says Eman.

A special kind of chemistry

For husband-wife scientists Dr. Hassan and Eman Massalha, Weizmann is their second home

When Eman Khatib-Massalha first stepped onto the Weizmann Institute campus as a PhD student, she was nervous about moving somewhere with a very small Arab community. She had studied in both Jerusalem and Haifa, where the Arab student population is large, and grew up in the northern Israeli town of Tamra, near Akko, but knew very little about Rehovot.

She soon came to realize that it was a non-issue. Eman recalls how she was "just another student in a lab"—Prof. Tsvee Lapidot's lab in the Department of Immunology—and immediately felt at home.

The road to Weizmann, from the Galilee

She had never even heard about the Weizmann Institute as an undergraduate, despite completing her BSc in medical laboratory science at Hadassah Academic College in Jerusalem in 2011, Eman reveals. She then completed an MSc at the University of Haifa and at the Eliachar Research Laboratory at the Galilee Medical Center, Nahariya, where she studied human biology and worked as a research assistant.

It was during this time that a (Jewish) female colleague told Eman about a friend at the Weizmann Institute named Hassan—she thought he and Eman might make a good match. What started as a set-up evolved into Hassan's encouragement for her to come study at the Weizmann Institute, too.

Eman had planned to continue in the Eliachar Research Lab for her PhD, and was hesitant to move. Her programs in Jerusalem and Haifa had been split evenly between Arab and Jewish students, and she felt socially comfortable where she was.

Students

Dr. Hassan Massalha, from the northern Arab village of Daburiyya, outside of Nazareth, had been in Rehovot for more than 12 years. After completing his BSc in biotechnology and food science at the Hebrew University's Rehovot campus in 2009, he moved across the street to the Weizmann Institute, where he attained his MSc under Prof. Dov Zipori in the Department of Molecular Cell Biology. He then went on to complete a PhD in the Department of Plant and Environmental Sciences, studying under Prof. Asaph Aharoni.

He convinced Eman to at least come visit the campus—and visit him, too—and see the Institute for herself. And the rest is history. They married a year later and in 2014 Eman began her PhD research in the Department of Immunology.

"The things you get at Weizmann, you will not get anywhere else in Israel," says Eman. "From the start, Tsvee [Lapidot] has given me all the tools to do everything I wanted to do and has encouraged me to submit my studies for awards, symposiums, and conferences."

Eman, whose PhD focus is on immune-metabolism and inflammation, is working on a study that reveals immune-metabolic crosstalk between lactate-producing neutrophils (innate immune cells formed from stem cells in bone marrow) and the bone marrow endothelium, which has implications for treating immune disorders.

In 2016, she won the Israeli Council for Higher Education Excellence Award for Arab Students, and was invited to attend a symposium at the Max Planck Institute in Germany. At the 2017 World Immune Regulation Meeting in Davos, Switzerland, she won both a European Federation of Immunological Societies-European Journal of Immunology Travel Grant, and a highly selective best workshop presentation award.

Steps away

The couple has shared credit on a recent journal article, and today, they share a building. Dr. Massalha is now conducting postdoctoral research on the sixth floor of the Wolfson Building—in Prof. Shalev Itzkovitz's lab in the Department of Molecular Cell Biology—while Eman works on the third floor. They consult with each other on their research, attend conferences together, and encourage each other when the going gets rough.

When Eman shied away from injecting mice in her lab, her husband came up with a solution: she would prepare the injections and he would administer them for her. And now that there's a baby in the picture, they take turns—Eman prepares the injections while Hassan sits in the car with their daughter or takes her on a stroll around campus; then they switch places.

Recently, she spoke at her former high school in Tamra about her experience at the Institute and her budding scientific career. The students expressed hesitation about venturing to Rehovot, not only because of distance but because they did not know how they would fit in. Eman urged them to come for a visit, just as her husband had urged her a few years prior. The students are now planning a trip to the Institute this spring, which Eman is helping to coordinate.

"As the only female PhD student from Tamra at the Weizmann Institute, I feel proud to be able to encourage students in my town—particularly girls—to pursue science, and to not be afraid of relocating to another part of the country where they will be in the minority," she says.

They have also both helped to make activities at the Davidson Institute of Science Education and the Clore Garden of Science more accessible to the Arab community, and have translated various educational content into Arabic. "Basically anything you see around Weizmann in Arabic, we probably had something to do with it," Hassan jokes.

In all, he has been at the Institute for 10 years and Eman, five. As for their daughter, Heba, they call her a "Weizmann baby."

