

No. 17 • Fall 2020

The Weizmann

International Magazine of Science and People





From the President

Dear friends,

As the world is looking to science for solutions to the coronavirus, we at the Weizmann Institute of Science face an opportunity to contribute to the global effort and make new insights on infectious disease and many other aspects of COVID-19. More than 60 projects related to the virus are underway in our labs, some of which you can read about here. This research has been made possible, in large part, by supporters of our **Coronavirus Response Fund**, and so we are sharing inspiring stories about some of those special friends in this issue.

At the same time, our regular research agenda is forging ahead. In the last issue of *Weizmann Magazine*, you got a taste of the planned **Institute for Brain and Neural Sciences**. In this issue, we are excited to introduce you to a second flagship project, **Frontiers of the Universe**, in which our astrophysicists and particle physicists are expected to make major advances in the understanding of physics on the grandest scale—the cosmos—and the most infinitesimal scale—the particles that comprise our bodies and the world around us.

I am personally thrilled about the first formal inter-university agreement between the Weizmann Institute and a partner in the Gulf; this is a major milestone and it follows on the heels of Israel's normalization agreement with the UAE in August. I invite you to read about this new partnership with Mohamed bin Zayed University of Artificial Intelligence in our opening story. Science is an international endeavor, which involves engaging in valued partnerships and collaborations that will benefit humanity in all corners of the world.

Sincerely,

Prof. Alon Chen
President, Weizmann Institute of Science

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A publication of the Department of Resource Development

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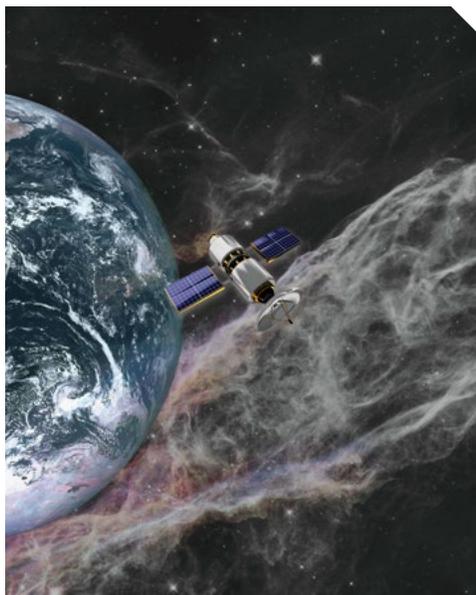
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Weizmann signs MoU with Mohamed bin Zayed University

Science Briefs



A memorandum of understanding (MoU) between the Weizmann Institute of Science and the Mohamed bin Zayed University of Artificial Intelligence (MBZUAI) in the United Arab Emirates was signed in mid-September, on the heels of the recent agreement for normalization in relations between Israel and the UAE signed in Washington, DC, on September 15.

An initial signing ceremony between the two institutions was held virtually on September 12, in the presence of Weizmann President Prof. Alon Chen and His Excellency Dr. Sultan Ahmed Al Jaber, Minister of Industry and Advanced Technology and member of the Federal Cabinet, and Chairman of the MBZUAI Board of Trustees. Prof. Chen and other senior Weizmann management will travel to Abu Dhabi to finalize the details of the MoU and discuss its implementation.

The agreement covers a range of opportunities for collaboration between the two institutions, including student and postdoctoral fellow exchange programs, conferences and seminars, various forms of exchange between researchers, sharing of computing resources and the establishment of a joint virtual institute for artificial intelligence.

The partnership will advance the Weizmann Institute's flagship project, the Artificial Intelligence Enterprise for Scientific Discovery, which will build on the Institute's prominence in mathematics and computer science, and which is meant to activate the potential of AI to speed knowledge acquisition in data-heavy endeavors like biomedicine, environmental research, chemistry, and astrophysics.

The Mohamed bin Zayed University of Artificial Intelligence, established in 2019, is a graduate-level, research-based academic institution located in Abu Dhabi. Named for the UAE crown prince, the

University is part of a broader national strategy to make the UAE a leader in artificial intelligence. It offers doctoral and master's degree programs in the fields of computer vision, machine learning, and natural language processing.

Speaking about the agreement, His Excellency Dr. Sultan Ahmed Al Jaber, says: "As a pioneering university, MBZUAI seeks partnerships with leaders in their respective fields to further our collective scientific understanding and push the boundaries of technological innovation. Therefore, I welcome the opportunity to collaborate with such a renowned establishment as the Weizmann Institute of Science. Through this MoU we can leverage the expertise of both our institutes towards using artificial intelligence to address some of the world's most pressing challenges, from COVID-19 to climate change and beyond."

"We are thrilled to have the opportunity to collaborate with this unique, pioneering institution and to advance the field of artificial intelligence together," says Prof. Chen. "As a neuroscientist, I believe that AI is an extension of the power and intricacy of the human brain into the digital realm; the implications will be vast, affecting our lives, our health, and the global economy. It is said that science knows no borders. I have every hope this collaboration between scientists in the same region will be a shining example of this expression, and will extend the boundaries of human knowledge."



Clocking it to Triton

Weizmann-made timepiece will assess data after voyage to Neptune's oddball moon

by SANDY CASH

Getting to know Triton—just one of 14 moons known to orbit the planet Neptune, Earth's very distant neighbor—might seem a surprising goal for a scientific space mission. But the mysteries of this particular moon are so compelling that NASA's Discovery Program, which supports missions dedicated to advancing planetary science, recently chose a proposed Triton-bound launch as one of four finalists to receive funding and further development. The proposed mission, which will include several novel technologies including one designed by scientists at the Weizmann Institute in collaboration with the Israel Space Agency, may help clarify the conditions needed to support life on other planets within our solar system, and even beyond.

Triton, which orbits in the opposite direction of all of Neptune's other moons, is an intriguing oddity. Some scientists believe that eons ago, Triton wandered into our solar system from the outside, where it became trapped by Neptune's gravitational field. Characteristics of its surface—identified through

pictures beamed back from Voyager 2, a NASA space probe that was launched into the solar system three decades ago—marked Triton as one of the most youthful moons ever observed. It has winds and an atmosphere, as well as surface dynamics that hint at the presence of large reserves of liquid—a hidden, underground ocean.

This combination of factors makes Triton an exciting target for space exploration, because it could help us understand how habitable worlds might develop in our solar system and beyond. However, analyzing evidence gathered on future fly-by missions to Triton requires extremely powerful and accurate technology. That's where the Weizmann Institute—specifically, the work of Prof. Yohai Kaspi—comes in.

A hidden, underground ocean?

A member of the Department of Earth and Planetary Sciences, Prof. Kaspi is part of the team behind



Trident—a space mission designed to examine Triton's atmosphere and surface, and to determine whether this moon indeed has a subterranean ocean. Headed by Dr. Louise Prockter of the Lunar and Planetary Institute in Houston, Texas, and partially funded by \$3 million in grant money recently conferred through the NASA Discovery Project, the mission would involve flying a spacecraft over Triton at a distance of only 500 km from the lunar surface.

The data gathered through this mission will be beamed back to scientists on Earth in the form of radio beams. Preserving the accuracy of this data over its long journey will depend on a clock that will be carried aboard the spacecraft, designed by Prof. Kaspi together with Dr. Eli Galanti, a staff scientist and a member of his research group. The clock is so accurate it will lose less than a second over the course of 10 million years.

Based on the scientists' instructions, the clock will be built by the Jerusalem firm AccuBeat. The construction and integration of the clock into the exploratory mission will be funded by the Israel Space Agency.

The new technology builds on something the scientists previously developed for use aboard a spacecraft that, in May 2022, will set out to explore the moons of Jupiter. Sponsored by the European Space Agency, this mission is called JUICE—short for JUPiter ICy moons Explorer. It will use a Weizmann-designed clock to calculate Doppler displacement of radio waves beamed back from Jupiter to scientists on Earth.

As Prof. Kaspi and Dr. Galanti prepare for their clock's inclusion on board the spacecraft bound for Triton's lunar surface, they have no choice but to take the long view. This is because the launch date must be timed according to a window of opportunity in which the configuration of the planets would enable a spacecraft to reach Triton in just 12 years. The next opportunity will not come around until 2026, marking the beginning of a journey that will culminate in the craft reaching Triton's atmosphere in 2038.

Weizmann supporter leads COVID vaccine deal for Latin America

by TAMAR MORAD

Pharmaceutical giant AstraZeneca's COVID-19 vaccine, now in advanced clinical trials, is being licensed and produced in Argentina and Mexico by Grupo Insud. Dr. Hugo Sigman, President of the Argentinean Association of Friends of the Weizmann Institute of Science, is owner and CEO of Insud.

Insud owns the biotechnology company that signed a tech transfer agreement with AstraZeneca. The agreement involves the production of 150-250 million doses of the vaccine, enough to supply all of Latin America with the exception of Brazil, which has its own licensing agreement.

The vaccine was developed at the University of Oxford, and is beginning Phase III trials in Brazil, with other large-scale clinical studies underway in the UK and South Africa, with promising results. AstraZeneca has forged deals with multiple countries to produce more than two billion doses of the investigational COVID-19 vaccine, expected to be delivered in the first half of 2021, pending successful Phase III studies and regulatory approvals.

Dr. Sigman was born in Buenos Aires and has an MD from the Universidad de Buenos Aires. Together with his wife, biochemist Silvia Gold, he co-founded Chemo Group in 1977, a chemical-pharmaceutical company, and the first company of Grupo Insud. The diversified group has a commercial presence in the fields of pharmaceuticals, agroforestry, cinema, and design.

Under Dr. Sigman's leadership of the Argentinean Friends, the group has come together in a collective effort to establish two postdoctoral fellowships to bring talented Argentinean PhDs to the Weizmann Institute. This initiative is being carried out in cooperation with Conicet, Argentina's National Scientific and Technical Research Council.

The Earth's earliest proteins

The unearthing of an amino acid that gave birth to modern proteins

by DINAH ELASHVILI

Despite the many astounding scientific achievements over the past few centuries, the basic question of how life on Earth emerged is one that has remained unanswered, confounding humans since time immemorial. How did this transition from a primordial soup of chemicals to a living organism occur? And what did the building blocks that would ultimately lead to life as we know it today look like billions of years ago?



 Prof. Dan Tawfik

Prof. Dan Tawfik from the Department of Biomolecular Sciences, in collaboration with Hebrew University's Prof. Norman Metanis, set out to illuminate one poorly understood part of the evolutionary puzzle—determining what the predecessors of modern proteins looked like.

Predating living cells, modern proteins are large, complex chains comprised of 20 amino acids that are essential for cell structure and function, and are involved in almost every biological function, including growth and development, healing and repair, normal digestion, and energy supply. But they weren't always this way. Prof. Tawfik's study

found that one amino acid—called ornithine—was likely a key precursor to the proteins in the human body today. And moreover, its interaction with RNA—which helps code genes and convey genetic information—played a key role in creating the earliest life forms.

Earlier this year, Prof. Tawfik received the prestigious EMET Prize this year for his work on the evolution of proteins.

An amino acid that was history in the making

In 1952, scientists Stanley Miller and Harold Urey demonstrated that amino acids could spontaneously be generated by replicating the conditions of pre-life Earth. Their famous experiment caused quite a stir in the scientific world and provided the first evidence that the organic molecules needed for life could be formed from inorganic components.

Of the assortment of molecules that arose from this experiment, the amino acids arginine, lysine, and histidine—the three positively charged amino acids found in modern proteins—were not among them. These molecules are crucial for the development of living cells partly because they interact with the negatively charged DNA and RNA.

Prof. Tawfik's research, however, centered around the one positively charged amino acid that was generated in the Miller-Urey experiment: ornithine. While ornithine exists in the body today, it is not involved in the production process of modern proteins. However, it played a bigger role in human biological history: In fact, this one positively charged amino acid could be the missing link in the evolution of proteins, Prof. Tawfik's study suggests.

After selecting protein sequences rich in arginine or lysine, the Tawfik team modified them by replacing all their positively charged amino acids with ornithine. They found that these synthetic proteins bound weakly to DNA, but by subjecting them to simple chemical reactions that were likely available on Earth when life emerged, ornithine would convert to arginine. The more ornithine that was converted to arginine, the more the proteins started to resemble modern proteins and the stronger and more selective their bonds to DNA became.



Scent of a memory

Sniffing memory-related odors while sleeping can improve our recall when we wake

by ANNE SPERLING

If you've been wracking your brain to retrieve a memory, maybe it's time to turn your attention to your nose. It could be an important key to memory processing.

Most of us know that “sleeping on it” helps us consolidate memories we first formed while awake. And neuroscientists have shown that it is possible to influence the process of memory activation while we sleep by using odors we've come to associate with those memories. Now, a Weizmann Institute study looking at the function of the olfactory system during sleep found that introducing certain odors directly to a single nostril of sleeping subjects can specifically activate that same side of the brain—and thereby reactivate specific memories. The study, published in *Current Biology*, was carried out by neuroscientists Profs. Rony Paz, Noam Sobel, and Yadin Dudai, in collaboration with Prof. Yuval Nir from Tel-Aviv University.

The team reached this discovery by studying a process called targeted memory reactivation (TMR), which involves exposing participants, while they nap, to sensory cues for information they learned while awake. Previous studies of TMR—which works during the non-dreaming, or NREM part of the sleep cycle—showed that such cueing typically causes memories to reactivate across the brain, rather than in a particular region. In this study, the scientists took advantage of a unique characteristic of the human olfactory system: When you sniff odors through your left nostril, the odor will mainly activate the left side of your brain; odors sniffed through the right nostril will mainly activate the olfactory cortex on the right

side. Thus, the scientists hypothesized that single-nostril olfactory stimulation would lead to ‘one-sided’ brain activation, and therefore if done during sleep, could reactivate memories selectively on one side of the brain.

And that is exactly what they found: Ella Bar, a PhD student under the joint supervision of Prof. Paz and Prof. Nir, directed participants to learn to associate words with specific locations on a screen. That is, the words were presented either in the left visual field or the right visual field. All the while, the participants smelled a particular scent—like roses—through both nostrils. Later, as the participants snoozed, Ms. Bar delivered the scent to only one nostril. As predicted, participants were better at remembering the locations of words that been presented to the side of the brain that been stimulated with the scent while they slept.

“The study proved it is possible to transcend the across-the-brain activation typical of TMR by selectively promoting specific memories,” says Prof. Paz, who also heads the Department of Neurobiology.

Can we translate this scented effect to real life? Yes, say the researchers. They envision using this non-invasive technique to help individuals with one-sided brain problems, such as persistent traumatic memories—which are frequently stored on the right side—or unilateral stroke injuries.

Such rosy—and collaborative—thinking typifies the goals of the Weizmann Institute's neuroscience flagship project, the Institute for Brain and Neural Sciences.

The new normal for internationals on campus

The Kekst Office is helping foreign scientists and students during the pandemic

by SHARON REINHEIMER

In response to the coronavirus pandemic, the Gershon Kekst International Office has transformed into a hub for international scientists and students needing logistics assistance related to travel, quarantine, and family matters.

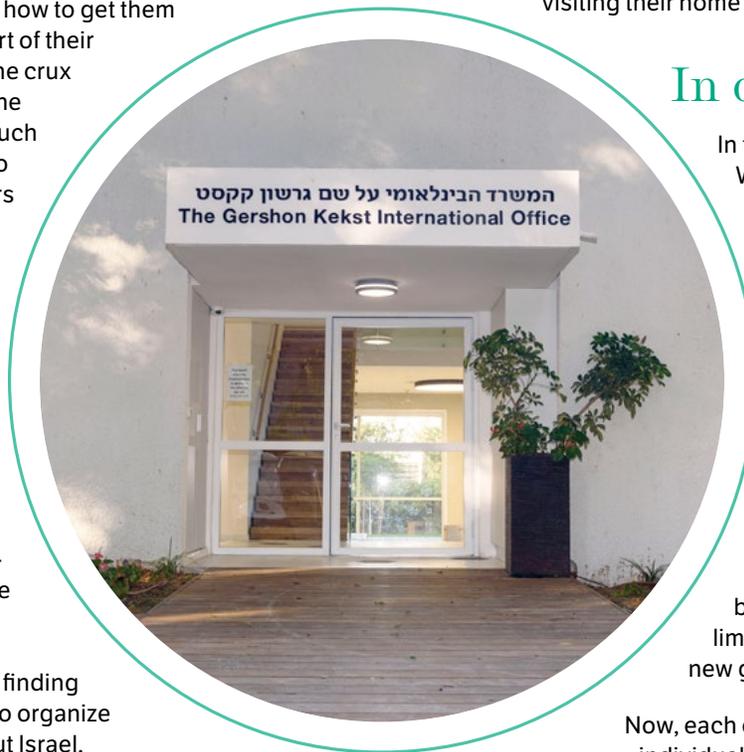
In March, some 60 students and postdocs from the Institute found themselves stuck abroad and unable to return to Israel. The task fell on Aileen Halbershtat, Head of the International Office Domain, and her team to figure out how to get them back—not exactly part of their job description, but the crux of their role remains the same: providing as much support as possible to the talented foreigners who have chosen to conduct research and studies at the Weizmann Institute.

The Kekst Office was established in 2018 to offer a range of services for international scientists and students around non-academic needs—like converting a driver's license or registering children for school or finding housing. The staff also organize group trips throughout Israel, and offer a “home” on campus for Weizmann's international population, where people can meet, form friendships, talk about life outside the lab, and work in the communal space. The Kekst Office team hosted cultural events nearly every month and for holidays of all kinds, evincing the diverse international makeup of the Weizmann population.

Now, says Ms. Halbershtat, “The emotional needs have changed.” It isn't just about the logistics of

securing a visa. There is a more personal element as well. People want to go home; they miss their families. In one particularly heartbreaking case, a postdoc was desperate to get home as his wife was due any day to deliver their first child, but there were no flights going in or out. He missed the birth.

For one parent from Asia, a two-week trip to Israel to visit her son (a PhD student) and his wife and child turned into a stay of several months. Another group of students found themselves stuck in Serbia for nearly five months, en route back to the Institute after visiting their home in China.



