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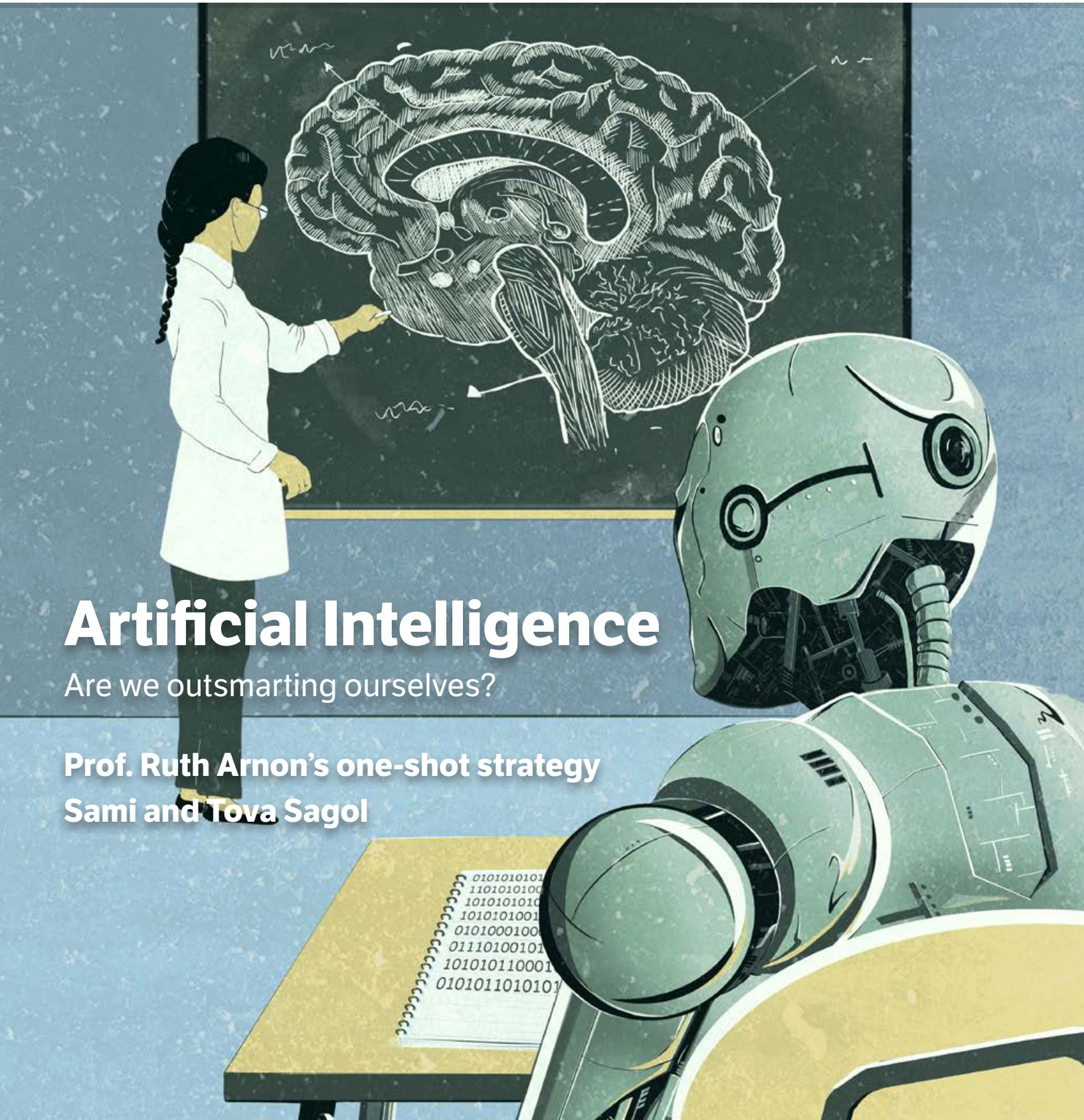

Artificial Intelligence

Are we outsmarting ourselves?

Prof. Ruth Arnon's one-shot strategy

Sami and Tova Sagol

From the President

Dear Friends,

Technology has vastly changed the way we live our lives today, as compared to several decades ago—or even five years ago. It has revolutionized the way we work, how our medical ailments are diagnosed, how our cars keep us safe, and the way in which scientific research is conducted. But what if this revolution is just the beginning? The age of artificial intelligence—which integrates a deep understanding of how the human brain works with feats of computer engineering—is perhaps just at the starting gate.

In launching a new Institute for Artificial Intelligence, the Weizmann Institute is creating a platform for our scientists to invent, plan for, and safely steward in the coming age of AI—ensuring that the next age of computer science will do good for humanity, and preclude a dystopian world in which machines replace humans in all areas of life. You may read about our efforts in AI in this issue, among many other exciting developments in science.