Team MabTrix: L-R: Dr. Daphna Miron, Dr. Moran Grossman, Dr. Dorit Landstein, Prof. Irit Sagi, Dr. Polina Toidman-Rabinovich. At back: Navah Figov.

The matrix modifier

Could fixing the cell's support system hold promise for disease?

A new biotech start-up is trying to restore the cell's support system and in doing so, offer a solution for patients suffering from inflammatory bowel disease, or IBD.

In such conditions, like Crohn's disease and ulcerative colitis, the immune system mistakenly attacks the body's tissues—and the result is often debilitating, with patients suffering over their entire lifetime. In 2012, Prof. Irit Sagi of the Department of Biological Regulation and her lab team made a key discovery that infused promise into the treatment of these diseases. Since then, the discovery was patented and licensed to a start-up company, MabTrix, whose singular task is to further develop the breakthrough and bring it to a critical point at which a major investor or pharmaceutical company can make it commercially viable.

Beyond the Bench

The company is one of over a dozen biotech start-ups under development in the FutuRx accelerator in Nes Ziona, near the Weizmann Institute. At FutuRx, companies receive an investment and are offered an infrastructure for early-stage innovation—i.e., lab space, personnel, management expertise, and more—for a period of three years. MabTrix, led by CEO Dr. Dorit Landstein, is nearing the end of its incubation period and has achieved a more-defined antibody for treating IBD and cancer.

Why a matrix matters

The discovery that became the basis of MabTrix had its origins in Prof. Sagi's longtime interest in the structural and biochemical support system of cells, called the extracellular matrix. These components are involved in a vast number of normal physiological processes—from embryonic development and reproduction to bone development, wound healing, and blood vessel development. When something goes wrong in these matrices, the implications can be ominous. In fact, they appear to be a major factor underlying IBD.

More than a decade ago, Prof. Sagi began looking for ways to home in on and manipulate members of a family of enzymes, called MMPs, that work to remodel the extracellular matrix. What interested her was how, when MMPs—and in particular MMP9—get out of control, they can aid and abet autoimmune disease and cancer. Finding a way to block these proteins, she understood, might lead to effective treatments for a number of diseases.

It was a novel way of looking at the scaffolding around cells—and how they malfunction. Few scientists had ever focused on this particular enzyme, and Prof. Sagi and her group felt that there might be uncharted and promising territory ahead. Aware that the body has a natural blocker to MMP9, they set out to find something similar: an antibody, that could keep MMP9 in check. Her 2012 publication in *Nature Medicine* made major waves in the field when it described how her lab had managed to trick the immune systems of mice into creating natural antibodies targeting MMP9 through an immunization.

"By injecting a complex that mimics the heart of MMP9 into mice, we could isolate an antibody with protective response that kept MMP9 in check," says Prof. Sagi. In time, aware of the promise of the breakthrough, the Weizmann Institute's technology transfer arm, Yeda, ushered the discovery into the preclinical stage with the establishment of MabTrix.

About three million people suffer from IBD in the United States alone. As CEO of MabTrix, Dr. Landstein's job is to both refine the science and interest investors who would be able to invest the sums necessary for preclinical development and to perform clinical trials in patients who suffer from IBD. Its utility in cancer, which also involves the degradation of the extracellular matrix, could also be studied.

Refining the science

"I have been focusing on development of therapeutic antibodies for many years," says Dr. Landstein, who has played key roles in other start-ups in the same field. "But when I heard about this discovery, I got excited about the potential and we think it could have a real beneficial impact for many patients."

When she started in 2015, her first task was to recruit just the right mix of professionals. Among MabTrix's small team of scientists is Dr. Moran Grossman, who earned her PhD in Prof. Sagi's lab. Dr. Grossman is helping optimize the technology that was identified in her mentor's lab, for generating function-blocking therapeutic monoclonal antibodies that specifically inhibit the activity of MMP9.

"Understanding the history of the research process on MMP9, and now working on refining it, alongside this team, is thrilling," says Dr. Grossman. "What is clear is that true breakthroughs start at the level of basic research."

MyMilk and the science of breastfeeding

How two Weizmann graduates are optimizing the original nutrient

Not all breast milk is created equal. While many pregnant mothers intend to nurse their babies, only a fraction are able to do so. Often, low milk supply, infections, pain, and other complications get in the way.

Drs. Ravid Shechter-Ushpizin and Sharon Haramati, who became friends as graduate students in neurobiology at the Weizmann Institute, made this discovery a few years ago, while on maternity leave at the same time.