 *The Gershon Kekst International Office*

In constant flux

In the past, assisting a Weizmann student, fellow, or visiting scientist in getting to Israel involved a single email outlining visas, flights, health insurance, and housing. Today, with travel and quarantine requirements in constant flux, many government offices closed, and movement between countries limited, it's a whole new game.

Now, each case is dealt with individually. “We have to understand where this student or scientist is in the world,” says Ms. Halbershtat. “What's happening there right now? What restrictions are in place?” From there she and her team begin securing travel permits, visas, flights; setting up living arrangements, both initial quarantine housing (which must take place in a designated space on campus) and long-term housing immediately after; coordinating transportation from the airport, and making sure there is food in the refrigerator upon arrival. And if a flight gets

A place for postdocs to call home

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by ANNE SPERLING

cancelled, they must start the process all over again.

Small successes now give them reason to cheer. For instance, when a handful of Weizmann students from India found themselves stuck there and unable to get to Israel, the Kekst team joined forces with other Israeli institutions that had students due to arrive in Israel. Together, the group found an Israeli airliner in India and chartered a flight. There is now a WhatsApp group for all the international student coordinators in Israel, which, says Ms. Halbershtat, would probably not have happened otherwise.

“So many things have popped up out of necessity,” she adds. “The Weizmann Institute is an international institution. Weizmann without internationals is just not an option. So we do what it takes and we make sure Weizmann still feels like a home away from home.”

מכון ויצמן למדע

A new, state-of-the-art residential building—the U.S.-Weizmann International Residence—will provide housing for international postdoctoral fellows just steps away from the main gate to the campus.

The Weizmann Institute welcomes a growing number of foreign postdocs every year. About 290 postdocs on campus are from overseas (about two-thirds of all postdocs), bringing invaluable diversity and experience with them from their countries of origin. These scientists—whose average age is 30, and most of whom have spouses and in some cases young children—require spacious apartments suitable for individuals or couples, without roommates and at a high standard, as is customary in the world’s leading academic institutions.

At 16 stories tall and containing 120 units, with two below-ground levels for parking, the planned U.S.-Weizmann International Residence will be situated close to the campus gate. The building is designed to provide its own residents and other fellows and graduate students living nearby with a variety of social, recreational, and study spaces.

 *Rendering of the planned U.S.-Weizmann International House*

The building design (by the Tel Aviv firm Kimmel Eshkolot Architects) offers quality housing quarters with an emphasis on environmentally sustainable construction, combined with common spaces that will constitute the beating heart of the residence.

In light of the housing shortage in Israel, and the dearth of small apartments in close proximity to the Institute, “the expansion of postdoc housing is a vital strategic need,” says Prof. Roee Ozeri, Vice President for Resource Development. “Increasing the supply of postdoc housing will enhance the Institute’s competitiveness in terms of attracting top Israeli and foreign students, which ultimately translates into world-class science.”





Life beyond the lab for Weizmann scientists now includes a community garden.

Green thumbs at the community garden

by SHARON REINHEIMER

It is often said that the Weizmann Institute of Science nurtures the whole scientist. Beyond providing its staff with an exceptional research environment, the Institute emphasizes the importance of life beyond the lab. The campus is not only a green oasis in the middle of Israel, it is also home to day-care centers, swimming pools, and citrus orchards.

Thanks to a project initiated by Dr. Haim Beidenkopf, Weizmann staff have another outlet outside the lab in the form of a community garden, located near the physics buildings and not far from the scientists' neighborhood. Dr. Beidenkopf got the idea for the garden several years ago while walking across campus from his child's nursery school to his lab in the Department of Condensed Matter Physics.

"I crossed a barren piece of land and thought to myself that there must be a better use for it," he recalls. A year later, his idea came to fruition, with 30 plots set up; today there are 60 plots allocated to Weizmann scientists who come with their families to

tend to their organic gardens. The crop: everything from tomatoes and pumpkins to melons and strawberries. In years past, the garden was host to planting festivals in spring and fall, and celebrations for Jewish holidays that celebrate the harvest like Shavuot and Tu B'Shvat, but now such events are on hold.

At least, says Dr. Bat Chen Wolf, a staff scientist in the lab of Prof. Eran Segal, the garden provided a much-needed open space during the coronavirus lockdown in Israel. "Coming here to water our plants was one of the only things I could do with my son," she says.

Feinberg graduation with an all-star cast

10–11

by TAMAR MORAD

The Feinberg Graduate School's commencement ceremony on September 9 had been rescheduled from June because of the pandemic and was fully online this year, but what was lacking in physical proximity was gained in the all-star cast of speakers.

Israel's President Reuven Rivlin offered greetings, as well as Israel Prize winner Prof. Nili Cohen, President of the Israel Academy of Sciences and the Humanities. Weizmann speakers included President Prof. Alon Chen, Feinberg Dean Prof. Gilad Perez, and Scientific Council Chair Prof. Daniella Goldfarb.

Speaking on behalf of the students was Dr. Eman Khatib-Massalha, who received her PhD in the lab of Prof. Tsvee Lapidot in the Department of Immunology and is starting at postdoc fellowship at Cambridge University, as a Clore Fellow of the Israel National Postdoctoral Award Program for Advancing Women in Science. "I wish us all success ahead in the path we wisely choose, in the spirit of Dr. Chaim Weizmann's vision to promote science, peace, and equality in this country," she said.

Judoka Yael Arad, Israel's first athlete to win an Olympic medal, also offered greetings and congratulations. Comedian, artist, and entrepreneur Lior Halfon jokingly chided the Weizmann Institute for being #2 on the worldwide *Nature* ranking of research impact, saying: "Next year, I expect a drastic improvement!"



Some of the 2020 graduates

A quarantined lemon tree

by TAMAR MORAD

And you think you're sour from being in quarantine or lockdown? This lemon tree on campus wasn't isolating against the coronavirus, though anyone who walked by was likely to wonder as much. Dr. Tamir Klein and Ido Rog of the Department of Plant and Environmental Sciences covered the tree in plastic as part of their research on how trees function in their environment. Specifically, they are exploring how trees manage their carbon and water budgets, both separately and as a community.

"The isolation of the lemon tree is a simulation for a labeling experiment on forest trees, where we 'feed' trees with isotopic CO₂, allowing us to track the different ways carbon moves from leaf to root, and on to below-ground partners and even to trees of different species," says Dr. Klein.

Trees in Israel offer unique knowledge for the study of carbon allocation in the soil because the country's climatic and ecological diversity leads to great biodiversity among species of trees and soil microbiota.



The Klein lab isolated this lemon tree from its neighbors to measure its carbon and water budgets.

As far as the eye can see—and beyond

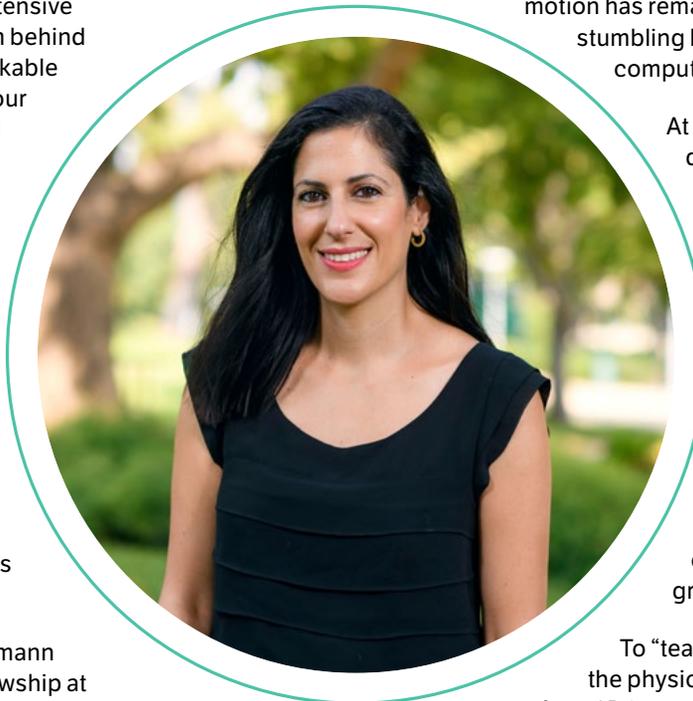
Dr. Tali Dekel's algorithms teach computers to mimic human vision

by DINAH ELASHVILI

Our eyes—and the extensive human visual system behind them—have a remarkable ability to make sense of our three-dimensional world from two-dimensional information. Mimicking this ability with artificial means, through algorithms and computer-based technologies, is a major challenge. This is precisely the focus of the research of Dr. Tali Dekel, who joined the Department of Computer Science and Applied Mathematics in October.

Dr. Dekel comes to Weizmann after a postdoctoral fellowship at MIT's Computer Science and Artificial Intelligence Lab, followed by a position as a Senior Research Scientist at Google in Cambridge, Massachusetts.

Recreating spatial geometry from two-dimensional images is one of the fundamental challenges in the visual computational field. The object must be captured from two points of view at any given time, which requires either the subject or the camera to be stationary. Interpreting the three-dimensionality of the scene when both camera and object are in



 *Dr. Tali Dekel*

motion has remained a fundamental stumbling block in the field of computer vision.

At Google, Dr. Dekel developed a solution to this challenge through combining fundamental knowledge in computer vision and deep learning. Deep learning—a subset of artificial intelligence where machines can learn directly by observing large amounts of data—has been revolutionizing computer vision and graphics in recent years.

To “teach” a computer to predict the physical dimensions of a human from 2D images, Dr. Dekel discovered a surprising new source of data: thousands of YouTube videos of the viral “Mannequin Challenge”—in which groups of people imitate mannequins by freezing in place

while a moving camera films them. Because the subjects are stationary, it is possible to accurately estimate the geometry of the entire scene, including the people in it.

Based on a large collection of such videos, Dr. Dekel designed a deep learning-based model that could

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 *The “In Motion” exhibit at the MIT Museum*

analyze non-stationary video footage and accurately interpret the geometry of any moving human in it. Future potential applications of this technology are numerous—from advanced computer graphic effects to revealing obstructed objects in videos.

Of more than 5,000 papers submitted to the 2019 Computer Vision and Pattern Recognition Conference—the premier annual computer vision event held in Long Beach, California in June 2019—this work was one of just two that received honorable mention awards.

Mimicking movement

In another project, Dr. Dekel used machine learning to develop the Motion Sculpture system, or “MoSculp,” which can visualize the complex 3D movement of a video subject. For example,

if presented with a video of an Olympic runner, MoSculp can follow the 3D path traced by the subject as he or she moves through space—and render a 3D simulation. It can even physically print a sculpture of the runner in three dimensions.

The MIT Museum recently worked with Dr. Dekel to create a new exhibit, “In Motion,” which explores movement. (The museum has temporarily closed its doors due to the COVID-19 pandemic.)

These are only a sampling of Dr. Dekel’s deep-learning projects in computer vision and graphics. She has contributed to many models that are helping advance technology and enhancing our visual and auditory perception of the world.

“In the new era of deep learning, we can go beyond what we may think is possible today,” says Dr. Dekel. “A whole new world of research questions can be asked and addressed.”

Dr. Tali Dekel earned her BSc and MSc in electrical engineering, both *cum laude*, from Tel Aviv University. After interning at the Disney Research lab at ETH Zurich (the Swiss Federal Institute of Technology), she returned to Tel Aviv University to earn her PhD in electrical engineering and computer vision in 2015. She completed her postdoctoral research with the support of a Rothschild Fellowship and the Israel National Postdoctoral Award Program for Advancing Women in Science.

She received the Alon Fellowship for outstanding young researchers from the Council for Higher Education. In 2019, Dr. Dekel was the first woman to win the prestigious Eric and Sheila Samson Prime Minister’s Prize for Innovation in Alternative Fuels and Smart Mobility. She received the Prof. Norman W. Rosenberg Memorial Prize at TAU in 2013, and an Excellence Scholarship from the TAU School of Electrical Engineering in 2009. In 2005, she won a scholarship from RAD Data Communications, Ltd.

Unraveling cancer in its environment

Introducing Dr. Leeat Keren

by EDWARD TRUITT

Cancer researchers are just beginning to unravel the interplay between the individual cells of a tumor, the immune system, and the normal cells that surround tumors, which comprise what's known as their microenvironment. The immune system can attack growing tumors—or be fooled into ignoring them—allowing healthy cells to provide a supportive environment for the tumor.

Dr. Leeat Keren has helped develop some revolutionary new scientific tools to explore the full extent of the mechanisms that tumor cells use to take over their microenvironment and avoid the immune system's scrutiny.

As a postdoc, Dr. Keren helped develop a new form of imaging technology combined with mass spectrometry, called multiplexed-ion-beam imaging by time-of-flight (MIBI-TOF). With it, she and her colleagues have been able to view, in an unprecedented way, the precise amount and location of dozens of different proteins at work in each cell in clinical specimens. It's the photographic equivalent of bringing a blurry, black-and-white picture from a bygone age into full color and exquisite resolution. But even better, because this isn't just for viewing pleasure; it could help save lives.

During her postdoc, Dr. Keren applied these tools to investigate the tumor microenvironment in triple-negative breast cancer—one of the most aggressive and deadliest forms of cancer, because of the lack of effective treatment—and identified patterns of interaction between the tumor and immune cells along the edges of the tumor that helped them predict a patient's prognosis for survival and their response to treatment. They suspect that these patterns represent cases in which the immune system manages to mount a successful response against the tumor. Now, at her new lab in

the Department of Molecular Cell Biology, she is applying the same approaches to study melanoma, which has evidenced promise for treatment with immunotherapies.

Dr. Leeat Keren received her undergraduate degree in life sciences from Tel Aviv University, a masters at the Weizmann Institute, and her doctorate—which focused on systems biology—under the guidance of Prof. Eran Segal (in the Department of Computer Science and Mathematics and the Department of Molecular Cell Biology) and Prof. Ron Milo in the Department of Plant and Environmental Sciences. She completed a postdoctoral fellowship at Stanford University, where she was a Clore Fellow of the Israel National Postdoctoral Award Program for Advancing Women in Science, and also was a beneficiary of Rothschild Foundation, Fulbright, and Damon Runyon postdoctoral fellowships. She was a TAU Dean's list scholar and Wolf Prize winner; received the Weizmann Institute's Dean's Prize for outstanding MSc students; the Azrieli Center for Systems Biology prize for a student-initiated project; an Azrieli Foundation early-career faculty fellowship; and a Horizon 2020 starting grant from the European Union.



מכון ויצמן למדע

“My father-in-law passed away from melanoma many years ago, and so my family and I have a special interest in this disease,” she says.

In a clinical collaboration between her Weizmann lab and the Dana-Farber Cancer Institute in Boston, Dr. Keren and her team will be investigating changes in the tumor microenvironment in patients undergoing immunotherapy for melanoma, looking for clues about why certain individuals respond better or worse.

Melanoma’s new tricks?

The main cause of death in melanoma patients is widespread metastases. So in another clinical collaboration with Hadassah Medical Center in Jerusalem, Dr. Keren and her group will compare the immune system and microenvironment interactions between primary melanoma tumors and the disease that has metastasized to the lymph nodes. “We want to understand what parts of the immune response happen at the primary site compared to the metastasized tissues,” she says. “Our main question is: Does melanoma use the same strategies to evade the immune system wherever it goes in the body? Or does it develop new tricks that allow it to metastasize?”

Her team will also map the mechanisms underlying these interactions, using the MIBI-TOF platform, in collaboration with the lab of her departmental colleague, Prof. Yardena Samuels. The Samuels lab, renowned for its breakthroughs in the understanding of melanoma, has developed a mouse model for the disease that enables scientists to precisely control the strains of melanoma. This effort will elucidate why some melanoma tumors are attacked by the immune system, and others are ignored.

Flagship project launches Weizmann on an odyssey toward the future of physics

by SANDY CASH

The Universe is everything, from the tiniest sub-atomic particles to the largest galaxies, to the very existence of space, time, and life itself. But how did it all begin, and how did primordial events lead to the shape—and the content—of the cosmos? These are the fundamental scientific questions behind a new flagship initiative at the Weizmann Institute of Science called *Frontiers of the Universe*.

Designed to capitalize on Institute expertise in both particle physics and astrophysics research—the study of phenomena that occur over infinitesimal distances, and at the grandest scale—the Frontiers project will create a powerful, integrative framework for solving mysteries related to cosmology, the branch of science that explores our Universe's ancient origins. At the same time, it will generate new methods for characterizing physics as it plays out at both ends of the scale—from the quantum distances that separate atoms from their nearest neighbors, to the unfathomably distant reaches of outer space.

Building on the Weizmann Institute's recognized global leadership in the study of physical systems—both the very large and the very small—the Frontiers initiative, which will be housed in a new building, is expected to generate an unprecedented, wide-lens view of where the Universe has been, where it is going, and how.

The initiative will include multiple research sub-centers that will support the range of investigations required to develop new methods and technologies to advance astrophysics, particle physics, and the physics theory that binds it all together.

The history (and science) of everything

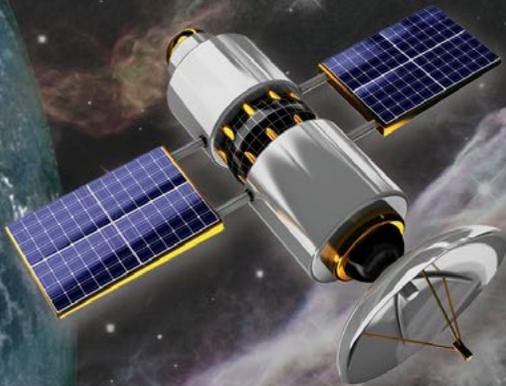
Throughout history, different cultures have put forth foundation myths about the Universe's origins. In the modern scientific community, however, the debate has been settled by the Big Bang Theory, which neatly encapsulates the life story of the Universe, and also explains the genesis of the fundamental particles that are the source of everything we know—as well as an uncountable number of things that we don't know yet.