I would also like to turn your attention to stories on Sami and Tova Sagol, who recently generously funded the new Sagol Institute for Longevity Research and are funding a new collaboration with MIT; and on Ted Teplow and David Teplow, who have their own personal ties with the Institute—and a very special family connection to its very origins.

Our 69th Annual General Meeting of the International Board in November was a big success, and I'm looking forward to the Global Gathering of the Weizmann Institute, which will take place in Boston in early June.

Sincerely,

Prof. Daniel Zajfman
President, Weizmann Institute of Science

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Sting operation

How malaria parasites trick the immune system

Malaria parasites are known to be master manipulators, capable of making drastic changes during their lifecycle that promote their survival. But now, research by Dr. Neta Regev-Rudzki of the Department of Biomolecular Sciences has revealed a previously unknown defense strategy that is downright devious: malaria parasites generate "decoy" messages that misdirect the body's immune response. This provides a critical window of opportunity during which the parasites can replicate freely with no immune involvement, making malaria infection more difficult to contain.

In her previous research, Dr. Regev-Rudzki discovered that malaria-infected red blood cells communicate by exchanging vesicles—tiny, membrane-bound sacs—that contain a specific collection of genes, RNA, and proteins. This vesicle-encased cargo throws the normal immune response off-balance, allowing the parasite to live on, and to infect again.

Dr. Neta Regev-Rudzki

In the current study, performed in collaboration with Prof. Andrew G. Bowie of Trinity College Dublin and other researchers, Dr. Regev-Rudzki identified the decoy messages' cellular recipient: immune cells called monocytes which normally form the body's first line of defense against foreign attack.

Within the first 12 hours of infection, malarial parasites generate DNA-filled nanovesicles that penetrate monocytes. This causes other immune mechanisms to rush to the monocytes' defense, leaving the malaria parasites safe to replicate and spread. Dr. Regev-Rudzki and her team identified the molecule responsible for trumpeting out the parasites' devious message: a protein that goes by the acronym STING, which is activated during nanovesicle infiltration of the monocytes.

"We knocked out the gene that codes for the STING protein, and as a result, the chain of molecular reactions that generated the misleading signaling was interrupted," says Dr. Regev-Rudzki. "We discovered a subversive strategy used by the malaria parasite to thrive in human blood, as well as a way to block it."

Further studies related to this mechanism may point the way toward new clinical therapies for malaria, a dreaded disease that kills an estimated half-million people annually.

Science Briefs

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Autism and the smell of fear

Is there an odor associated with fear? A recent study at the Weizmann Institute not only confirms that there is, but also reveals that individuals with autism perceive fear-associated odors—like sweat from an anxious skydiver—in a way that is different from how smells are experienced by individuals who are not on the autistic spectrum.

It has long been recognized that certain emotions—including happiness, aggression, and fear—are associated with specific smells produced by the body, and that people respond to such odors, even if they are not consciously aware of their existence. Prof. Noam Sobel and his team in the Department of Neurobiology set out to test whether, like other forms of social communication, this "smell sense" is disrupted in the case of autism.

Working with a group of participants on the high-functioning end of the autism spectrum who volunteered for the study, as well as a control group of individuals without ASD, the scientists began by verifying that all participants had a similar ability to sense and identify odors that can be consciously detected. Then, the two groups were exposed to an odor that went under the olfactory radar: the smell of fear.

Prof. Noam Sobel

Prof. Sobel and his team exposed the study participants to two different samples of human sweat. In the first sample, the sweat was collected from people while they were exercising, in a fear-free environment. The second sample was gathered from the same people while they participated in an activity that is highly correlated with fear: skydiving classes.

Presented with the "fear-neutral" and "fear-enhanced" sweat, the two groups of participants responded in two very different ways. In the control group, smelling the fear-induced sweat produced measurable increases in skin conductivity—a physiological response associated with heightened anxiety in which the skin momentarily becomes a better conductor of electricity. (This is the same difference in conductivity that provides the "true or false" indication on lie detector tests). Exposure to the sweat gathered under calm conditions did not trigger this response in this same control group.

Participants with autism, on the other hand, responded in the opposite manner: fear-induced sweat lowered their fear responses, while the odor of "calm sweat" measurable raised anxiety levels.

In a separate set of experiments, Prof. Sobel and his team evaluated how the unconscious perception of fear-associated odors affected participants' response to social cues. The scientists created talking robotic mannequins that emitted different odors through their nostrils. These mannequins gave the volunteers—who were unaware of the olfactory aspect of the experiment—different tasks designed to evaluate the level of trust that the volunteers placed in the mannequins.