"We called this initiative our 'second PhD,'" says Dr. Shechter-Ushpizin. "We basically learned everything there is to know about breast milk—in academia, in the healthcare system—and soon understood that it could be a meaningful diagnostic tool for supporting breastfeeding success."

Their research revealed that, before giving birth, 90% of pregnant mothers say they intend to nurse, and over 83% of mothers do in fact start nursing upon giving birth. But six out of 10 of those mothers stop before they had planned to, with low milk supply being the most prevalent complication.

From the land of milk and honey

Entrepreneurial in spirit, the duo founded MyMilk in 2014, to assist mothers who are struggling to nurse their babies and to address the dearth of resources to help them monitor their own breastfeeding and milk supply—both in terms of diagnosing difficulties and measuring milk quality. As scientists, the Weizmann alumnae also recognized the potential of human milk as a powerful data source which, like blood, can be studied at different stages and deviations.

"Even though there is a lot of information regarding this amazing fluid for research purposes, none of that was translated to clinical, personal use for the mother or the healthcare provider," says Dr. Shechter-Ushpizin.

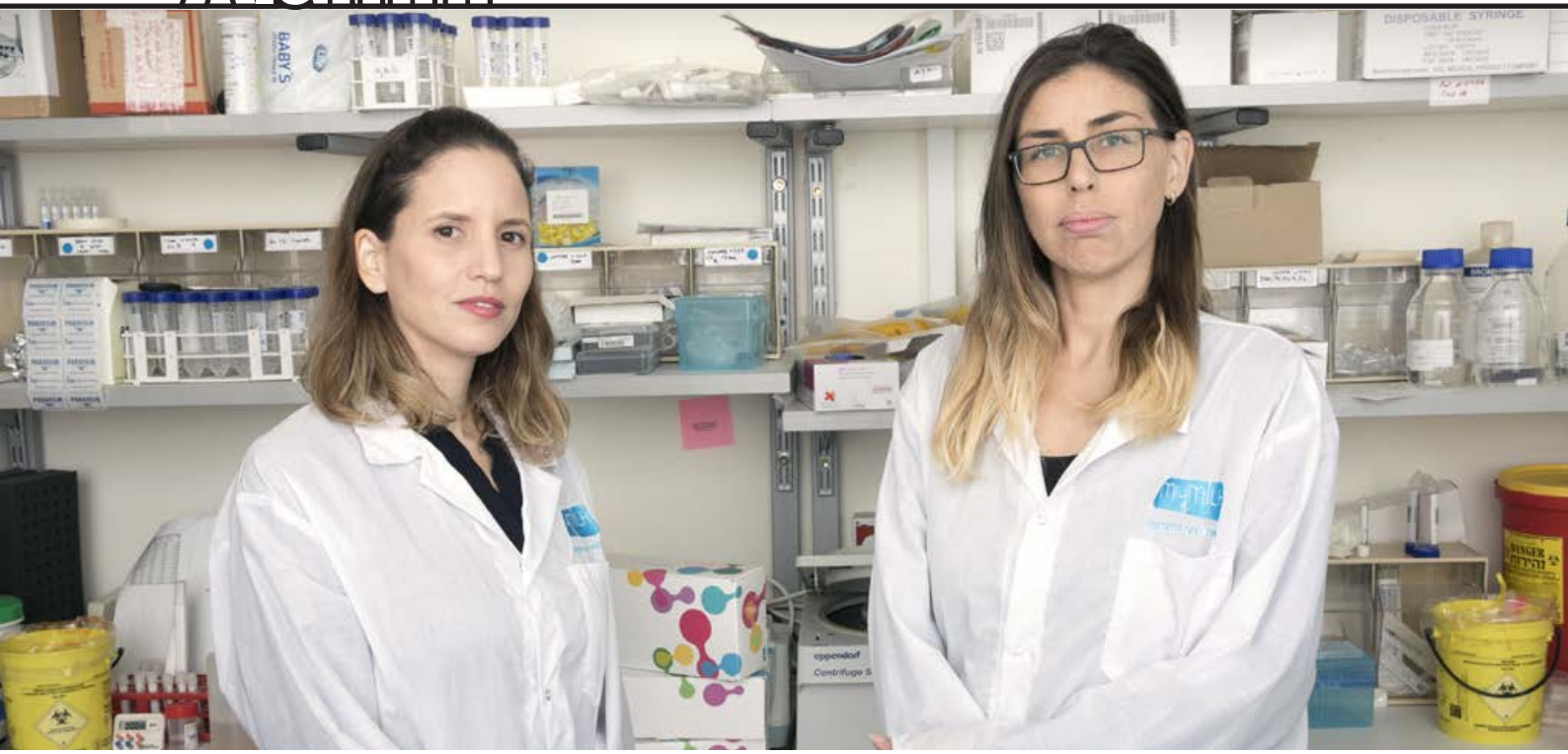
Their products include personal kits that are sent to the MyMilk lab in Herzliya. With these kits, mothers can test whether their babies are feeding well and if they are producing enough milk, assess the milk's nutritional value, and identify infections or other problems. The company is now piloting the second generation of its hand-held device for on-the-spot analysis—requiring just six drops of human milk.