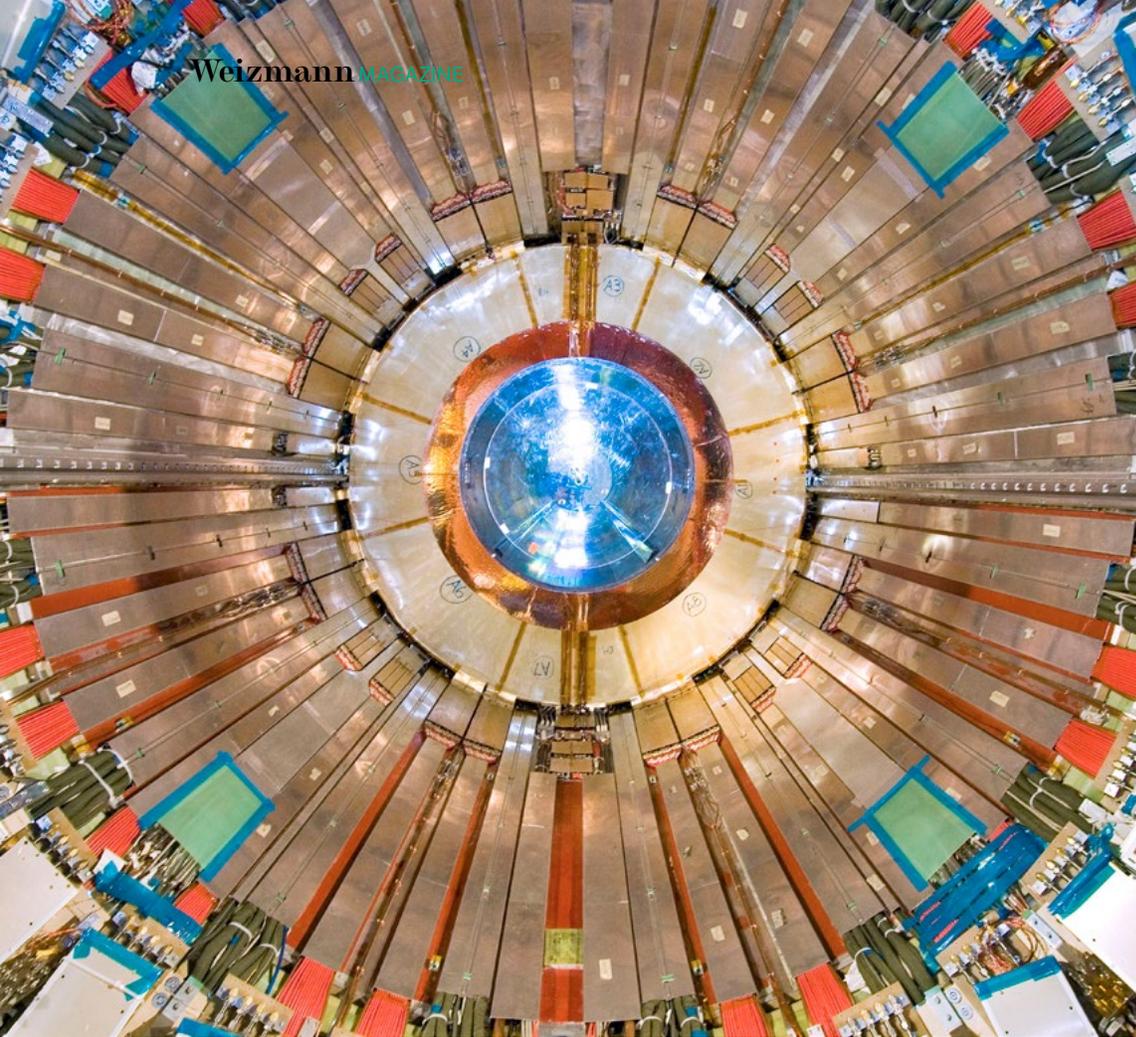


Science Feature

16-17

FRONTIERS OF THE UNIVERSE





The Large Hadron Collider at CERN

According to the Big Bang Theory, the Universe began some 14 billion years ago as an unimaginably hot and dense place that suddenly exploded, then later expanded and cooled. Under these cooler conditions, sub-atomic particles fused, creating the first simple chemical elements, and—eventually—forming clouds of atoms from which galaxies would arise. Inside these galaxies, gravity caused atomic clouds to coalesce, forming stars. The new stars' tremendous internal heat drove nuclear reactions that forged almost all the Universe's remaining elements. Finally, these stars would explode, ejecting elements that would become the building blocks of planets, moons, and every form of organic life—including human beings.

ULTRASAT

The night sky is a window to the distant past, with transient events such as the collisions and explosions of stars—invisible to the naked eye here on Earth—bearing fleeting witness to celestial episodes that occurred billions of years ago. A central component of the *Frontiers of the*

Universe initiative will be ULTRASAT, a satellite designed by Weizmann physicists Prof. Eli Waxman and Prof. Avishay Gal-Yam that will help the world's astrophysics community capture and “read” the messages hidden in transient, cosmic events before they fade away. By advancing our understanding of the Universe's origins and development, the ULTRASAT project is expected to place Israel at the forefront of world astrophysics research and discovery.

Fitted with a telescope designed to observe the Universe as it has not been seen before, ULTRASAT will be a small and relatively affordable satellite that focuses on ultraviolet (UV) emissions, and

captures images of an unprecedentedly wide swath of the night sky. It will gather and transmit the data it collects in real time, alerting the world astrophysics community to point their land-based telescopes toward transient events that might otherwise be overlooked.

ULTRASAT will be capable of detecting and measuring the UV emissions generated by the explosions of stars and other phenomena minutes after they occur, rather than the days or weeks required by current telescopic systems. Its continuous observations are expected to generate a “discovery rate”—the rate at which celestial events are identified—that is 300 times greater than today's technologies. The data it streams to Earth will be analyzed in a new project center on campus.

Analysis of data from the ULTRASAT mission is expected to help answer some of astrophysics' most important questions: How do stars merge and emit gravitational waves? How do supermassive black holes affect the “fabric” of space? How do stars explode? What is the birth story behind the

Universe's heavy elements? How fast is the Universe expanding? Which stars are most likely to have planets able to sustain life?

An official kickoff ceremony for the mission, held on campus, celebrated the signing of a joint agreement between the Weizmann Institute, the Israel Space Agency, and the Helmholtz Association of German Research Centers. Additional collaborative support will come from the European Space Agency, as well as from NASA, which has agreed to help facilitate the satellite launch, scheduled for 2023.

Adding to the astrophysics toolbox

Weizmann Institute astrophysicists are contributing other new methods and technologies that will improve our understanding of outer space. For example, recent faculty recruit Dr. Sagi Ben-Ami is developing a novel way to detect “bio-signatures”—substances that provide scientific evidence of past or present life—on planets outside of our solar system. Using this approach, he plans to map and monitor approximately 200,000 stars, and to narrow down the list of stars with orbiting planets that have an atmosphere capable of supporting life.

Prof. Eran Ofek—another key member of the ULTRASAT team—is a technology innovator who has built a new type of telescope, capable of capturing the “dimming” of light that occurs when comets cross between the Earth and a distant star. These advances, and others like it, will help Weizmann Institute scientists fill in the “big picture” of the Universe.

ATLAS leaders

Colder than outer space, yet able to smash particles together at energies a million times higher than the sun does, the Large Hadron Collider at CERN is the world's most powerful particle accelerator. The largest machine ever built, the LHC rests in a 27 km (19 mile) long circular tunnel, dug 100 m (328 feet) below ground on the border between France and Switzerland. The mission of the LHC is as simple as it is ambitious: to find “missing pieces” within and beyond the Standard Model of physics—the best theory we have to describe the fundamental building blocks of the Universe.



Prof. Eli Waxman

Weizmann Institute scientists are prominent leaders in ATLAS, an international collaboration that is one of the four cornerstones of the LHC. The 7,000-ton ATLAS detector—the largest ever constructed for a particle accelerator—is designed to detect and record the trajectory, momentum and energy of particles as they collide. Over 40 million collisions take place in the ATLAS detector every second, generating vast amounts of data analyzed at 130 computing centers around the globe.



Dr. Shikma Bressler

Members of the Weizmann Institute's Department of Particle Physics and Astrophysics—Dr. Shikma Bressler, Prof. Ehud Duchovni, Prof. Eilam Gross, as well as recently recruited faculty member Dr. Noam Tal Hod—have been involved in the design, construction, management, and operation of the ATLAS detector's largest subsystem, which was actually built on the Weizmann Institute campus. Weizmann scientists also made a significant contribution to CERN's most dramatic discovery to date: a long-predicted piece of the particle science puzzle called the Higgs boson. This elementary particle, the last hold-out



 *Prof. Avishay Gal-Yam*

particle remaining hidden during the quest to check the accuracy of the Standard Model, verified the existence of the Higgs field—energy thought to exist everywhere in the Universe, and which is necessary to explain why certain particles, and not others, have the property of mass.

New detectors for neutrino physics

Dr. Shikma Bressler, a member of the ATLAS team, develops technologies for future experiments in particle physics. She recently created a new device that could potentially improve the way the detectors in particle accelerators identify neutrinos—a nearly massless type of subatomic particle that rarely interacts with normal matter. Dr. Bressler's device may offer a solution to unanswered questions in the study of the quantum world.

This and other technological advances, which emerged from Weizmann Institute labs, may help particle physicists reveal the laws that govern how particles combine to create everything we know. As part of the Frontiers of the Universe initiative, scientific activity like this—pursued in tandem with astrophysics research—will paint a new picture of how the world works, on every scale.

Theory leads the way

Space missions and particle accelerators are expensive—and that's an understatement. In theoretical physics, however, dramatic progress can be achieved by just gathering

Bringing dark matter to light

Telescopes and accelerators can be effectively blind when it comes to a hidden factor that shapes the Universe: dark matter. Enshrined in physics theory since the 1970s because it helps to explain observed galactic dynamics, dark matter—estimated to make up 80% of the total matter of the Universe—has never been directly detected.

The dark matter mystery inspired Dr. Ranny Budnik to join an international team that designed and operates the XENON experiment (at the Laboratori Nazionali del Gran Sasso, a facility located 1.4 kilometers underground in Italy) where scientists hope to detect the dark matter particles believed to be passing through the Earth at 200 km per second, without interacting with it. The XENON team recently marked an exciting breakthrough: the first-ever

detection of cosmic activity supporting the existence of a particle not currently included in the Standard Model. This novel particle—called a solar axion—may shed light on the properties of neutrinos, neutral particles that, because of their extremely small mass, typically pass through matter unimpeded and undetected.

Currently, Dr. Budnik and his colleagues are in the process of developing a new dark matter detection strategy. The new system—which will also be installed deep underground—will rely on pure crystals that would acquire color upon contact with dark matter particles, similar to the way in which some diamonds acquire a colorful appearance while they form underground over millions of years.

ULTRASAT will be a small satellite outfitted with a telescope that focuses on ultraviolet emissions and captures images of an unprecedentedly wide swath of the sky.

20–21

 Architectural designs by MYS Architects

the best minds together for coffee and a little conversation. This is the “business model” behind the Schwartz/Reisman Institute for Theoretical Physics (SRitp), which will complement the Frontiers of the Universe initiative.

Established by a major gift from Gerald Schwartz and Heather Reisman of Toronto, the SRitp has a three-fold mission: to highlight the exceptional theoretical physics work at the Weizmann Institute, attract world-leading theoreticians to the campus, and create the personal connections that can lead to fruitful international collaboration.

Following the successful model established by a handful of other theoretical physics institutes—most notably at the University of California, Santa Barbara, and including Germany’s Johannes Gutenberg University Mainz—SRitp sponsors workshops focused on emerging questions, including recent gatherings devoted to quantum physics, fluid mechanics, and so-called fast radio bursts (FRBs)—transient pulses emerging from deep space. Whatever the topic, such discussions help bridge gaps between scientific worldviews, bringing us closer to a comprehensive understanding of the world’s physical laws.



A new physical space for physics

The Frontiers of the Universe project is all about space—the outer space of planetary and galactic exploration, and the inner space of subatomic particles and interactions. But another meaning of the word “space” relates to a separate, critical challenge: establishing sufficient and appropriate physical space to allow Weizmann physicists to effectively pursue this integrated research.

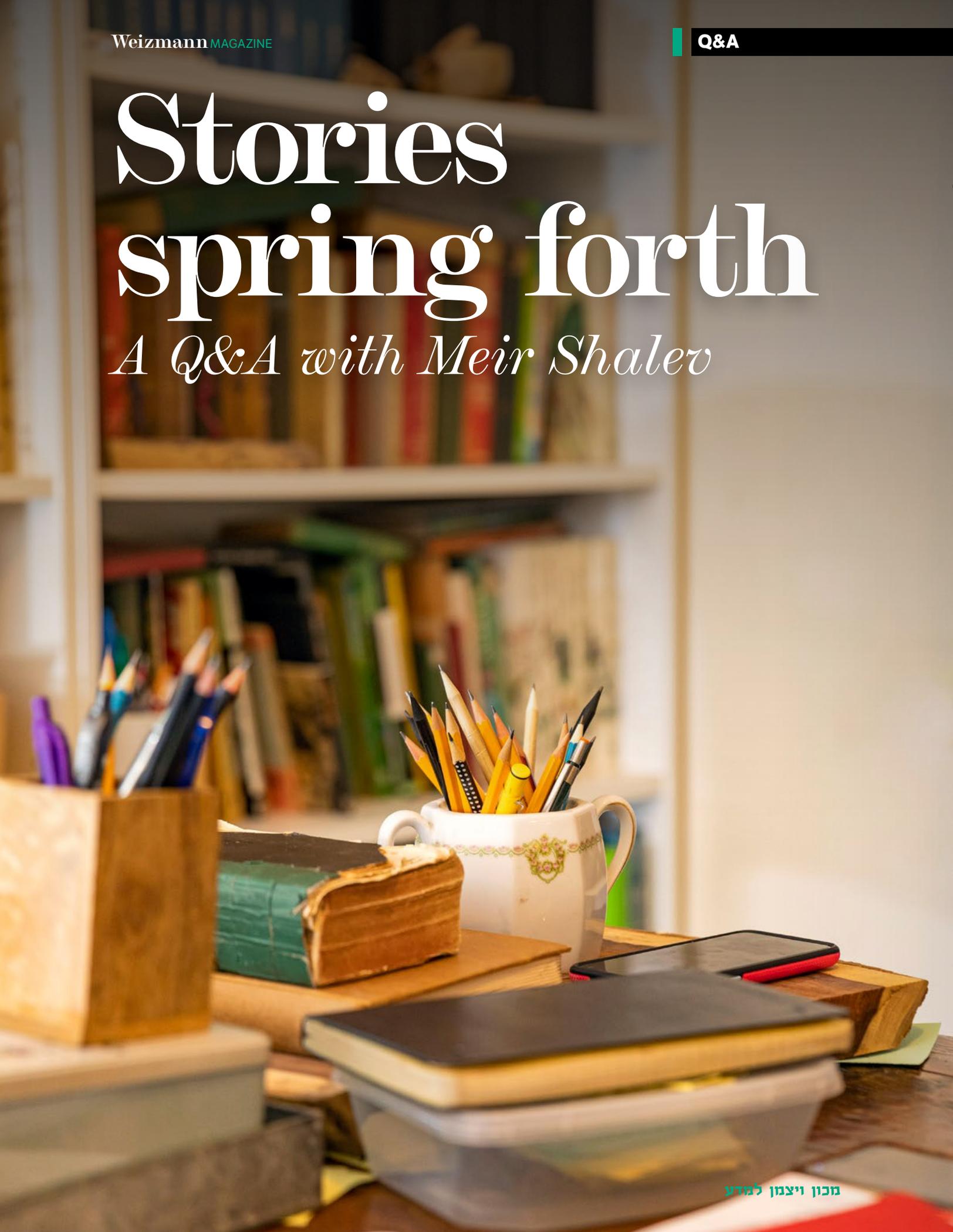
Today, the buildings that house the Institute’s astrophysics and particle physics research groups are full, with additional students, staff, and researchers expected to enter this already-crowded space. To address this problem, and to provide much-needed technical facilities, the Institute is planning a new physics building, not far from the existing physics infrastructure on campus.

In addition to offices, labs, and conference space, the new building will house facilities for the construction of particle detector component prototypes—work that currently takes place on a distant corner of the Weizmann campus. The building will also serve as ULTRASAT headquarters, where scientists will receive transmissions from the ULTRASAT satellite, and have access to the high-performance computing infrastructure needed to analyze this data.

Significantly, the new building will be designed to welcome school groups. An “operating theater” concept is being developed, one that would allow school-age students to observe and learn about the scientists’ work without disturbing it, and also participate in age-appropriate educational activities.

Stories spring forth

A Q&A with Meir Shalev



Q&A

22–23

by TALI GALSKY

He weaves magical, intricate tales, avoids the role of preacher, and sees writing as a meticulous, painstaking craft. Meir Shalev, one of Israel's most popular and critically acclaimed writers and a celebrated literary figure abroad, will receive a PhD *honoris causa* from the Weizmann Institute of Science on November 17. He will be the keynote speaker.

Sitting next to a stone bench outside his home, Meir Shalev carefully extracts a seed from its pod. His fingers, now carefully harvesting a plant, will later write a few more lines in his new novel and proofread his newspaper column. In the garden surrounding Shalev's modest home in a village in the Jezreel Valley, between the labors of the land and the toils of the mind, the dusty heat of late July is gently relieved by jasmine shrubs, lemon trees, and a single sea squill already in bloom.

Shalev's novels, essays, and children's books have been translated into many languages, and some have been adapted into plays. His opinion column, published regularly in the weekend edition of Israel's *Yediot Ahronot* newspaper, approaches current affairs and cultural issues with sharp, sophisticated wit.

Words, says the narrator in Shalev's second novel, *Esau*, can travel faster than the wind, faster than light, and even faster than the truth. In his mind, words transcend all else. What, then, is the position of the person creating the words in this hierarchy? Shalev answers simply: "We have an important cultural role: to tell stories."