The mannequins emitted the same sweat-based odors as in the previous experiment, and again, they found that the response to the smells was reversed in autistic participants as opposed to the control group. The ASD participants placed more trust in the "fear smell" mannequin, as opposed to the mannequin that exuded a "calm smell." These results suggest that people with ASD can misread olfactory cues, something that may contribute to their confusion about social cues.

Prof. Elisabetta Boaretto

European artists' Middle Eastern roots

The prehistoric culture that left us spectacular cave paintings, exquisite statuettes and expertly-crafted bone tools across western Europe seems to have sprung from an earlier, similar human culture of the Middle East. What's more, according to researchers at the DANGOOR Research Accelerator Mass Spectrometry (D-REAMS) Laboratory at the Weizmann Institute of Science, once the population that produced these early artists arrived in Europe, some individuals executed a U-turn, and high-tailed it back to the Near Eastern corridor.

Studying northern Israel's Manot cave, which was occupied for tens of thousands of years, D-REAMS Director Prof. Elisabetta Boaretto and her colleagues discovered evidence of two different populations of early humans—the Ahmarians, who crafted their tools from stone only, and the Aurignacians, who also made tools from bone. Archaeological evidence from progressively younger sites indicates that the Ahmarians moved out of the Middle East, and slowly evolved into art-making Aurignacians as they made their way to Europe. What, then, is the source of the bone-based Aurignacian tools found in the Israeli cave?

Radiocarbon dating provides evidence that while expanding through Europe, some Aurignacians returned to the Middle East and that, in some cases, they reoccupied the same caves their ancestors had used thousands of years before. The layered findings—including stone and bone tools, as well as charcoal remains from the ancient fireplace—confirm that the Middle Eastern Ahmarians indeed pre-dated the artistically inclined European Aurignacians. But they also provide evidence for a back-migration from Europe, suggesting that, even in the ancient world, adventurers who embark on an artistic path sometimes have second thoughts, give up, and go home.

Scallop secrets revealed

While some invertebrates can only sense light and dark, scientists have long suspected that the scallop—a sea creature that has no brain, but hundreds of eyes, each containing not one, but two retinas—uses visual cues to avoid underwater predators. Now, a postdoctoral fellow at the Weizmann Institute has revealed a hidden secret of the scallop eye: a dual-action mirror that bears a striking resemblance to the curved, segmented mirrors of reflecting telescopes.

The scallop's ocular mirror is made up of millions of intricately layered crystals of guanine—the same material that gives fish scales their silvery glint. Postdoctoral researcher Dr. Benjamin Palmer recently discovered that scallops produce exquisite layers of a shape of guanine crystal never seen before in nature: a flat square.

The study was performed with Profs. Steven Weiner and Lia Addadi in the Department of Structural Biology, as well as Prof. Dan Oron of the Department of Physics of Complex Systems.

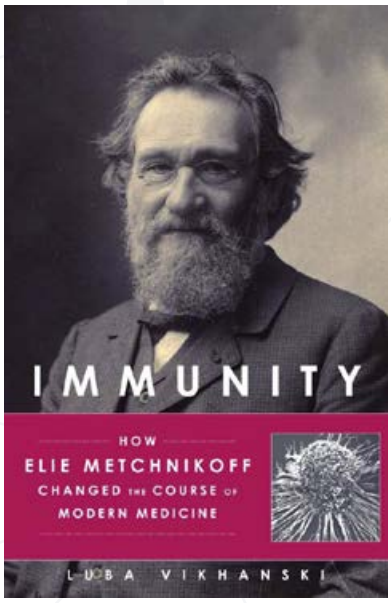
Dr. Palmer determined how light passes through the mirror, then bounces back, with one retina receiving information about what's straight ahead, and the other getting a better view of the eye's periphery. This divided focus may give scallops a survival advantage, allowing them to watch for predators while foraging for food. Dr. Palmer's research gives the scientific community something else: new knowledge about how the scallop's specialized crystals manipulate light—findings that might eventually make their way into engineered materials, or novel imaging systems for watery environments.

Next-Gen Immunology Conference

The Next-Gen Immunology Conference, held at the David Lopatie Conference Centre Feb 11-14, drew 600 scientists and students from across the globe. It was the second such conference, and now one of the world's most important immunology conferences. It was organized by Profs. Ido Amit and Eran Elinav of the Weizmann Institute's Department of Immunology (pictured here with Dr. Joao Monteiro, Chief Editor of *Nature*). Keynote speakers were Prof. James Allison from M.D. Anderson Cancer Center and Prof. Ruslan Medzhitov of the Yale School of Medicine.