If a nursing mother is having pain, for example, an evaluation of her milk can identify the cause—discriminating between an obstruction of milk flow or an active infection. It can even diagnose whether the pathogen is fungal or bacterial, down to the specific strain—and from there MyMilk professionals provide personalized treatment solutions.

Because the technology can be used as a preventative tool, providing early identification of delayed lactogenesis (the initiation of lactation) and low milk supply can enable effective intervention. Untreated or inaccurate management of breast pain or milk supply establishment can lead to recurrent complications, discomfort, reduced milk volume, and early weaning—earlier than the mother had planned.

"We're not in the business of criticizing women that decide not to breastfeed, but the fact is most mothers choose to breastfeed," says Dr. Haramati. "And so this is what MyMilk is here for: to help those 80 to 90% of mothers who do nurse to achieve their own breastfeeding goals, and with less of a struggle."

Alumni



Milk masters: Dr. Sharon Haramati (left) and Dr. Ravid Shechter-Ushpizin at the MyMilk lab in Herzliya

Most MyMilk clients are based in Israel, where they carry out their pilot programs and tests, though they have some presence in the United States and Europe, and plan to continue expanding. MyMilk is also partnering with physicians at various healthcare centers, including Stanford Children's Hospital and Brigham and Women's Hospital in Boston, and companies developing breast milk-related drugs, including a drug for premature infants that is made, in part, using mother's milk.

They are also working closely with the Ministry of Health and Magen David Adom to establish the first human milk bank in Israel. Once it is in place—anticipated this year—MyMilk will provide testing services.

'Born and bred' at Weizmann

The scientists agree that their years of training at the Weizmann Institute—both studied in the Department of Neurobiology, Dr. Shechter-Ushpizin under Prof. Michal Schwartz, and Dr. Haramati under Prof. Alon Chen—helped them become the co-CEOs they are today.

"We gained many tools for critical thinking, for designing both research and work approaches, for dealing with and overcoming failure," says Dr. Haramati. "Both of us undertook research that allowed us to be very innovative and use novel approaches in order to get results."

"We needed to see clearly through successes and failures—and in research you experience a lot of failures—so this translates well into being an entrepreneur," Dr. Haramati continues.

And while they are not interested in debating whether or not breast is best, for those women who do choose to undertake this commitment, MyMilk aims to help them make the best of it.

Oded Aharonson

- The Helen Kimmel Center for Planetary Science
- Adolf and Mary Mil Foundation
- Zuckerman STEM Leadership Program

Ido Amit

- Adelis Foundation
- BLG Trust
- Estate of Ruth Drobnes
- European Research Council
- Alan and Laraine Fischer Foundation
- Drs. Herbert and Esther Hecht
- Estate of Lydia Hershkovich
- Carla Hunter and Andre M. Schub
- The Kekst Family Institute for Medical Genetics
- Helen and Martin Kimmel Award for Innovative Investigation
- Isa Lior
- Rising Tide Foundation
- Eden and Steven Romick Postdoctoral Fellowship Fund
- Anita James Rosen Foundation
- Steven B. Rubenstein Research Fund for Leukemia and Other Blood Disorders
- Sagol Institute for Longevity Research
- Estate of Simon Saretzky
- The Felix and Silvia Schnur Endowment Fund in Stem Cell Research
- Estate of Alice Schwarz-Gardos
- David and Fela Shapell Family Foundation INCPM Fund for Preclinical Studies
- Thompson Family Foundation Alzheimer's Research Fund
- The Wolfson Family Charitable Trust

Yaron Antebi

- The Abramson Family Center for Young Scientists
- Clal Insurance
- Harmstieg New Scientist Fund
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Bacterium

/bakˈtiriəm/

noun

Plural: bacteria

A member of a large group of unicellular organisms, which have cell walls but lack organelles and an organized nucleus, including some which can cause disease.

Mid 19th century: Modern Latin, from Greek *baktērion*, diminutive of *baktēria* meaning ‘staff, cane’ (because the first ones to be discovered were rod-shaped).