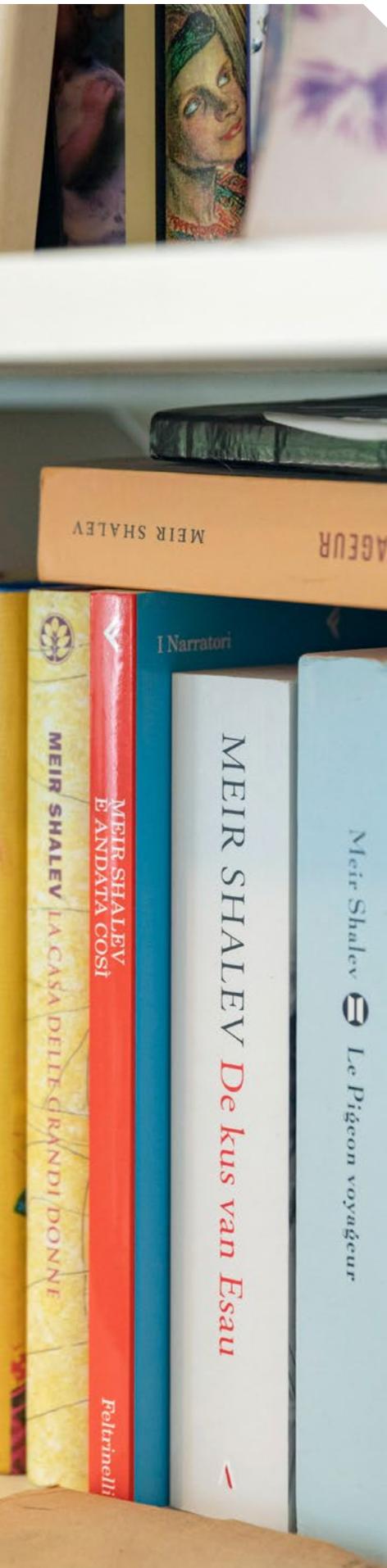
Q Many people expect writers to be prophets. What do you think?

A Because we tend to be eloquent, well-spoken individuals, we are automatically appointed preachers and watchmen unto the house of Israel. In my newspaper column I regularly voice my political opinions, but I am very careful never to write political books. I don't use literature to promote political agendas, and I don't use my politics to promote my literary works. Some accuse me of laboring under an elitist misconception, but by the same token, why aren't Weizmann Institute professors held to the same expectations? They too are intelligent people with a firm grasp of current affairs, and they are obviously capable of discussing various phenomena in a logical manner.

Q Scientists are motivated by their passion to understand how things work. What motivates you to write?

A I write mainly so that I can live in peace with myself. So that I know I'm doing something I love and appreciate, and that I am conceivably good at. I started writing fairly late in life, publishing my first novel when I was 40. Before that, I worked in





television with considerable success, but I wasn't comfortable with what I was doing. The decision to attempt a new profession at 40, with a family and two kids, was quite bold. I considered becoming a teacher, like both of my parents, but I was honest enough with myself to admit that I lack the necessary patience. My other option was zoology, but I was already too old. Because I'm a voracious reader, and because I like hearing stories, love language, and can string words together with some skill, I decided to give writing a try.

Q When you are writing, do you experience moments of inspiration?

A Sometimes, on very rare and happy occasions, an idea comes to me while I'm writing that I didn't think of in advance, seemingly of its own. For example, in *Esau*, I describe how the narrator and his twin brother have an appointment with an optometrist, who gives both of them the same eyeglass prescription. Their father, a renowned miser who is also short of money, buys them a single pair of glasses. The fact that they have to share the glasses shapes their lives. I didn't plan that in advance, it just flowed through my fingertips onto the keyboard, and when it did, I had to stand up and walk around the room for a little while until I calmed down. I suddenly realized what a treasure fell into my lap, as if it was launched from somewhere outside the book to land in the middle of it. But this is a very rare occurrence.

Q The act of writing moves between the polar opposites of revealing and concealing. The writer knows how the story ends, but leads the reader step by step all the way to the finish line. How do you accomplish this?

A I only start writing when I have a general outline of the plot. While I'm writing, I can take a character out, add a protagonist, or create a dramatic turn of events. But the overall framework of who marries whom, who is born to which parents, and who dies and when and why—these are all elements I know for certain from the outset. A novel is a work of philharmonic complexity, and novels of the type I have been writing, with multiple protagonists, spanning many years and several generations, must be conducted with careful attention and a firm hand.

If there's a surprising event in the plot, I'm careful not to give it away too soon. For example, in my first novel, *The Blue Mountain*, the reader does not discover that one of the protagonists is actually a mule until about page 200. Until that point, he is described only as a hard worker with big ears. When this fact is revealed, it's a definite surprise. Readers told me they read back to see whether there were any clues leading up to this discovery.

Q What techniques do you use to keep track of these complexities?

A Amos Oz once told me that readers should never be allowed to know what I'm about to tell you, because they must be made to believe that there is something mysterious about what writers do. I argue that even when the minute technicalities of writing are revealed, there remains something mysterious about them that even I don't fully understand and that still surprises me.

I keep a little notebook with diagrams, research material, and ideas. I draw a chart with the characters' names on one axis and the years on the other, and I fill in what happens to each character in each year, so I don't end up with someone living in Germany at the same time that he is reported to have died in Tel Aviv.

Also, my narratives often do not progress in chronological order and are delivered through first-person narration, which means that the narrator jumps

“I write mainly so that I can live in peace with myself. So that I know I’m doing something I love and appreciate,” says Meir Shalev.

24–25

from one thing to another the way people do when they tell a story, associatively. So I use sticky notes to help me keep track of things. One note, for example, reads ‘the pregnant math teacher.’ This refers to a computer file that describes what my narrator had to do with the pregnant math teacher; a conversation, a request she made to him. And this note reads ‘asks him to stay.’ I know exactly what this means. For each book I create dozens, sometimes hundreds, of notes like these.

Q How do you weave these notes into a story?

A When I start writing, I write different scenes in the characters’ lives. Each scene is in a separate file. The story is not told in chronological order, and my narrator is not a particularly organized person, but the way in which he reveals the information should be interesting and must make sense. So my floor is littered with sticky notes, and for about two or three weeks I walk around holding a long, supple stick, using it to move the notes around. If there were any onlookers, they’d probably find this practice extremely silly. After I finish arranging the notes, I sort the computer files in the corresponding order and then read the whole thing and realize that while it might look great on my floor, it is horrendous in book form. And then I go back to the notes. This process repeats itself four or five times. I find the physical act of standing over the notes and moving them around to be oddly inspiring in and of itself somehow.

When I edit the printed out texts, I use a classic Parker 51 fountain pen that belonged to my father, Yitzhak Shalev, who was a poet. He wrote many poems using this pen.

Q When you are writing, do you think about your readers?

A No. When I’m writing, I ask myself would I be interested in reading this. I have considerably more experience as a reader than as a writer, and greater success, and I’m honest enough with myself to be able to say: This is garbage, this is pretentious, and this is just plain boring. I think that’s a good quality in a writer.

Q What are you reading these days?

A Right now I’m hardly reading anything. I’m writing. During this stage I read very little, because it tends to get in the way of my work. If I do read, I read little and only books I’m very familiar with and that are pleasantly inspiring. I also read old topographical maps. I have maps dating from the British Mandate. A topographical map is a book that requires you to translate two-dimensional into three-dimensional information. You read the terrain, mountains, hills, ravines.

Q Your books are rooted in the landscapes of your childhood. What do you think gives them a universal appeal?

A The local is also the universal. When I read Thomas Hardy’s *Far from the Madding Crowd* or Nikolai Gogol’s *Dead Souls*, they transport me to distant lands, back 150 or 250 years, but I feel completely at home, the same way I do when I’m reading love stories in the book of Genesis. The human soul changes little across time and space. Cultural differences obviously exist, but love, jealousy, death, and sibling relationships are shared by many cultures throughout many periods.

A Druze man once told me that my novel *The Blue Mountain* was written about his home town of Daliyat al-Karmel, because the old farmers there are exactly the same as the farmers in my book. So although I wrote about a socialist Zionist village with strict regulations and the labor movement, there is something about old farmers living on their land that seems to be the same everywhere. When my children’s book *My Father Always Embarrasses Me* was translated into Japanese, one critic wondered how a Western writer could have such profound understanding of the psychological complexities of the Japanese family. In the end, people are very much the same wherever they are.

Targeting COVID-19

Weizmann scientists are advancing 60-plus projects related to coronavirus



Cover Story

26–27

by ANNE SPERLING



Since the global coronavirus outbreak began, Weizmann Institute scientists have been working diligently to apply their expertise in life sciences, chemistry, physics, computer sciences, and artificial intelligence to find solutions for new testing methods, unique tracking solutions, and devising potential drugs and vaccines. Others are looking at the mental health effects of the pandemic. All in all, more than 60 projects are ongoing on campus related to the urgent hunt for understanding and solutions. Generous donors throughout the world have supported this research through the Weizmann Coronavirus Response Fund.

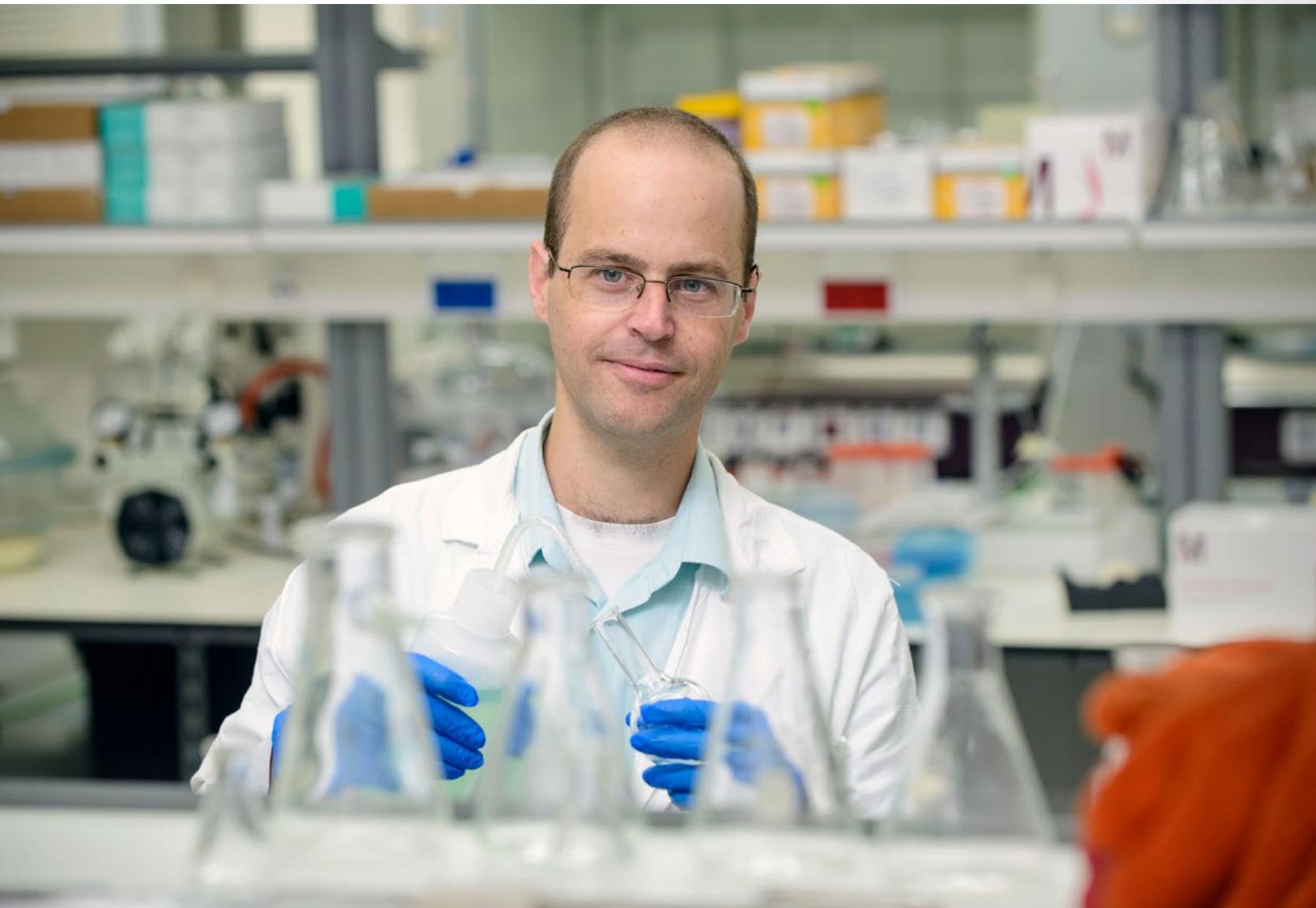
Here is a snapshot of just a few of the many ongoing Weizmann projects aimed at overcoming the COVID-19 challenge.

Screening and diagnosis

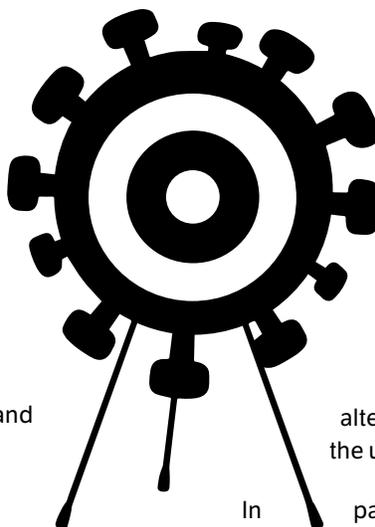
Prof. Ido Amit and Prof. Eran Elinav in the Department of Immunology and their teams have collaborated to develop a radically improved system—meaning, safer and faster—for screening individuals for SARS-CoV-2 infection. The process includes the use of specially designed swabs and a “one-step” buffer that both neutralizes the virus (so that it's not alive, but its presence can be tested for) and

allows for direct screening of the samples with no further required genetic extraction steps. Since the technology is based on next-generation sequencing, samples can be pooled such that screening can be performed in parallel and massively scaled up for tens of thousands of individuals a day. Any positive samples can then be winnowed down and re-tested for confirmation without concern about cross-contamination.

The system uses advanced microfluidics and robotic systems that improve both reproducibility and accuracy, while also reducing risk to technicians and labor requirements. The system also uses AI methods for both diagnostic and prognostic applications.



 *Dr. Nir London leads the international Covid 'Moonshot' initiative.*



The testing pipeline has already been performed on thousands of samples, in collaboration with Israel's Ministry of Defense, Ministry of Health, and various hospitals nationwide.

The hunt for drug options

Dr. Nir London from the Department of Organic Chemistry and the COVID 'Moonshot' consortium he spearheaded is experimenting with a new way to discover drugs: crowdsourcing ideas, eliminating intellectual property, and involving every key player in the long drug-discovery process—from biotech companies to contract research organizations—from the get-go, to expedite development. Following a screening sprint in February, Dr. London and colleagues released all of their data to the public. In March, they posted a request to medicinal chemists worldwide to use this data and suggest designs for a molecule that might inhibit a main coronavirus enzyme, called a protease. The effort has generated more than 10,000 design ideas from more than 350 contributors. The consortium synthesized more than 1,000 compounds, tested their activity, and are homing in on the most promising possibilities.

Diamond Light Source—the UK's national synchrotron facility—helped refine the short list of the best inhibitory molecules by determining their structure. To date, the Moonshot team has identified several series of compounds that are potent at low doses at combatting the virus. In an illustration of the widespread collaborative spirit this outbreak has engendered among scientists, the resultant data are made public in real-time—precluding competition to publish and providing a clear blueprint for further optimizing these compounds.

The project is now nearing its next stage: focusing on the three best-performing series of candidates to take into pre-clinical assessment in animal models, and ensuring safety, efficacy, and stability.

The consortium demonstrates that there's more than one way to run a drug discovery pipeline—and this is an alternative that can be implemented against the unmet medical needs of the future.

In parallel, the high-throughput screening unit at the Weizmann Institute's Nancy and Stephen Grand Israel National Center for Personalized Medicine, led by Dr. Haim Barr, screened 200,000 pre-existing compounds from the Grand Center's library against the protease. Approximately 135 of these compounds warranted follow-up, including analysis by the Diamond Light Source.

Existing drugs, new purposes

For many years, Prof. Emeritus Yosef Shaul has studied virus-host cell interactions, with a focus on the hepatitis B virus (HBV). These investigations have shown how HBV, with its limited genetic content, can invade cells and occupy its host's relevant cellular machinery. He developed a highly effective vaccine for HBV. He now plans to re-purpose a compound approved by the U.S. Food and Drug Administration (imatinib, sold under the brand name Gleevec) to inhibit SARS-CoV-2 infection.

In previous studies, researchers have reported that imatinib can be effective against the 2003 severe acute respiratory syndrome (SARS) virus as well as the 2012 Middle East respiratory syndrome coronavirus (MERS-CoV) in cell culture. The Shaul lab's preliminary data—collected in collaboration with the Israel Institute for Biological Research—demonstrate that imatinib markedly inhibits SARS-CoV-2 infection, in nearly all cases by preventing virus/cell membrane fusion, a critical step in the entry of a virus into a healthy cell. Given this dramatic effect and its proven satisfactory safety profile, Prof. Shaul believes that imatinib may be an effective drug for treating COVID-19.

Tricking the virus

Immunotherapy for COVID-19 is one of the most promising clinical approaches for treating patients and improving their outcomes. In his two-pronged project, Dr. Ron Diskin of the Department of Structural Biology—an expert in lethal animal-borne viruses like Ebola—is working to devise a ‘decoy’ molecule that will allow healthy cells to evade SARS-CoV-2, and find an antibody that accurately binds to it.

With its expertise in the interplay among viruses, hosts, and the immune system, the Diskin group recently developed a broad-spectrum and highly potent decoy (an ‘immunoadhesin’) against a class of viruses known as arenaviruses. They now are using that same technique to develop an immunoadhesin against coronaviruses, and SARS-CoV-2 in particular. They have focused on outwitting a specific cellular receptor (ACE2) that the virus binds to in order to gain entry to a cell. Using a computational algorithm, the group has had much success modeling the structure of the ideal decoy immunoadhesin—one with unprecedented potency, which they named “Coronacept”.

Encouraged by these exceptional results, Dr. Diskin and his team are now finalizing the biological design of Coronacept, with the hope of partnering with a pharmaceutical company for advanced pre-clinical development.

Slipping through the defenses

Prof. Sarel Fleishman of the Department of Biomolecular Sciences and his team are applying a unique platform he developed in his lab—that has already led to a candidate for a potential malaria vaccine—to the coronavirus. This involves the design of millions of “nanobodies”—small synthetic antibodies that could possibly slip through the coronavirus’s formidable defenses. Prof. Fleishman hopes to home in on the most effective ones as possible drug candidates.