How the global yogurt craze began

Lately, some of the hottest stories out of the Weizmann Institute refer to how the balance of microbes in the human intestine—collectively referred to as the microbiome—impacts human health. Now, the century-long history behind these discoveries has been presented in an award-winning book by Weizmann Institute staff member, Luba Vikhanski, entitled *Immunity: How Elie Metchnikoff Changed the Course of Modern Medicine* (Chicago Review Press).



Ms. Vikhanski describes the theory of immunity put forward in the early 20th century by Russian-born biologist Elie Metchnikoff, who pioneered the scientific study of intestinal bacteria and aging. Dr. Metchnikoff's controversial theories on longevity sparked a global craze for yogurt, based on the idea that the beneficial bacteria used to make yogurt and other types of sour milk could prolong life by counteracting harmful bacteria in the human intestine. Dr. Metchnikoff, who became known as the "Father of Innate Immunity," was awarded the 1908 Nobel Prize.

A veteran science journalist who authored two previous books, Ms. Vikhanski's latest book was favorably reviewed in *Nature* ("an engrossing scientific biography"), *Kirkus Reviews*, and elsewhere, and was cited for excellence in the 2017 Medical Book Awards of the British Medical Association.

One fish, two fish

To marine biologists who monitor the gulf between Eilat and Aqaba in the Red Sea, population counts of the tiny larvae that develop into mature fish are an important indicator of ecological health. But with more than 500 fish species known to frequent the gulf's coral reefs, and with the dispersal of fish larvae governed by chaotic underwater currents, identifying and tracking individual species has been nearly impossible—until now.

Prof. Rotem Sorek of the Department of Molecular Genetics has developed a new "barcoding" technique that allows scientists to monitor not only which larvae species are present in the Gulf of Aqaba, but how many of each, at what time of year, and at which depths. Collaborating with marine biologists from Tel Aviv University and Ben-Gurion University whose previous research involved inspecting larvae under a microscope and counting spines, Prof. Sorek's new technique was based on the sequencing of larval genomes. This work was conducted at the Stephen and Nancy Grand Israel National Center for Personalized Medicine on campus.

To gather the relevant data, the scientists took up diving in the Gulf, clipping the fins of adult fish for DNA analysis. Prof. Sorek and his team then used a "metagenomics" technique to match this adult genetic material to larvae, ultimately achieving barcodes for around 80% of the fish species.

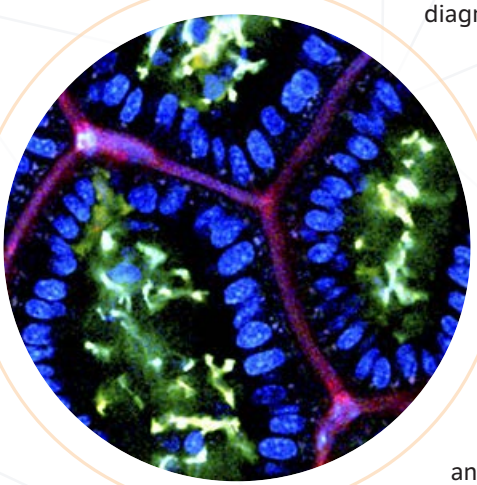
"Although the initial process was a bit arduous, we now have an excellent tool for monitoring the health of the reef ecosystem, and other reef researchers may follow suit," Prof. Sorek says.

The Human Cell Atlas Project

As scientists scramble to outmaneuver the diseases that threaten human health, a comprehensive roadmap of the body's healthy cells may soon help steer them in the right direction.

Some 38 international research teams are joining forces to map and characterize every cell in the human body in a project called the Human Cell Atlas. The project is funded by the Chan Zuckerberg Initiative, the brainchild of Mark Zuckerberg and Priscilla Chan. Among the investigators partaking in this prestigious international project is Prof. Ido Amit of the Weizmann Institute's Department of Immunology.

"The huge revolution taking place in the development of new technologies is helping us realize our vision: the creation of a complete reference of all human cells, which will be a critical reference map similar to chemistry's periodic table of elements," Prof. Amit says. "This will allow us to understand how healthy and diseased cells work, something that will ultimately aid in the development of new diagnostics and drugs."