Since the first molecular structures of the so-called SARS-CoV-2 spike protein were published in early March 2020, the Fleishman lab has focused on targeting their nanobodies to specific sites on the spike protein. The ability to bind to these sites would indicate a powerfully effective inhibitor—one resistant to the emergence of viral mutations. (Viral mutations account for why flu vaccines must be redesigned each year.)

The Fleishman lab designed and tested two million nanobodies; a very small fraction bound to the spike protein. The lab is now optimizing these antibodies’ affinity and in parallel, computing additional versions for experimental testing.

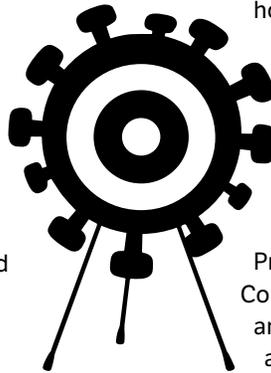
Prof. Fleishman is also collaborating with the Israel Institute for Biological Research to test the effectiveness of recovered COVID-19 patients’ antibodies to inhibit SARS-CoV-2 infection in others.

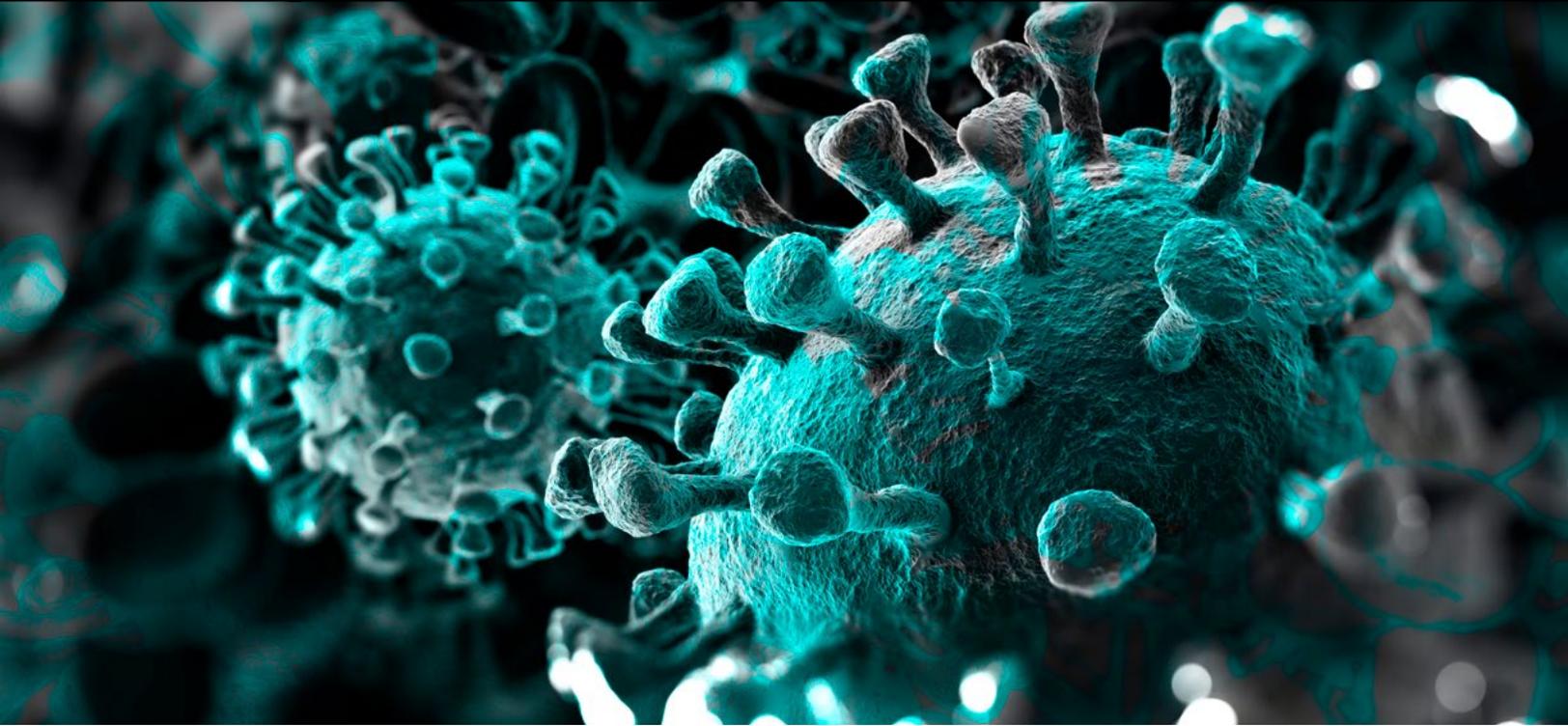
Looking at the lungs

Doctors treating COVID-19 patients have seen widespread evidence of the effect of the disease in images of the lungs. While CT scans are considered the best imaging option, they are expensive and non-portable, and it is complicated and time-consuming to disinfect CT scanners between patients. Most hospitals use X-ray machines to image the lungs of COVID-19 patients, as it is cheaper, more accessible, and easier to disinfect, but the results are often ambiguous. Ultrasound is portable and relatively easy to disinfect, but it is not widely used as a lung diagnostic tool.

Prof. Yonina Eldar of the Department of Computer Science and Applied Mathematics and her lab group are tackling this problem by assembling a uniquely diverse and extremely talented team of Weizmann life scientists and machine learning and data science experts, a volunteer squad of data science experts from Israeli companies, as well as hospital physicians across Israel who are already participating in a clinical forum Prof. Eldar heads. The group aims to develop and implement image analysis techniques, using AI that will help with the identification, triage, and diagnosis of COVID-19 patients and suspected carriers, using X-ray and ultrasound. These methods will also be used to monitor disease progression and prognosis as well as to monitor patients post-disease.

Early findings show 90% accuracy in diagnosing patients admitted to hospitals, which far surpasses the detection rate of the standard blood-based genetic tests (currently at 70% success for virus carriers), and the speed of obtaining results (minutes versus hours or days). This work paves the way for using X-ray and ultrasound as diagnostic tools outside hospitals—at a community clinic, for example.





Weizmann alumni take on COVID-19

In biotech, Institute grads are making inroads on key drugs and vaccines

by DINAH ELASHVILI

The world transformed in 2020. In a matter of months, COVID-19, the infectious disease caused by the novel coronavirus, SARS-CoV-2, brought the world to its knees, infecting millions and killing hundreds of thousands of people. Despite various strategies and efforts to slow its spread, the number of coronavirus cases are still rising in many countries across the globe.

Weizmann alumni in biotech companies in Israel and beyond are hard at work on possible solutions in the form of drugs and vaccines.

Clinical trials at Hadassah

Dr. Noga Alagem, who earned her PhD from the Weizmann Institute, works as a medical associate in the Clinical Development Department at Kamada—the first company in the world to initiate clinical trials for a plasma-derived anti-SARS-CoV-2 immunoglobulin therapy. A phase I/II clinical study, which recruited a total of 12 patients with COVID-19 pneumonia, was successfully completed at Hadassah Medical Center, with 11 out of the 12 patients showing improved symptoms within 48 hours of treatment and subsequently getting discharged from the hospital within a few days.

Based in Rehovot, Kamada specializes in developing and manufacturing therapeutics from human plasma. When the pandemic broke out, the company decided to develop a plasma-derived immunoglobulin therapy for COVID-19. Using its advanced purification technology, Kamada extracted and concentrated antibodies from plasma collected from recovered patients.

Immunoglobulin therapy, or “passive immunization,” involves transferring antibodies from recovered patients to infected individuals. The simplest form of treatment is infusing COVID-19 patients with donor plasma. Kamada developed an antibody purification process that took this immunoglobulin therapy and created a more effective product, by removing potential pathogens, pooling antibodies from many donors, and creating a uniform dosage.

Dr. Alagem was involved in planning clinical trials for this new antibody treatment.

Engineering an oral vaccine

At Tel-Hai Academic College and MIGAL Galilee Research Institute, Dr. Itamar Yadid is working as a researcher and group leader to help develop an oral vaccine for COVID-19.

In 2016, MIGAL, in collaboration with Israel’s Veterinary Institute, began developing a vaccine for a different strain of coronavirus called the infectious bronchitis virus (IBV)—which infects chickens. Recognizing the similarities between IBV and COVID-19, MIGAL established a specialized company, MigVax, to focus on developing a vaccine for SARS-CoV-2. Using the existing knowledge and research setup for the IBV vaccine, Dr. Yadid and other MIGAL researchers are designing an oral vaccine for COVID-19 that utilizes a chimeric protein to generate three kinds of immunological responses simultaneously—mucosal, blood-based, and cell-mediated immunity. This triple-armed approach provides comprehensive protection against infection, by preventing detrimental immune responses and allowing for the complete eradication of the invading virus.



 *Dr. Veronique Amor*

Dr. Yadid discovered the fascinating and diverse world of enzymes and synthetic biology as a PhD student in Prof. Dan Tawfik’s lab in the Department of Biomolecular Sciences. “My time at Weizmann gave me an extensive education in protein engineering and production,” says Dr. Yadid. “It gave me the tools I needed to develop screening methods and automated procedures, which are essential in my current work at MIGAL.”

Quelling the cytokine storm

Dr. Veronique Amor is Head of Development at Enlivex, a clinical-stage company that develops and commercializes cell therapies that rebalance the immune system.

When a foreign entity enters the blood stream, the immune system releases alert signals and specialized cells to neutralize the threat. Once the infection is defeated, a healthy immune system should return to a normal, balanced state. However, a number of viral, bacterial, and fungal infections can trigger an overreaction of the immune system, called a “cytokine storm,” which causes the immune system to spiral out of control and attack healthy tissues. It is now well understood that many coronavirus patients experience a cytokine storm, which can lead to severe complications such as organ damage and multiple organ failure—and has led to the deaths of many coronavirus patients.

“There is not a day that goes by that I don’t think of my time at the Institute,” Dr. Veronique Amor says. “Weizmann gave me the opportunity to learn from the best in the life sciences.”

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Enlivex is developing a therapeutic, Allocetra-OTS, to treat organ failure due to exaggerated immune responses and cytokine storms in septic patients. By harnessing the activity of early apoptotic cells (cells that self-destruct), Allocetra-OTS signals the immune system to react less aggressively, thereby resetting the system towards homeostasis. Earlier this month, Enlivex reported that five coronavirus patients treated in Hadassah Hospital in an initial clinical trial of its product were released within 5-8 days after their condition improved and they tested negative for the virus.

This treatment could potentially offer a novel and holistic solution to the hyperimmune responses observed in severe COVID-19 patients, and as clinical trials progress, Dr. Amor and the development team will continue to improve the manufacturing process of Allocetra-OTS.

Dr. Amor earned her MSc in 2010 and her PhD in 2015 in the Department of Molecular Cell Biology under Prof. Elior Peles. She credits her expertise in assessing and implementing new technologies at Enlivex to her time spent at Weizmann.

“There is not a day that goes by that I don’t think of my time at the Institute,” Dr. Amor says. “Weizmann gave me the opportunity to learn from the best in the life sciences fields. It taught me how to manage my time and set priorities, how to carefully build a study, critically analyze data, and logically organize and present results.”

Placenta-derived cells

Working on yet another therapy being developed to mitigate the over-activation of the immune system, Dr. Gilad Kunis, a research scientist at Pluristem Therapeutics in Haifa, is studying the effects of

placenta-derived cells on the immune system. These cells, called PLX cells, are mesenchymal-like stromal cells with regenerative and immunomodulatory properties that induce the immune system’s natural regulatory mechanisms, preventing its over-activation.

Pluristem has initiated a phase 2 clinical trial of its new PLX-PAD therapy for severe COVID-19 patients—as they run a higher risk of developing cytokine storms—enrolling 140 individuals in the U.S. and 40 patients in Israel and Germany.

Parallel to these clinical trials, Pluristem also treats COVID-19 patients in the U.S. and Israel through compassionate use programs, which stipulate that a new, unapproved drug can be used to treat a seriously ill patient when no other treatments are available. The first American to be treated with Pluristem’s PLX-PAD therapy was Edward Pierce, the Broadway designer whose recovery made headlines and was lauded as a “miracle”—as he went from being critically ill to leaving the hospital in short order.

As a PhD student on Prof. Michal Schwartz’s team in the Department of Neurobiology, Dr. Kunis studied how immune cells could be harnessed to support the central nervous system and treat neurodegenerative diseases such as Alzheimer’s disease and ALS.

“In Prof. Schwartz’s lab, we were always looking at the big picture to see how things work systemically and how they could be realistically applied—a mindset that has been very useful in how I study the PLX cells at Pluristem. Now that we are in advanced clinical trials with our PLX cells product candidates, I can see the application of the science, which is really exciting.”



 *Dr. Gilad Kunis*

Earning to give, yearning to give more

Joyce Eisenberg Keefer is improving lives through science

by TAMAR MORAD

As a child growing up in Chicago and then Los Angeles, Joyce Goodman made do with \$3 per week for lunch. Her father drove a cab; her mother was a housewife. Her parents couldn't afford to join a synagogue, though she wanted to, and she was curious about her Jewish heritage.

Fast forward to today, and Joyce Eisenberg Keefer, 85, says she has spent the last four decades "earning money so that I can give it all away." Deeply affected by her sister's ongoing battle with multiple sclerosis, the loss of her brother from brain cancer at 53, and the early passing of her first husband, Ben, from melanoma—with whom she established a foundation before his death—Joyce has dedicated her life to philanthropy, largely in education, science and medicine, and elderly care.

The Weizmann Institute has benefited greatly from her generosity, which has spanned a wide array of areas starting in 1984. Her most recent gift was visionary support for the Weizmann Coronavirus Response Fund. At the Institute, she has supported research on breast cancer, MS, alternative energy, personalized medicine, neuroscience, and three chairs; all of the incumbents are women—and that's no coincidence, as she is a major proponent of advancing women in science.

Spotlight On

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Joyce Eisenberg Keefe

Building and giving

At a young age, Joyce entered a career in real estate, working with developers and lawyers in commercial property management. When she was 25, she met Ben Eisenberg. Ben had also grown up with modest means, and peddled clothes on the street in New York as a young man. He then moved to Los Angeles where he purchased two sewing machines and began to manufacture women's clothing. When he retired from the clothing trade in the 1970s, he made a smart gamble on the future of the LA fashion district and bought several buildings including a 12-story building in the heart of the city.

Together, as heads of Ben B. Eisenberg Properties, they began transforming the building, which they

renamed New Mart (from the Harris Newmark Building), from a manufacturing facility into a gallery of apparel showrooms. The duo had a keen eye for properties with potential, and had a special faith in the fashion district (known as the garment district until 1996). In the 1970s, this district was comprised of a handful of city blocks and today spans more than 100 blocks consisting of more than 4,000 independently operated wholesale businesses, in apparel, footwear, accessories, and fabrics.

Shortly after the purchase of the New Mart, Ben was diagnosed with cancer, and he started thinking about his legacy beyond real estate. "Ben was the biggest possible believer in philanthropy, and my first lessons were from him," says Joyce. He established the Ben B. and Joyce E. Eisenberg Foundation, and indicated to his wife that he wished for the great majority of their earnings to go to charity. She cared for him during his illness, and after his death in 1986, Joyce became head of the foundation and continued to advance both his business and his philanthropic vision—and made it hers.

By the following year, she fully transformed the New Mart building from a manufacturing facility into a gallery of apparel showrooms. It soon became one of the most preeminent showplaces for fashion designers from around the world, with nearly 1,000 collections on display.

In 1990, she married Mel Keefe, a design illustrator well known for his golf strip "MacDivot," syndicated in over 250 newspapers for more than 20 years, and they settled in the lively beachside city of Santa Monica. Together with her longtime property manager, Ethan Eller, she has generated substantial profits in a booming city where the fashion industry continues to thrive. To this day, all of the company's net proceeds go to the foundation for charitable giving. Joyce determines the long list of beneficiaries—some 250 organizations in all—according to her philosophy of "cradle to grave" giving (from the very young to the very old).

"I earn in order to give," says Joyce. "I have a singular purpose in life and I'm lucky that I can live out my dream." Though well past retirement age, she works



The neural basis of behavior

Joyce recently established the Ben B. and Joyce Eisenberg Foundation Research Fellow Chair, with its first incumbent staff scientist Dr. Liora Las in the lab of Prof. Nachum Ulanovsky in the Department of Neurobiology. Dr. Las has been studying the neural basis of behavior in animals for more than 20 years. One of her recent contributions is the recording of brain activity in flying bats, using wireless neural loggers that she and Prof. Ulanovsky developed. This system has significantly advanced the understanding of the neural coding of spatial awareness in mammalian brains.

“Our work will have implications for better understanding the human brain and, importantly, how the brain calculates space and encodes it in memory is of critical importance, for instance, in Alzheimer’s and other brain diseases and conditions,” says Dr. Las. “Joyce Eisenberg Keefer is helping us make this all happen through her extraordinary support.”

five days a week, carving out as much time as possible to execute her philanthropy and active engagement on the boards of a range of organizations.

Through her foundation, she is a major supporter of elder care in LA through the non-profit Los Angeles Jewish Home, which serves thousands of seniors throughout the area. She also founded the California Oncology Research Institute, among other organizations.

During Ben’s illness, she came to know his UCLA oncologist, Dr. Donald Morton, who became chief of the melanoma program at the John Wayne Cancer Institute at St. John’s Hospital in Santa Monica, and a world-renowned surgical oncologist. Weizmann immunologist and former President Prof. Michael Sela and Dr. Morton were colleagues at one point, recalls Joyce, “and although Ben already knew about the Weizmann Institute, Ben’s friendship with Michael solidified and deepened our commitment to Weizmann which has only grown and blossomed through my relationship with Janis Rabin,” National Vice President and Executive Director, Southern California, for the American Committee.