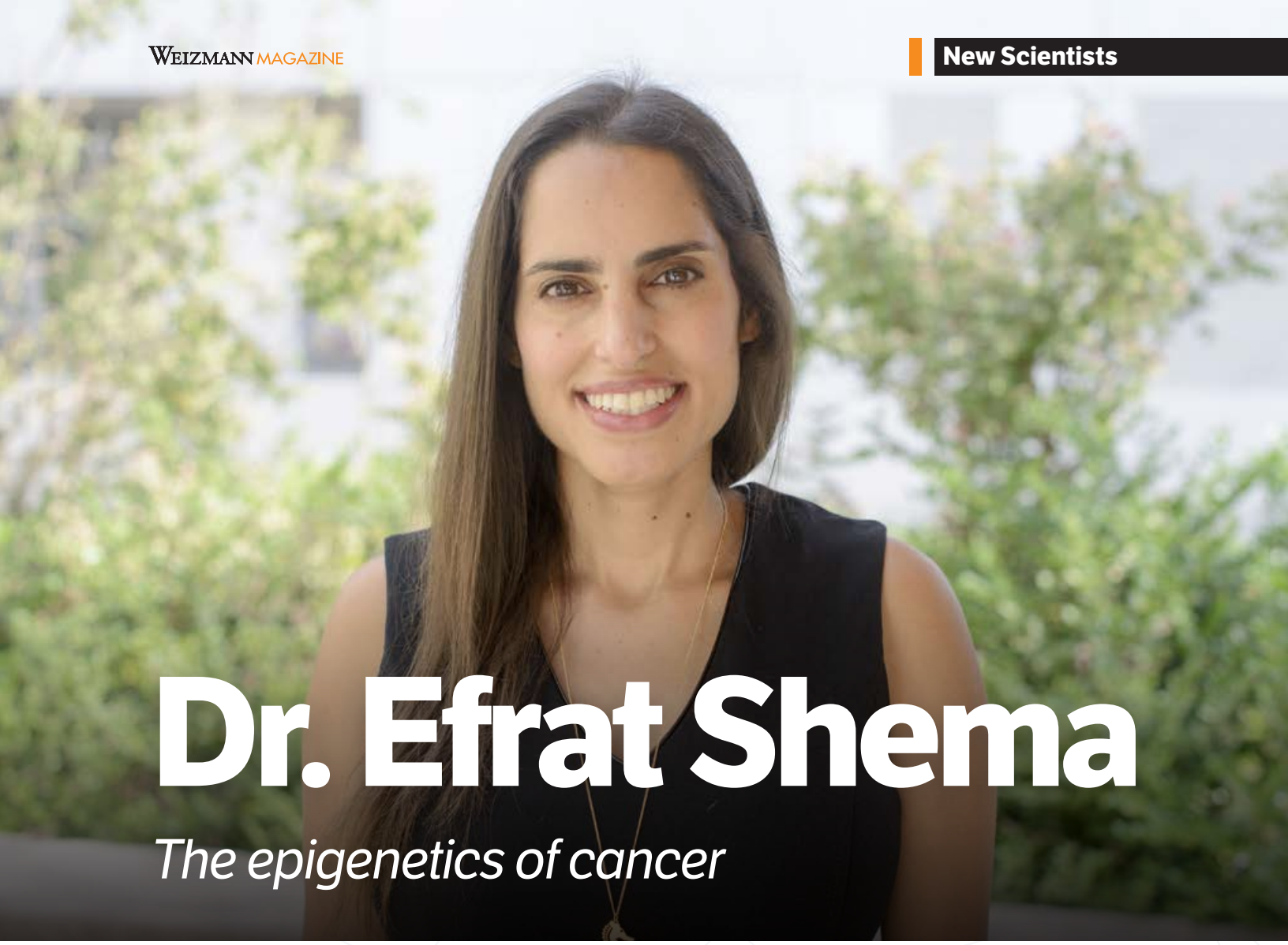


Dendritic cells in the small intestine

Prof. Amit's team is the sole Israeli group in the program, and one of 12 teams outside the U.S. Together with Prof. Amos Tanay from the Department of Biological Regulation and Department of Computer Science and Applied Mathematics, he is developing technologies to help map the cells of the bone marrow and blood, The scientists hope to improve the diagnosis and treatment of various blood cancers, such as multiple myeloma and lymphoma, by identifying rare cells and their corresponding genes implicated in various malignancies.

New magnet for brain research

At right, the new 7-Tesla MRI is being swung into its new home in the Lubin Building where it will begin its new role as the centerpiece for the Azrieli National Institute for Human Brain Imaging and Research headed by Prof. Noam Sobel. The heavy instrument required building a special skylight on the building's roof in order to insert it. The Institute was inaugurated on March 6 with guest speaker Prof. John Gabrieli of MIT's McGovern Institute for Brain Research.



Dr. Efrat Shema

The epigenetics of cancer

Within the nanoscopic depths of the human cell nucleus, a two-meter spool of DNA is tightly coiled around tiny, ball-shaped nucleosomes. Many scientists are hard at work understanding these nucleosomes, with the knowledge that they may play a pivotal role in regulating gene expression and the development of diseases like cancer.

Dr. Efrat Shema works with the histone proteins making these nucleosomes, which are collectively responsible for packaging and organizing DNA strands. As these proteins undergo modifications, they can alter the accessibility of different regions of the DNA and dictate which genes will be expressed. Such modifications are a critical part of the regulatory systems that determine how stem cells differentiate into specialized cells, how cancer cells avoid chemotherapy, and how tumors survive.

"We have the same DNA in all of our cells, but every cell is different," Dr. Shema explains.

New Scientists

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During her postdoctoral fellowship, she developed a revolutionary technique that could record the position and modification state of each histone, using fluorescently labeled antibodies and a type of technology called single-molecule total internal reflection microscopy.

When combined with single-molecule DNA sequencing technology, her approach revealed the changes occurring in thousands of individual histones. Zeroing in on this basic mechanism is particularly relevant to science today, due to the involvement of these proteins in disease development. For example, Dr. Shema explains, more than half of all cancers have known mutations in the genes that encode for proteins that regulate DNA packaging.

Dr. Shema aims to continue studying such basic mechanisms of cancer biology, as well as develop new tools that she hopes will "pave the way for novel things to be discovered," she says. Among her specific plans include the generation of the first-ever genome-wide map of combinatorial histone and DNA modifications. Such a map could provide insights into the epigenetic changes—those changes that alter gene activity without modifying the DNA sequence—which are involved in stem cell differentiation and cancer cells.

Dr. Shema also plans to analyze the pattern of histone modifications in pediatric glioma, a type of brain cancer characterized by a high occurrence of mutations in the genes encoding histones. Another goal of her lab is to examine the cell-free nucleosomes that circulate in the bloodstream, whose DNA content and tissue of origin remains difficult for scientists to detect. It is Dr. Shema's hope that her work could lead to a new test that could overcome these barriers, providing early detection of various types of cancers.

Both she and her identical twin sister, Dr. Reut Shema, earned PhDs from the Weizmann Institute.

"In a scientific world that is still influenced by gender biases, it is critical that all girls have the same opportunities as we did to pursue their desired career paths from a young age," she says.

As a youngster, it was this mentality, coupled with her curiosity and aptitude for biology, that fueled her own path forward, she says. While she dabbled with the idea of pursuing piano and music professionally, she ultimately chose to continue studying the sciences after focusing on biology in high school.

"I like the process of doing research and asking questions, devising hypotheses, trying to design experiments," she says. "You keep evolving when you do research."

Born and raised in Rehovot, Dr. Shema completed her MSc and PhD at the Weizmann Institute in 2007 and 2012 in molecular cell biology, after earning her BSc in life sciences at the Hebrew University in Jerusalem in 2005. She moved to Boston in 2012 as a Fulbright Scholar, conducting postdoctoral work under Dr. Bradley Bernstein at Massachusetts General Hospital, Harvard Medical School, and the Broad Institute of MIT and Harvard.

During her PhD studies at the Weizmann Institute, Dr. Shema received a prestigious Adams Fellowship from the Israel Academy of Sciences and Humanities, as well as the Otto Schwartz Prize for Excellence and a UNESCO-L'OREAL national award for young women in life sciences. As an undergraduate at the Hebrew University, Dr. Shema participated in the national Amirim program for outstanding students and received the Dean's Scholar award each year.

Dr. Assaf Gal

Materials of the sea

Dr. Assaf Gal is entranced by the complex beauty of the delicate shells created by mineralizing marine algae.

"The minerals that simple unicellular organisms form out of seawater outperform any man-made synthetic material, and we want to know how they do it," says Dr. Gal, whose research has implications for global warming, medicine, and beyond.

Coccolithophores—a dominant family of marine algae—build their elaborate structures from calcium carbonate, while diatoms, another common algae, create their geometric wonders out of silica. These two families of unicellular organisms play a pivotal role in the marine ecosystem and together they carry out nearly half of the planet's total photosynthesis. They also have a critical role in the global carbon cycle and are the building blocks of sedimentary rocks formed by ancient seas.

Dr. Gal is especially intrigued with trying to understand how these minute creatures can build such exactly ordered and complex structures. The biomineralization process—the hardening or stiffening of minerals—involves exquisite biological control over the formation of crystals and the growth of shells or bones. However, trying to follow the biomineralization process in living cells is highly challenging since the biochemical events often occur within cells, and standard imaging and analytical techniques are incompatible with the study of the unstable, soluble, and short-lived mineral phases that occur along the way.

Dr. Gal is taking advantage of the rapid development of new molecular biology tools and improved *in vivo* imaging capabilities. Using powerful electron microscopes, he follows the cellular pathways that lead to the accumulation

of calcium in coccolithophores and silicon in diatoms. During his postdoctoral research at the Max-Planck Institute in Germany, he discovered a previously overlooked organelle where calcium is stored in intracellular reservoirs in coccolithophores. This intermediary step helped fill one of the gaps in understanding how these single-celled algae convert seawater into elaborate mineral structures.