Joyce went on to fund Dr. Morton’s research, including a breast cancer center he led at the John Wayne Cancer Institute, named the Joyce Eisenberg-Keefer Breast Center. In Israel, she has supported a range of beneficiaries, including a pediatric wing, a chest trauma care unit, and a cardiothoracic care unit at Shaare Zedek Medical Center in Jerusalem. She is also one of the major supporters of the Israel Tennis and Education Centers, and of the Israel Philharmonic Orchestra. She is an actively engaged board member of many of the organizations she supports.

The people behind the science

Among her many gifts to the Weizmann Institute, Joyce says she especially loves to fund people, “because Weizmann is filled with extraordinary people and it is the people that drive the results.” One is Prof. Sima Lev, the incumbent of the Joyce and Ben B. Eisenberg Professorial

Chair of Molecular Endocrinology and Cancer Research. More recently, Joyce established the Ben B. and Joyce Eisenberg Foundation Research Fellow Chair, with its first incumbent staff scientist Dr. Liora Las in the lab of Prof. Nachum Ulanovsky in the Department of Neurobiology. (See sidebars).

Major gifts to alternative energy research, under the guidance of Prof. Ron Milo of the Department of Plant and Environmental Sciences, have helped the Weizmann Institute become a leader in this field, while her generosity has driven the science underway at the Nancy and Stephen Grand Israel National Center for Personalized Medicine.

When the coronavirus pandemic hit, Joyce was among the first Weizmann supporters to contribute to its 60-plus projects tackling the virus. “It didn’t take much consideration—I was asked and within an hour the gift was made,” she says. “I can make decisions this way because of the faith I have in Weizmann that has developed over the course of my life, and the results and the relationships I have built. And so I am pleased to do it without hesitation.”

“*“I earn in order to give,” says Joyce Eisenberg Keefe. “I have a singular purpose in life and I’m lucky that I can live out my dream.”*”

מכון ויצמן למדע



Advancing breast cancer research

Prof. Sima Lev, the incumbent of the Joyce and Ben B. Eisenberg Professorial Chair of Molecular Endocrinology and Cancer Research, is testing a range of combinations of drugs against triple-negative breast cancer, one of the deadliest types of breast cancer. She and her team in the Department of Molecular Cell Biology have made major progress in identifying early blood biomarkers of this type of cancer—a major step forward for patients, because early detection translates into earlier treatment and higher success rates.

“I am very grateful to Joyce Eisenberg Keefe for her support of my chair, and thanks to this support we are able to advance rapidly in our research for the benefit of breast cancer patients,” says Prof. Lev.

A magnetic connection

Miel de Botton, from soulful music to heartfelt philanthropy

by TAMAR MORAD

At the nexus between music, art, and science lies creativity, says Miel de Botton. This is exactly the commonality that excites the London-based singer-songwriter, philanthropist, psychologist, and art collector, and has led her to explore and nurture a love in all three directions.

While it was her father, Gilbert de Botton, who instilled in her a love of music, art, and science—and a special connection to the Weizmann Institute—Miel hasn't merely followed his example but has advanced into new frontiers, personally, professionally, and philanthropically. Today, she is a much-loved musical artist with a series of albums under her belt, a mother of two, an avid art collector, and a donor to and participant in a long list of organizations and institutions including the Tate Gallery, the Royal Academy of the Arts, the Royal Society for the Protection of Birds, the World Wildlife Fund (WWF), the YMCA Jerusalem Youth Chorus and the Jerusalem Foundation.

Her relationship with the Weizmann Institute and Israel is a unique one, and she has given generously to the Institute throughout the years to areas that are close to her heart. She received an honorary PhD in 2015. After the start of the coronavirus pandemic, she made a major gift to the Weizmann Coronavirus Response Fund, specifically to COVID-19 research involving sophisticated protein-profiling techniques in the de Botton Institute for Protein Profiling. She established the de Botton Institute in 2014 as one of the pillars of the Nancy and Stephen Grand Israel National Center for Personalized Medicine on campus.

The de Botton Institute was part of the early national effort to produce tests for the coronavirus, and now its scientists, in partnership with the Grand Center, are working to understand how the immune system responds to SARS-CoV-2 infection, the virus that causes the COVID-19 disease. Miel's latest gift will support a series of research efforts at the de Botton Institute, including sequencing antibodies, testing favorable and unfavorable immune system responses to the virus, and identifying novel viral proteins that replicate during infection.

"It was obvious to me that if there is one institution that would make progress on this virus to help solve the pandemic, it would be Weizmann," says Miel. "Knowing that some very important work is already happening at the de Botton Institute sealed the deal" in determining to give to the Coronavirus Response Fund.

"In large part because of the infrastructure and expertise in the de Botton Institute, we were able to partner with the Ministry of Health and the National Security Council to vastly increase the number of coronavirus tests conducted in Israel in the first stages of the pandemic, and make the tests more efficient and less risky for those administering them," says Prof. Robert Fluhr, Head of the Grand Center.

Among her other gifts throughout the years, Miel also established the de Botton Center for Marine Science in 2013, headed by Prof. Ilan Koren, reflecting her deep interest in the environment. Research in the center has led to key insights about the health of the oceans, and contributed to a growing body of work on campus in the field and burgeoning expertise in ocean and climate studies.

An inspiring legacy

Born and raised in Zurich, Miel and her younger brother Alain, a philosopher and prolific writer, had a colorful, dynamic childhood. Their parents, Gilbert and Jaqueline, ensured their children were surrounded by interesting people of all kinds, and their education was enriched by travel and the arts. While Miel's upbringing was a European one, "we were always keenly aware and appreciative of my father's roots in Egypt and his special attachment to Israel," remarks Miel. That story, she says, starts with her paternal grandmother, Yolande Harmer.

Harmer worked in Egypt as an undercover agent for Israel leading up to the birth of the State, in 1948, and for several years afterwards. Recruited by Moshe Sharett, the second Prime Minister of Israel, for her contacts in elite and royal circles in Cairo and Alexandria, Yolande passed key information to Israel at a critical time. Her first marriage, to Jacques de Botton, Gilbert's father, was short-lived, and she invested herself fully in her son and her work on behalf of Israel.

After Yolande was arrested and jailed in the summer after Israel's independence, she was released and left with Gilbert for Paris, and later—surprisingly, Gilbert recalls in a documentary about his mother—they

went back to Egypt, where she continued her spy work initially unhindered. As her presence in Egypt became increasingly circumspect, she soon had no choice but to leave for Israel. Mother and son settled in Jerusalem. Gilbert received his bachelor's degree from the Hebrew University of Jerusalem, and went on to New York where he received a master's degree from Columbia University. Yolande passed away in 1959.

"I never knew my grandmother, but my father told me stories that inspired and enthralled me," says Miel, whose middle name is Yolande. Their physical resemblance, she admits, is striking.

Gilbert de Botton joined the investment group of the Zilkha banking family, another Jewish family with roots in the Middle East. He later joined the Rothschild Bank in Switzerland and moved to London, where he founded Global Asset Management (GAM), which he grew into a diverse and highly successful investment management firm and which he sold to UBS in 1999.

The engine for GAM's success "was Gilbert's incredibly curious and creative mind," says Prof. Haim Harari, former Weizmann Institute President who knew Gilbert well. Fluent in nine languages and having moved repeatedly throughout his life, "he was a man of the world who never felt at home in any country and yet he became a success in whatever country he stepped foot in."

Prof. Harari spent time with Gilbert and his second wife, Janet Wolfson, in their London home—a marriage that, serendipitously, brought together two families that were deeply engaged in the Weizmann Institute and in Israel. The highly philanthropic Wolfson family and its Wolfson Charitable Trust have given to Weizmann throughout the decades. "Sitting at the dinner table with Gilbert and Janet was to be surrounded by the most extraordinary artwork, while the discussion revolved around a love of Israel and Weizmann," recalls Prof. Harari.

Gilbert, together with the late Maurice Dwek, also a Swiss financier, developed a nucleus of support (and in their case, also offered investment guidance) for the Weizmann Institute in Europe in the 1990s, when Prof. Harari was President. Dwek and de Botton proposed the concept of a venture capital fund for early-stage start-up companies based on Institute discoveries, called PAMOT, to Prof. Harari. The duo very quickly raised \$20 million for the initiative, some from their own funds.

Ultimately, PAMOT—operated through Yeda R&D, the Institute's technology transfer company—didn't produce the desired results, notes Prof. Harari, because the infusion of funds necessary for tech transfer success was of a much higher order, and because there's never any guarantee that a certain discovery will work in the marketplace. "But it—and their financial advice in general—was a success in the sense that, while all of us scientists were in our labs exploring our curiosity and content with generating new knowledge, Maurice and Gilbert understood that scientific knowledge and information could be monetized, and they helped us think about how to do that, for the benefit of ongoing research, and for the Weizmann Institute."

Miel recalls that her father "was fascinated about astronomy, botany, fascinated with the world, with genetics... He was a Renaissance man. He took me to Weizmann when I was little and the visit left a very



Yolande Harmer, Miel's grandmother and an undercover agent for Israel

strong impression. He was so proud when talking about Weizmann scientists' prizes. I acquired from him his love of music, art, and curiosity about science and, before he died, he said he wanted to teach me about philanthropy, but he passed unexpectedly and he never had the time to do that."

Gilbert was widely eulogized upon his passing, at age 65 in 2000. The Institute named the Yeda building in his honor. The *Guardian* wrote: "Gilbert was a brilliant man, with the intellectual power to absorb, analyse and understand a mind-boggling amount of information. He was also cultured, suave, witty, modest and authoritative—an impossible combination to resist when first meeting him.... Ultimately, he was a great intellectual, a scholar who enjoyed applying purity of thought to everything he did."

“If there is one institution that would make progress on this virus to help solve this pandemic, it would be Weizmann,” says Miel de Botton.

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Hitting a high note

As a child, Miel dreamt of being a singer, but she kept her dream a secret. She was always surrounded by music growing up and has “always been transported by music,” she says. “My father loved classical music, and my parents often took me to concerts and the opera.”

She received a law degree at Oxford University and a degree in clinical psychology, then worked as a



The late Gilbert de Botton

clinical psychologist and family therapist in Paris, where she practiced for six years in a drug addiction center before moving back to London. After a divorce and her father’s death, and with some rethinking that came amidst raising her two children, she decided to throw herself into her music and formally launched her music career in 2014.

Her debut album, ‘Magnetic’, with producer Andy Wright, is a collection of reinterpreted French chansons from the 1930s-1950s—exactly the kind of songs her father used to relish and sing to her—and her own original material, in French and English. It was released to critical acclaim. Her most recent album, ‘Surrender to the Feeling,’ came out last year to equally positive reviews.

מכון ויצמן למדע

“I do believe that music and psychology are related—that music can be healing,” she says. “That is what I look for in my music: whether it has an ability to relate to a deep human emotion, and heal the soul.”

It was UK friend Jeremy Smouha, an International Board member who had worked with Gilbert, who connected Miel to Weizmann UK Executive Director Sheridan Gould. The tight friendship between the two women, says Miel, enables her to keep up to speed on Weizmann science, but also more broadly



Miel receiving an honorary PhD from then-President Prof. Daniel Zajfman in 2015.

keeps her connected to Israel. Miel’s involvement in Weizmann has also helped widen the circle of UK friends, including with Denis Raeburn, an International Board member and President’s Circle member, and a former director at GAM.

Miel recalls her performance at the Weizmann Institute campus after receiving her PhD as “a thrilling moment where my music came together with one of my passions, which is Weizmann and Israel.”

Today, she says, her musical career keeps her busy—though she looks forward to the end of the pandemic to return to the stage. In the meantime, she adds, “this is the time for science to do its magic and offer a solution for humanity.”

Latin America: Honoring a father, advancing Brazilian and Weizmann science

Sometimes, all it takes is one visit to get hooked on Weizmann science. That was the case with Marcos Pinheiro de Andrade and Vanessa Buchheim from Brazil, who came to campus in April 2019. Vanessa, who is Jewish, had been to Israel several times and said that over a decade, she encouraged her husband, who is not Jewish and had never been to Israel before, to make a visit.



L to R: Former Weizmann President Prof. Daniel Zaffman with Vanessa Buchheim and Marcos Pinheiro de Andrade at last year's Int'l Board

The opportunity finally came when a family bat mitzvah was held in Israel, and the duo visited the Weizmann Institute as part of an organized tour. They came at the suggestion of their friend Bruno Licht, a Weizmann friend and generous supporter. Vanessa, a nutritional therapist with special interest in microbiome research, was eager to visit the campus.

"Israel, and Weizmann in particular, was such an impressive surprise for me," says Marcos. "I like the Weizmann approach to science—basic research, but with an eye for application and for making discoveries, translate for the benefit of the world."

On the day they were scheduled to depart, they got in a taxi for the airport and made a detour to the Weizmann Institute, to visit for a second time. While strolling on campus, they decided to make a gift to establish a postdoctoral fellowship for Brazilian scientists at Weizmann. "The idea came to us on the spot," Marcos recalls. "I decided I wanted to honor my father, who is 83 and has Alzheimer's, and who has always cared about education and research. And we wanted to help Weizmann in some way. We didn't plan it at all, and it

suddenly became a very emotional moment since my father's illness has progressed substantially and this was a nice way for us to connect as a family."

The two-year Paulo Pinheiro de Andrade Fellowship, named for Marcos' father, was celebrated at last November's International Board.

"We wanted to both support Weizmann science and Israeli science, and at the same time nourish Brazilian science—and bring Israel and Brazil a little closer together," says Vanessa.

Marcos, whose career has been dedicated to finance and specifically asset management, says that they see the gift "as a fantastic investment with no risk, and with potentially huge returns. We hope to inspire others to give because the future relies on science and, as we see today, we can't live without it."

Paulo Pinheiro de Andrade is a former MBA professor and businessman who dedicated his career to market research. As a testament to his successful and influential role in his field, he was nominated as the Honorary President of the Global Business Research Network and granted the inaugural Jay Wilson Lifetime Achievement Award.



Paulo Pinheiro de Andrade

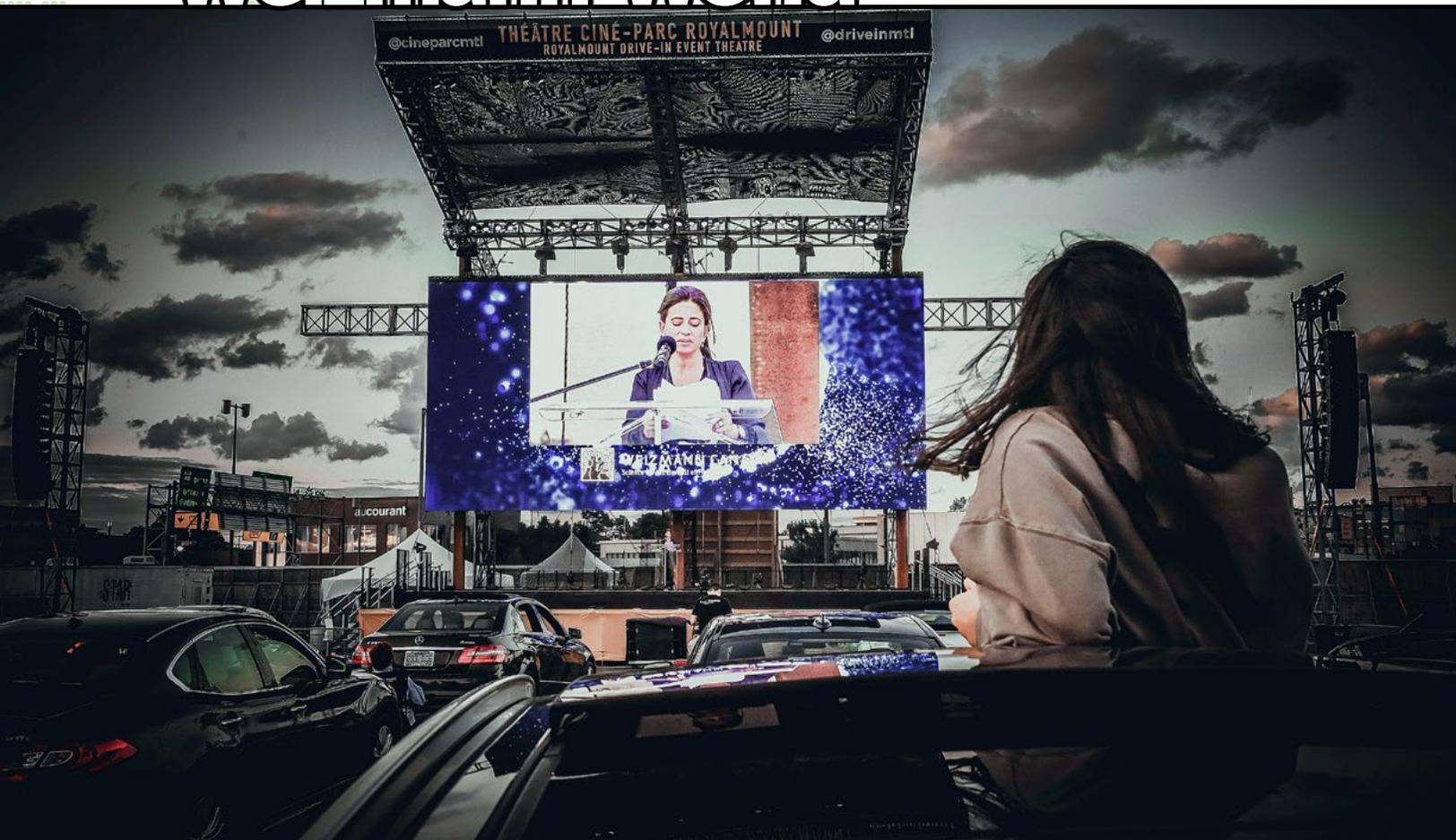
The first incumbent of the fellowship is Dr. Camila Pinto da Cunha, who will work in the lab of Prof. Yuval Eshed in the Department of Plant and Environmental Sciences. She will study the internal factors of the plant that define how meristem tissue—the plant equivalent of stem cells, in the sense that it can differentiate into various tissue types within a plant—grows into all the elements of a flower.

Understanding this process has implications for agriculture—for instance, knowing why a particular plant architecture produces more fruit—and the conservation of native species, especially in times of climate crisis.