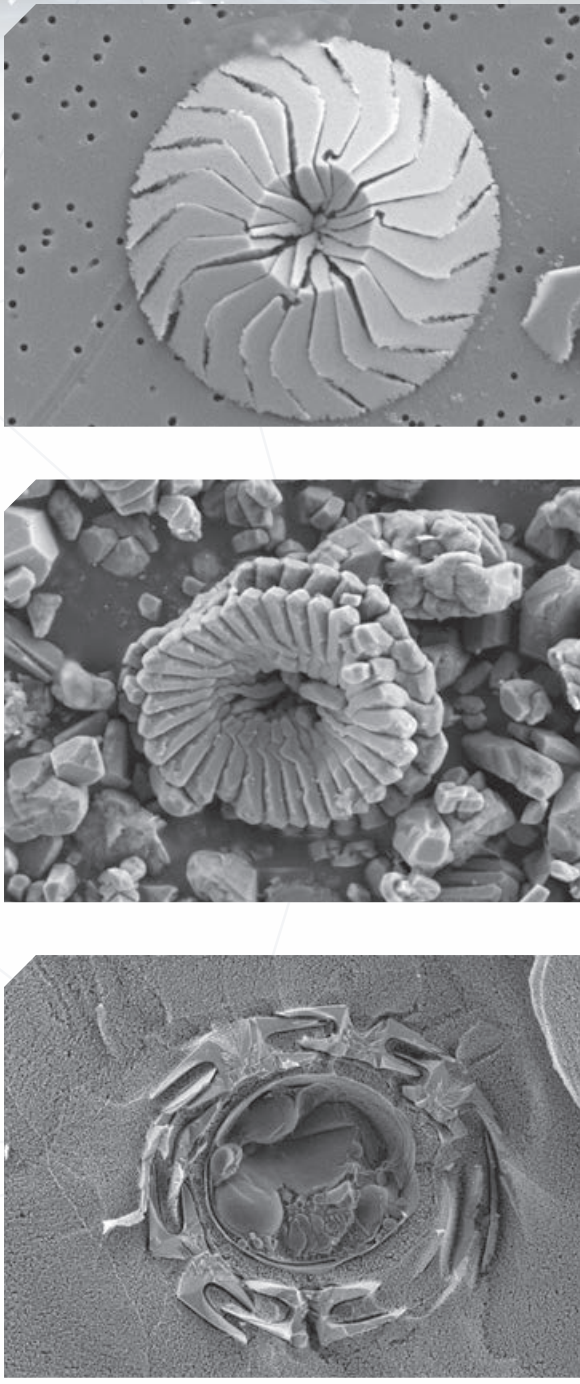
Beyond intrinsic beauty

Many global warming studies focus on the colorful coral reefs, but compared to marine algae, these reefs form only a tiny part of the ocean's ecosystem. Dr. Gal says that "understanding the effects of warming or acidification on diatoms and coccolithophores may yield even more important insights." These are some of the challenges he plans to work on in his new lab at the Weizmann Institute.

Beyond the intrinsic beauty and global role diatoms play in the ecosystem, scientists are beginning to find new applications for these bio-engineered silica structures. For instance, encapsulating an enzyme or drug into a diatom shell can create a very stable drug delivery system that is cheap to produce. Meanwhile, chemists are also starting to investigate complex silica and calcium carbonate structures as mesoporous surfaces (containing pores of 2 to 50 nm in diameter) on which to conduct very efficient catalytic reactions. Biomineral structures are also being explored for their optical and electrochemical properties.

Dr. Gal was born in Jerusalem. He earned BAs *magna cum laude* in biology and *summa cum laude* in geology at Ben-Gurion University of the Negev in 2008. He completed his MSc in 2010 and his PhD in the Department of Structural Biology at the Weizmann Institute in 2014, working jointly with Profs. Lia Addadi and Stephen Weiner. From 2014 until joining the Department of Plant and Environmental Sciences at the Weizmann Institute in February 2017, Dr. Gal studied biomineralization in algae as a postdoctoral researcher at the Max-Planck Institute of Colloids and Interfaces and the Max-Planck Institute of Molecular Plant Physiology in Potsdam, Germany.