The couple have three adult children whom they hope to bring to the Weizmann Institute when international travel resumes. As for Marcos, who admitted he initially needed some convincing to come to Israel, he says he plans to make Israel, and Weizmann, a "regular stop on my travels, and I hope to keep coming back."

Weizmann World

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📍 *Karine Cohen-Scali, National Chair of Weizmann Canada's Women in Science Committee, on the big screen*

Canada: Science under the stars in Montreal

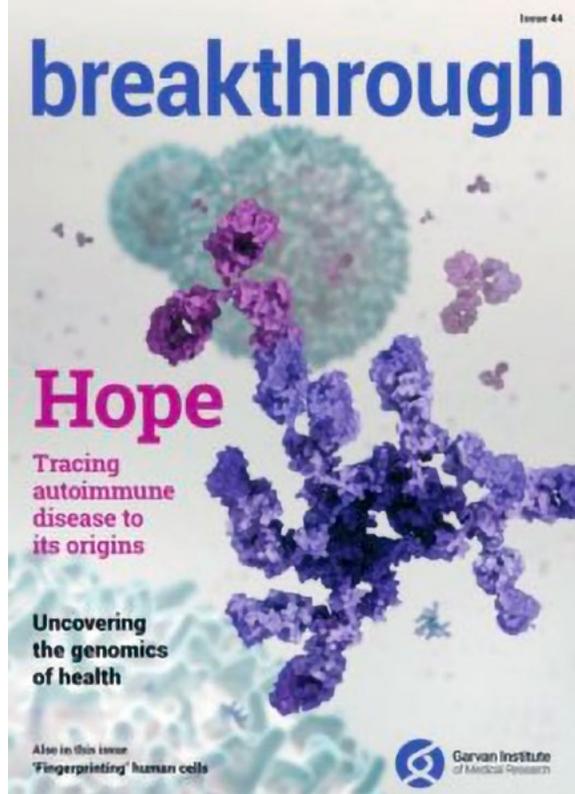
On August 5, Weizmann Canada hosted 'Movie Under the Stars!' at a Montreal drive-in movie venue with a screening of *The Imitation Game*. The historical film centers on pioneering computer scientist Alan Turing and Joan Clarke, who together saved countless lives as codebreakers during World War II.

Turing's legacy remains alive today through the Turing Award—known as the “Nobel Prize of computing”. Three Weizmann scientists have received the prestigious annual prize: Prof. Amir Pnueli (1996), Prof. Adi Shamir (2002) and Prof. Shafi Goldwasser (2013). Prof. Goldwasser is

one of only three women to have received the Turing Award in its history.

The socially distanced event was presented by Weizmann Canada's Women and Science committee, which is focused on empowering, celebrating, and promoting women in science. Karine Cohen-Scali, the committee's National Chair, kicked off the event by reflecting on the critical role science has played in the pandemic and the impact it has had on women on the frontlines.

The sold-out night was a resounding success, with all attendees receiving Weizmann Canada's 'Science speaks louder than words' masks safely.



Dr. Lumbroso's illustration on the cover of Garvan's Breakthrough magazine

Australia: Weizmann grad brings science to life

Science can be complex and often hard to “see”. But a scientific animator’s skill can change that by bringing it all to life, not just for the scientist but for the lay person too.

Weizmann PhD graduate Dr. Ofir Shein Lumbroso is doing just that. She is in Australia honing her skills to become a scientific illustrator as part of a year-long biomedical animator internship at the Garvan Institute of Medical Research in Sydney.

Dr. Shein Lumbroso completed her doctoral studies in the lab of Prof. Oren Tal in the Department of Chemical and Biological Physics. She says that she always had a passion for scientific animation, and put research aside to pursue it as a career. During the last year of her graduate studies she saw an ad for the Garvan position and “jumped at the chance,” she recalls.

Garvan and Weizmann have an extensive research cooperation program, including the Garvan-Weizmann Centre for Cellular Genomics in Darlinghurst.

As a medical animator, a position funded by Bob and Ruth Magid, Sydney-based friends and Garvan-Weizmann partnership supporters, the young scientist receives guidance from Garvan’s talented molecular animator, Dr. Kate Patterson.

“I am learning from one of the best and it’s an exciting time. Once the year is over, I hope to continue in a role as a scientific animator at the Weizmann Institute,” says Dr. Shein Lumbroso.

Her main project at Garvan is creating a 3D scientific video about the evolution of the genetic mutation that causes autoimmune disease. She works closely with Dr. Joanne Reed and Garvan’s Executive Director, Prof. Chris Goodnow—the scientists whose work this project is based on—in order to create the most accurate rendering.

“The greatest challenge for a scientific animator is to make science accessible while staying true to the most up-to-date research developments,” she says. “When successful, it is a great educational tool that can be used by scientists in presentations, while students can benefit from them in their studies. It’s so much easier to remember and understand a concept when it is visually presented. I love



Dr. Ofir Shein Lumbroso

combining my two passions, science and art, and the possibility of being able to communicate the magic of science through my animations.”

US: Embassy of Israel hosts President Prof. Alon Chen

In coordination with the American Committee's Mid-Atlantic Region, the Embassy of Israel to the US hosted a virtual dialogue with Weizmann Institute President Prof. Alon Chen in August.

Participants from across the US, as well as Mexico and Canada, tuned in for this engaging conversation between Prof. Chen and Tammy Ben Haim, the Embassy's Minister of Public Diplomacy. Prof. Chen discussed a wide array of topics, including the Institute's rapid response to the coronavirus, and the fact that its focus on basic, curiosity-driven research provided scientists with the agility and flexibility to immediately turn their attention to COVID-19 when the pandemic struck.

The collaborative, multidisciplinary atmosphere on campus, which he described as "a country within a

country," has also played a key role in the Institute's impressive mobilization.

Also in focus were the Institute's international partnerships; its initiatives to promote women in science; and the new \$100 million *Frontiers of the Universe* flagship project, aimed at uncovering the mysteries of the cosmos. In addition, Prof. Chen shared his personal scientific journey, recalling his postdoctoral fellowship at the Salk Institute in San Diego as a Fulbright Scholar. He shed light on his own neurobiology research on the science of stress, noting the pandemic's toll on mental health.

Earning one of the Embassy's highest turnouts, the webinar provided a fascinating window into Weizmann science and the people behind the science.

Europe: Weizmann Young European Network's Speaker Series

The large and growing network of young European friends isn't letting the distance and travel restrictions get in the way of continuing to learn about Weizmann science. Weizmann Young European Network's (WYEN) speaker series hosted Prof. Emeritus David Mirelman via Zoom on August 10, to talk about the technology transfer process and how the Weizmann Institute is a world model in translating discoveries from the lab into the business arena.

Prof. Mirelman's recent book, *Not for Profit: The Business of Academic Scientific Research*, is about the machinery of turning scientific discoveries into real-world applications. The Weizmann Institute's tech transfer company, Yeda R&D, has been a fundamental driver of Israel's prowess in science and technology, and he formerly served as its Chairman as well as the Institute's Vice President for Technology Transfer.



 *Dr. Adi Goldenzweig*

On September 7, WYEN hosted an online panel of three alumni. Dr. Lior Zelbuch is Senior Director at BiomX, a company that emerged from the research of Weizmann scientists Profs. Rotem Sorek, Eran Elinav, and Eran Segal. BiomX develops therapies to target harmful bacteria in inflammatory bowel disease and colorectal cancer.

Drs. Adi Goldenzweig and Ravit Netzer, who did their PhDs in the lab of Prof. Sarel Fleishman, described their research on computational protein design. Both are advancing protein-design methods that have relevance for pharmaceutical companies in drug design efforts.

Israel: The economy, health technology in focus

The Israeli Association of Friends of the Weizmann Institute has been hosting a series of virtual talks for friends and supporters, including one in June with the Governor of the Bank of Israel, Prof. Amir Yaron, who spoke about the impact of the pandemic on the economy. “This economic crisis is different than that of 2008, which did not greatly affect the Israeli economy,” he said. “In contrast, the corona crisis hit Israel when its economy was strong and is indeed affecting the country’s economy.”



Prof. Amir Yaron



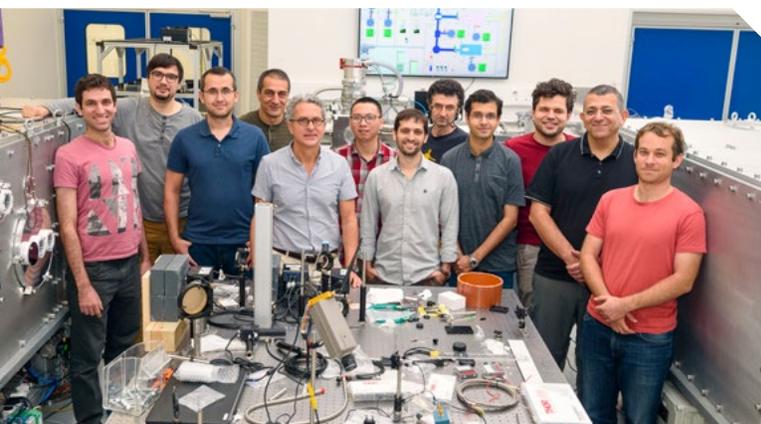
Dr. Yair Schindel

Dr. Yair Schindel, Co-Founder (with Marius Nacht) and Managing Director at aMoon, a health tech and life sciences venture fund, spoke to the Israeli friends on another occasion about the effect of the pandemic on the healthcare industry.

“The COVID-19 pandemic has accelerated the convergence of healthcare and technology more so than ever before,” said Dr. Schindel. “The health-tech

sector is surging, and Israeli entrepreneurs in this industry are uniquely positioned to create real change.” He added, “When we founded aMoon, we thought that the digital health revolution wouldn’t be fully realized for 10 years, maybe 20 years. Timelines have shortened dramatically in recent months and this revolution will happen sooner than expected.”

France: Connections and collaborations on the rise



Prof. Victor Malka (fifth from left) in his lab with French colleagues

The Making Connections France program brings together Weizmann scientists with counterparts at institutions throughout France in an effort to advance international scientific cooperation. The initiative is modeled after the successful Making Connections UK program, and the historic Pasteur-Weizmann partnership.

This year, Weizmann scientists and colleagues at the Institut Pasteur in Paris are working on solutions to COVID-19. Other collaborations have begun with the Institut Curie, Collège de France, and École Polytechnique. Investigations are ongoing in cancer, Crohn’s disease, and more. The Making Connections France program is fully funded by French donors and ensures the Pasteur-Weizmann model is expanded for the mutual benefit of French research institutions and the Weizmann Institute.

UK: New Making Connections grants strengthen UK-Israel research ties

Now in its 12th year, Weizmann UK's Making Connections Programme, which brings together scientists from the UK and Israel to collaborate on research projects, is going from strength to strength. Owing to a particularly strong round of applications, six grants rather than the usual five were awarded for 2020-2021, with grants of \$100,000 given for joint research projects over two years. The programme enables scientists at the Weizmann Institute to undertake research projects with researchers at UK institutions to stimulate discoveries, share resources, and facilitate long-lasting connections between the two countries. More than 60 grants have been awarded since the program began in 2008, bringing Weizmann scientists from a variety of fields into close working contact with scientists from more than 25 UK universities and research institutes.



Dr. Giora Alexandron, Dept. of Science Teaching

Due to coronavirus restrictions, Weizmann UK was unable to host any in-person gatherings this year but took the opportunity to showcase the research of two of this year's newly awarded Making Connections partnerships with a Virtual Cocktail of Science event on YouTube Live. Both projects had an appropriately



Prof. Yonina Eldar, Dept. of Computer Science and Applied Mathematics

virtual theme exploring questions around the role that Artificial Intelligence is increasingly playing in all of our lives.

Prof. Yonina Eldar from the Weizmann Institute and Prof. Miguel Rodrigues from University College London (UCL) discussed the question: Can we trust decisions made by an algorithm?

Dr. Giora Alexandron from the Weizmann Institute and Prof. Alexandra Cristea from Durham University explored the issue of how artificial intelligence can help personalize science education.

Weizmann UK has also recently hosted a number of online events to share the critical research being undertaken by the Weizmann Institute in response to the coronavirus crisis. These have included a fascinating insight into Dr. Nir London's role in the global search for a drug compound; and a panel event hosted by the United Synagogue featured presentations from Vice President for Resource Development Prof. Roe Ozeri, Dr. Noam Stern-Ginossar, and Prof. Uri Alon.



Launching dreams from Lod

Honorary PhD recipient Shirin Natour Hafi is building a better future for Arab students

by TALI GALSKY

A few days before the school year begins, Shirin Natour Hafi, the Principal of ORT School for Science and Engineering in the city of Lod, does a round of introductions with the new seventh graders. The students are sitting in a circle. After she asks for their names and the names of their former schools, she asks them what their dreams are. Some say they want to be doctors, others engineers, and some haven't decided yet. One of the girls says quietly: "I don't have a dream." The principal turns to the counselor and says: "That is our mission."

The first six-year Arab junior high and high school in Lod is located in the city's "Railway Neighborhood," known for its low socio-economic profile and high crime rates. For many of the students, the school is a lifeline, but for Shirin, who started the school in 2009 and has been its principal ever since, it's not enough. She wants them to set their goals high.

She is one of this year's recipients of Weizmann's honorary PhD, which she will receive during the

International Board, in recognition of her work in the ORT school, the influence she has had on hundreds of students throughout the years, and her role in a special joint program with the Weizmann Institute.

"A child raised in poverty has limited opportunities and plenty of frustration," she says. "Being part of a minority is also far from easy. But you achieve nothing by pointing your finger at others. I remind the students: if you know who you are, and you study and excel—you will get there." As a testament to that mantra, photos of Arab intellectuals in the humanities and the sciences decorate the building's main hall.

A Muslim, Shirin grew up in Lod herself, in a highly educated family; her mother is a music teacher and her father is a lawyer. "I had a privileged childhood in a household that encouraged excellence. I was always told that education establishes social standing and opens doors," she says.

Shirin attended a Jewish high school. She has a B.A. in literature and Arabic from Bar-Ilan University, and after graduating, she started teaching for the ORT

Up Close

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educational network. “There is something magical about teaching,” she says. “When I entered a classroom and taught a poem that made the children think and open their souls, it made me feel like I could change worlds.”

She advanced in her teaching career, aspired to become a principal once the opportunity presented itself, and successfully maneuvered between the two cultures that comprise her reality: Arab and Jewish. But she eventually came to the conclusion that she is a part of a community in which she has the tools to help and that, she says, “I couldn’t keep on working at a Jewish school and expect to see a change in Arab society.”

The opportunity soon presented itself to her. The mayor of Ramla stopped accepting students from Lod to the Arab high school in his city, making it necessary to start an Arab high school in Lod. Shirin applied for the principal position, and was hired.

Objections were plentiful. She faced suspicion—and even threats—being a young woman in a traditional, religious society. But Shirin was determined: the more challenging it got, the more resolved she was to succeed. “It made me insist on doing things my way,” she says. So she called the families, visited their homes, made friends—in short, led a campaign for acceptance.

With help from a series of local, national, and quasi-governmental bodies, she obtained a building and the doors opened to thousands of students. Among the first challenges was assisting students whose families couldn’t afford school books.

A safe haven

One of the school’s major collaborations is with Prof. Eran Bouchbinder of the Department of Chemical and Biological Physics. Prof. Bouchbinder met Shirin after

giving a lecture to members of the nonprofit organization Bashaar. They immediately saw eye to eye, viewing education as a tool for social mobility and opportunity.

Says Shirin, “When they asked me what I wanted, instead of asking for air conditioners and computers, I asked for help with our science studies. Eran attended one of the meetings, heard my request, and returned with volunteers.” Eran established a volunteer program in which scientists, students, and postdocs both teach lessons and serve as role models. Since then, every Friday for the past 10 years, Weizmann volunteers have come to teach and mentor the students.

Educating is only one aspect of the program; offering social support is essential. “Shirin one told us that before we talk about homework, we need to make sure that every child has a home, physically and emotionally,” he says. “Our volunteers put their time and effort into this program, as scientists with a commitment to society.”

Last year the Lod school started sending kids to the Schwartz/Reisman Science Education Center on the Weizmann campus, where they have been able to take physics classes for five matriculation units.

“Shirin told us that when we enter a classroom, we cannot immediately see a child’s burden, and many of them carry heavy burdens. Therefore, we know that the social and interpersonal elements are inseparable from the educational element, which echoes Shirin’s holistic approach to the school as a safe haven,” he says. Ultimately, the science program is about a lot more than science. Says Prof. Bouchbinder: “We try to create a real personal bond with the kids, to educate them, and to allow them to dream.”

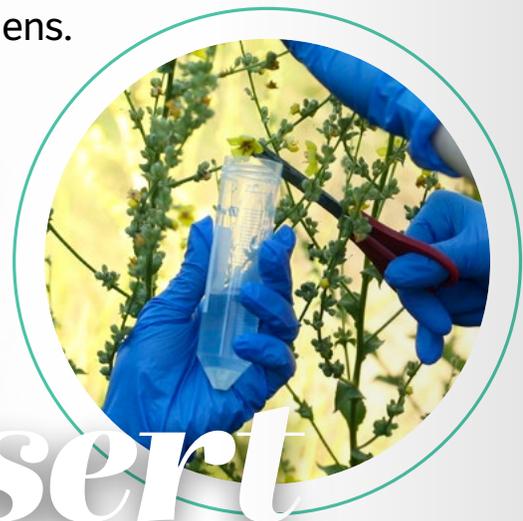


The Plant Microbiome Project takes root in Israel's Arava desert

by DINAH ELASHVILI

In recent years, plant microbiota—the bacteria and fungi found on flowers, soil, roots, and leaves—has been receiving growing attention, as scientists learn more and more about the significant role these elements play in ecosystems, from influencing plant growth to providing protection from invading pathogens.

However, because of under-sampling and lack of research, the scientific community's knowledge of plant microbiota in many types of terrain, such as the desert, is limited. Unearthing this domain could reveal an untapped resource as rich as the soil beneath it—the discovery of bacterial and fungal species that could lead to the development of improved biotechnological tools and methods, with implications for personalized human medicine.



Making desert

Launched in 2018, the Plant Microbiome Project is a collaboration between Prof. Ziv Reich of the Department of Biomolecular Sciences, and the Davidson Institute of Science Education. (Prof. Reich is also Vice President of the Weizmann Institute.) Also participating in the project is Dr. Noam Shental from the Computer Science Department at the Open University. The project's mission is ambitious: to compile a complete genomic library of the region's plant microbiome.

The impact of the Plant Microbiome Project reaches beyond Israel's borders. By partnering with Jordanian schools on the other side of the Dead Sea and working together toward a common goal, the project opens lines of communication and encourages camaraderie between Israel and its neighbors. The researchers include Weizmann scientists and graduate students, as well as Israeli and Jordanian school teachers and students, who take a leading role in studying, collecting, and processing the bacterial and fungal species found in the peripheral desert regions of Israel and Jordan.

In its first year, the project started in collaboration with the Central and Northern Arava R&D, led by Dr. Oded Keynan. The center recruited 40 teachers and more than 100 students, who gathered samples in easy-to-use collection kits and recorded environmental parameters such as temperature, light intensity, and humidity. Students and teachers alike dove deep into molecular biology, ecology, chemistry, and more, enriching their knowledge and understanding while actively participating in relevant, real-time scientific research.

Education

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The first sample went to Prof. Reich's lab for analysis. Using gene sequencing to identify and differentiate between closely related species, his lab team is now gathering and organizing the genetic information of the collected bacteria and fungi, and integrating them into a custom pipeline. They will make the information publicly available, providing scientists from other fields with tools that can be used for a variety of basic and applied research.

"The databases that currently exist are heavily skewed towards human microbiota: 82% is human-oriented bacteria," says Dr. Dagan Sade, a researcher in Prof. Reich's lab. "We want balance. By enriching the database with environment-oriented bacteria, we can learn about new species and potentially

Dr. Liat Ben-David, CEO of the Davidson Institute of Science Education, says: "This kind of collaboration is science education at its best. It's the creation of scientific exploration through the collective, holistic work of scientists, science educators and students, building knowledge and understanding for all, together."

Dr. Michal Stolarsky-Ben-Nun, project head at Davidson, adds: "The project is an exciting opportunity to connect scientific research and the educational world, allowing students and teachers to take part in contemporary research and study science in a creative and interesting way with relevance to everyday life."

research bloom

bring about new agricultural, eco-friendly, and pharmaceutical developments to help the world we live in."

Bacteria and bridges

In addition to creating a comprehensive microbiome database, the program offers a wholesome, educational experience for schoolchildren and teachers alike—an activity where they can come together, interact, and learn from top scientists—all while giving back to the community. The goal is to reach 2,000 participants in the next two years—and to complete the database.

"We are embarking on an expedition to bring to light the natural microbial world of plants while educating the next generation of scientific explorers," says Prof. Reich. "I believe that this is a terrific example of community science at its best."

"It was a powerful and special experience," says student Hila Lozdernik. "We received a kit with test tubes, gloves, and all the necessary equipment, as well as a booklet that explained exactly how and where to take samples. We went out into nature, learned about different plants, geographical areas, and types of climate. It showed me another side of science and research."

Says Shiri Orlitsky, another student, the project "gave me a taste of the impressive world of biology and provided me with an opportunity to get to know science in a different and applicable way. I wish everyone could have such an amazing experience."



Stepping into Weizmann science

The Neubauer Young Scholars Program has created a footprint—and path into academic research—for Israeli-Arab students

by ANNE SPERLING

Promising students from Israel's Arab sector face unique challenges when considering whether to pursue graduate degrees in science, ranging from language barriers and socioeconomic hurdles to difficulty finding housing. There is also the cultural challenge of adjusting to a Jewish-majority environment, and concerns about integrating into graduate-level academia.



Ameera Egbaria, who did her undergraduate degree at the Open University, worked on protein evolution and design in the lab of Prof. Dan Tawfik in the Department of Biomolecular Sciences. Ameera says she felt she'd joined a new family, "one where everyone works together, helps each other, and gets together just for fun." She worked with a lab technician and a postdoctoral fellow who taught her the lab's methods and everything she needed to know in order to run experiments independently.

A new program is helping to staunch this loss of talent—and offer a path forward for Arab undergraduate students considering careers in science.

In 2018, with the support of the Neubauer Family Foundation of Philadelphia, the Weizmann Institute's Feinberg Graduate School (FGS) launched a new summer program aimed at Arab-sector undergraduate students studying biology, chemistry, or physics. Headed by Prof. Prof. Lia Addadi from the Department of Structural Biology (and former FGS Dean, as well as current Advisor to the President on Women in Science), the Neubauer Young Scholars Program places these students in Weizmann laboratories for a two-month immersion into scientific research. The goal is to cultivate their interest in science and encourage them to pursue graduate studies in the sciences at both the MSc and PhD levels—ideally at the Weizmann Institute. Ultimately, it is hoped, this initiative will help strengthen the base of Arab-Israeli scientists and enrich the entire Israeli scientific community.

"Trying to encourage greater enrollment of Arab-sector Israeli students in PhD programs doesn't tackle the under-enrollment problem early enough," says Prof. Addadi. "You have to expose students to scientific research while they are still at the undergraduate level." While she notes that many Weizmann Institute investigators were open and eager to host summer students, Prof. Addadi credits the Neubauer Family Foundation as providing the essential "catalyst" to make that concept a reality.

"Strong role models accelerate talent development," said Joe Neubauer of the Neubauer Family Foundation. "The scientific success of every Arab PhD ignites the academic aspirations of dozens more. Research labs teach students from various cultures to work together. They examine and verify or disprove hypotheses. The scientific method enables students to reassess inherited social bias as well. Science is an important pathway to peace and democracy."

Students

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Getting the word out

The program was promoted via social media in Arabic and in other print media, inviting interested students to attend an Open Day on campus, and the Council for Higher Education also publicized the program's launch.

Out of 29 applicants to the inaugural summer 2018 program, nine were accepted and seven



Rawan Zoabi, who did her undergraduate degree at the Technion-Israel Institute of Technology, was unique among her peers in that she chose to participate in the program during the course of the academic year, rather than in the summer. From February through June—throughout the coronavirus lockdown—she conducted research on cancer immunotherapy in Dr. Rony Dahan's Department of Immunology lab. Rawan says that the "inspiring and insightful" experience helped her discover her "passion for research." She will begin her MSc studies at the Weizmann Institute this fall.



Shahd Ashouokhi completed her undergraduate degree at Hadassah Academic College, and was a Neubauer Scholar in the lab of Prof. Zvulun Elazar in the Department of Biomolecular Sciences. "I did not expect this to happen, but the program has changed my life," she says. When Shahd first saw the Facebook ad, she didn't think it would suit her: Weizmann was far from home, out of her comfort zone, and she wondered whether she would even qualify. But with the encouragement of her good friend Sameeha (whom Shahd encouraged to apply in turn), she signed up on the last day. When FGS Academic Secretary Dr. Ami Shalit called to invite her to the Institute, she had a sense that the Weizmann Institute could be a warm home.

Shahd found the concept of 'autophagy'—the cell's internal waste-removal system—interesting, and Prof. Elazar's lab was especially welcoming. Doctoral student Oren Shatz took a week out of his own experiments to teach her about the autophagy process, and continued to guide her through the lab's methods and "thinking like a scientist," she recalls. Shahd is now an MSc student at FGS.

completed the program. The following year, 25 students applied and 11 were accepted. The majority of the participants are women; in fact, the latest cohort comprised nine women and two men.

While the first year of the program produced positive outcomes—as evinced by feedback from both the students and the scientists in whose labs they worked—the results of the second cohort are remarkable. One of the students, Shahd Ashoukhi, enrolled in the Weizmann Institute’s MSc program in the fall of 2019, and four others will be enrolling as masters’ students this fall. All five are women.

Science without limits

Prior to the program, Shahd says she couldn’t have imagined leaving Jerusalem and her family to explore science—but now she has learned that science “has no limits,” she says. In time, her family, though initially anxious about the program, came to support her dreams.

The four newly enrolled MSc students—some of whom have already stated an interest in pursuing a PhD when the time comes—all sound the same refrain: Few of their peers in the Arab sector have heard of the Weizmann Institute, nor of the opportunity that awaits them to study science as a means to improve the world. Each one expresses gratitude to the Neubauer Family Foundation, and emphasizes the importance of the mentorship she received not only from the principal investigators, but also from other lab members.

Sameeha Mittwali completed her undergraduate degree at Hadassah Academic College. Having nudged Shahd into applying to the Neubauer program, as well as another friend, Carine Joubran, Sameeha applied herself. Placed in the lab of Prof. Yosef Yarden in the Department of Biological Regulation—at whose achievements in cancer research she marveled—Sameeha learned, as she puts it, that “science is an international language, especially in the Yarden lab,” where members came from all corners of the globe. Her own mentor, postdoctoral fellow Dr. Donatella Romaniello, hails from Italy.

Prof. Addadi concurs, noting that good mentorship is essential to students’ success, and that Weizmann Institute labs tend to have a “family tradition of caring for new members.”

This is all music to Prof. Michal Sharon’s ears. Asked by FGS Academic Secretary Dr. Ami Shalit to oversee the placement of life sciences applicants into specific Weizmann labs starting with the 2019 summer program, Prof. Sharon worked to match the students’ interests to appropriate laboratories. (Prof. David Margulies oversaw the process for applicants interested in chemistry and physics.) She enjoyed hosting one of the students in her own lab in the Department of Biomolecular Sciences—Bishara Hend, another female student who is now enrolled in Bar-Ilan University’s MSc program.

“It’s especially exciting that we supported so many Arab women through this program,” says Prof. Sharon, noting how underrepresented these women are in the sciences. Given her experience with the Neubauer Young Scholars Program, Prof. Sharon was chosen to represent the Weizmann Institute of Science in a new initiative led by the Israel Forum for the Advancement of Women in Academia to promote the recruitment of minority-sector women into graduate study.

Although FGS was forced to cancel the summer 2020 program owing to the global coronavirus outbreak, Dr. Shalit, Prof. Addadi, and everyone else involved are looking forward to continuing this successful program next summer, and to welcoming the new students to campus.

Carine Joubran, also from Hadassah Academic College, was a Neubauer Scholar in Prof. Moshe Oren’s cancer research lab in the Department of Molecular Cell Biology, whose prestige, she admits, initially intimidated her. She was heartened by the encouragement and camaraderie of the Oren team. Having thoroughly enjoyed her taste of lab life, Carine continued working part time as a lab technician in the Oren lab after the program ended. Prof. Oren has done groundbreaking research on a key player in molecular cancer control, the tumor suppressor gene p53.

Opinion

54–55

An ode to science literacy: confronting COVID-19



Dr. Liat Ben-David

In our inaugural Opinion column, in which Weizmann experts offer their view on a topical and timely issue, Dr. Liat Ben-David, CEO of the Davidson Institute of Science Education, addresses the value of science literacy.

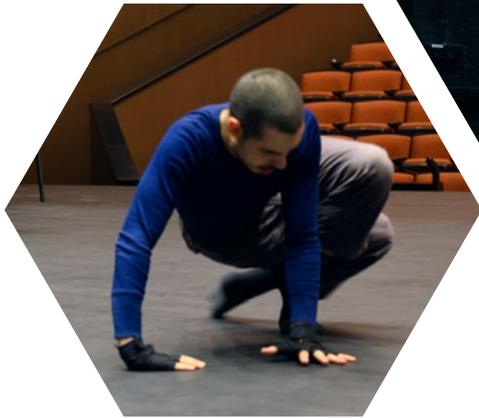
Where did COVID-19 come from? Why is it dangerous? What does it do to our bodies? Who is most vulnerable? This is just a small sampling of the basic 'wh'-questions that the Davidson Institute of Science Education has received by the thousands in recent months from anxious people in Israel and beyond. In search of informed answers around the coronavirus, people of all ages and across all sectors of society are aware that the most reliable answers will come from science. We've all had to become amateur epidemiologists as we navigate our lives, and have pinned our hopes and expectations on the scientific and medical community for a solution; it won't come from anywhere else.

More than ever before—in comparison to pre-pandemic times—grappling with this disease has proven the relevance of science to everyday life. It is clearer than ever that a baseline in scientific knowledge is essential for us, as individuals and societies, to make informed, responsible, health-promoting, and even life-saving decisions. Informed citizens will make sure to hold their governments and politicians to high standards and ensure that they make health a first priority.

But there's an added challenge: In an era of ubiquitous information available for all, it's easy to get lost in the weeds. We must know enough to be able to separate truth from fiction and advocate for ourselves, our families, and our communities. The answer lies in science education. This is precisely the agenda of the Davidson Institute: engaging students, teachers, families, and the general public in science, through educational programming and the dissemination of reliable scientific information. Our mission is for all segments of society to have access to the latest knowledge. We also hope that they develop a lifelong love for science.

When the coronavirus hit, the Davidson Institute was well positioned to offer learning solutions. With expertise in remote learning, we transformed most of our face-to-face activities into the digital arena, and developed new, exciting science activities as school children found themselves stuck at home. We launched 'Stuck at Home', a website with an endless array of scientific educational activities in four languages. The response was overwhelming. We quickly had more than 250,000 unique visitors per day. Educators who previously relied on online learning tools as curriculum-enhancers now rely on them as an integral part of instruction and learning, and the Davidson Institute has become a go-to source.

When relief is found in a solution (or solutions) for the coronavirus, I hope and believe the silver lining will be a deeper appreciation for science and for science education.



When science meets dance

Residency program creates a conversation between science and choreography

by TALI GALSKY

When people say to Shahar Binyamini that they do not understand dance, he responds by saying that he doesn't either. Coming from a prolific choreographer and former member of the Batsheva Dance Company, whose dance career spans over 15 years, this is a surprising statement. "Dance isn't a language you need to learn; it is beyond a language. It runs deeper than words." Likewise, he says, science is a dive into the unknown.

On stage at the Weizmann Institute's Michael Sela Auditorium, he is working with dancers on a new project, as part of a residency program supported by the Braginsky Center for the Interface between Science and the Humanities.

The program brings together scientists and artists for a mutual inspiration. In Shahar's case, he comes as a choreographer to create dance through an interaction with an engaged audience of scientists who provide input and feedback.

Shahar's residency, which involves visits to campus over the course of eight months in 2020, includes lab visits and conversations with scientists about their research. Ten Weizmann scientists watch his rehearsals and share their emotional reaction to the dance with Shahar and the other performers.

Dance and science are seemingly worlds apart. Science is verbal, relies on precise protocols, and presents the world with its outcomes in a commonly accepted language. Dance, on the other hand, is a physical and sensual profession, whose products are mainly visual and auditory. But both involve

Art and Science

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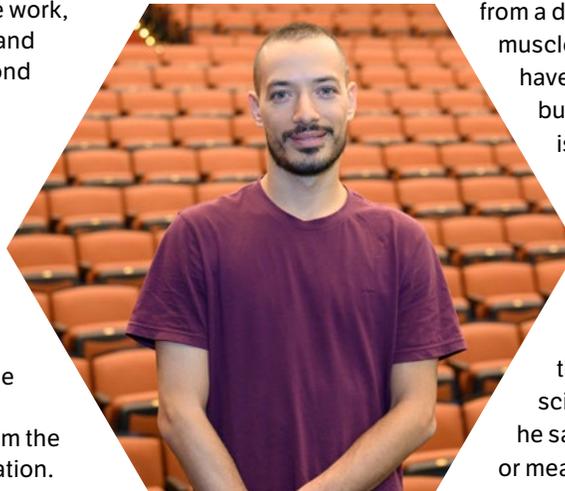
self-discovery, perseverance, continuous learning, and the presentation of outcomes to the world.

“We are similar in that we are people who are interested in creating and telling a story,” says Shahar. “In dance, it is the human body that moves in space with emotions, wishes, desires, abilities, difficulties, pains. I deal with all of these through movement.

“The campus is a beautiful, magical place,” he says. “Entering it is stepping into a bubble with no time and no buses, only trees and quiet. The responses we get from scientists who come to the rehearsals exhibit curiosity and are intriguing. They have told me how they feel about the work, which helps me better understand what I want to get from it.” Beyond his Weizmann residency, “I often invite people outside my field—non-dancers—to my rehearsals. I create for people and am interested in what people feel, what their interpretation is.”

This is Shahar’s second project at Weizmann. In 2015, he led an improvisation workshop initiated by Prof. Atan Gross from the Department of Biological Regulation.

Prof. Ofer Feinerman, from the Department of Physics of Complex Systems, studies the behavior of ants in a group and who attended that workshop five years ago, went to observe one of Shahar’s recent rehearsals at the Sela Auditorium. “The interaction between the two dancers on stage illustrated to me the wonder of the encounter of two people,” says Prof. Feinerman. “The fact that humans manage to connect with each other without sacrificing their complexity and their variability is surprising. Such magic between two individuals is rare—and in a large group, becomes virtually impossible. I think what enables ants to function in large groups is their simple communication and relatively predictable responses.”



 *Shahar Binyamini*

“Science is based on the attempt to understand which questions we are interested in asking and then finding the right ways to examine and approach them,” he says. “There is no recipe for all of these—creativity is pivotal. Similarly, in art, you often look at something and try to translate it into another language—a different angle to reality.”

Noa Dahan, a postdoctoral fellow in the Department of Molecular Genetics who watched one of the rehearsals, concentrated on the dancers’ movement. “I was surprised to find that a person’s movement can be so fragmented, almost pixelated,” she recalls. “As an audience, we usually watch dancers from a distance, not seeing how the muscles stretch. We always seem to have complete control of the body, but up close, I could see that there is something that the body itself produces, independently of the dancers.”

The residency program, says Shahar, will have unknown benefits—in the same way that basic science does. “Inspiration,” he says, “cannot be quantified or measured.”

“Scientists and artists both build new worlds driven by curiosity and creativity,” says Prof. Yitzhak Pilpel, head of the Braginsky Center, which also supports grants to Weizmann scientists doing research related to the nexus of science and the humanities. “But the joy of doing is mixed with questions regarding the justification of their products, for instance: Is my research topic interesting enough? If so, what makes it worthy—being new, controversial, or moving? They also examine themselves while examining the world. In addition, scientists and artists work in fields that reveal more than meets the eye, and therefore they need to learn how to use the unknown as a tool for creativity.”

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