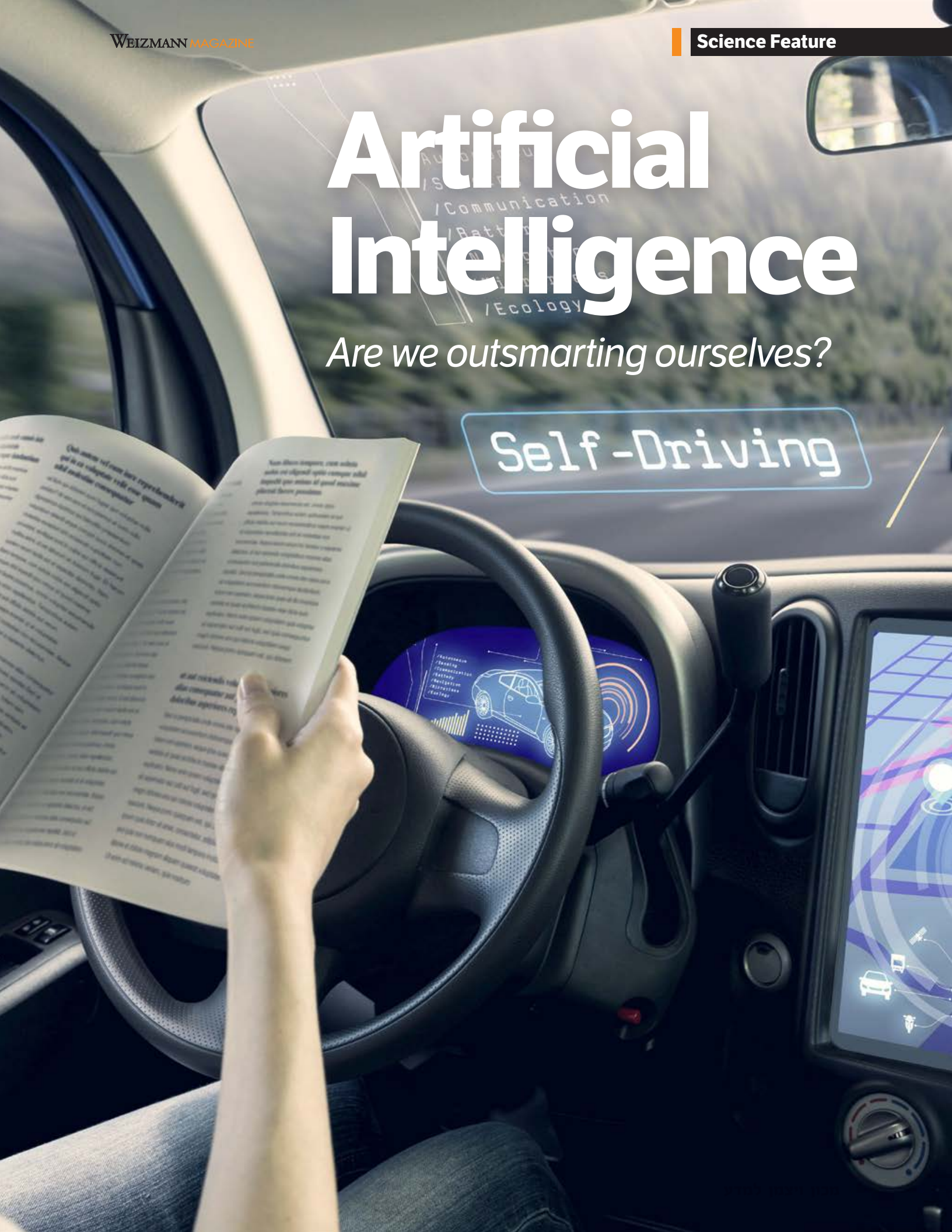
He won several departmental awards for excellence as an undergraduate at Ben-Gurion University. He was awarded a Clore Foundation fellowship for excellent PhD students from 2011 to 2014 and was invited as a student to attend the 63rd Lindau Nobel Laureate Meeting in 2013. Upon graduation, he was awarded the Shimon Reich Memorial Prize of Excellence awarded by the Feinberg Graduate School at the Weizmann Institute. Dr. Gal was awarded an Alexander von Humboldt Postdoctoral Research Fellowship in 2015 and 2016.



Coccolithophores and their minerals

Artificial Intelligence

Are we outsmarting ourselves?



Science Feature

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Explosive developments in artificial intelligence (AI) research are reaching a tipping point. Similar to how, in the 19th century, the steam engine augmented what could be achieved through muscle power alone, in the very near future it is expected that artificial intelligence will augment capabilities—such as contextual analysis and values-based decision-making—traditionally associated with the human brain.

But who will chart the course of the coming AI revolution? According to Prof. Shimon Ullman, an Israel Prize laureate and member of the Weizmann Institute's Department of Computer Science and Applied Mathematics, it is critically important for academia—as opposed to industry—to lead the way.

"Corporate giants like Facebook, Amazon, and Google currently invest many billions of dollars annually in artificial intelligence-related R&D, hoping to cash in on AI products' profitable potential," says Prof. Ullman, the designated Director of the Weizmann Institute's new Institute for Artificial Intelligence Research, now in formation. "Basic research, free of commercial interests, is essential for establishing AI's technical limits, as well as its potential."

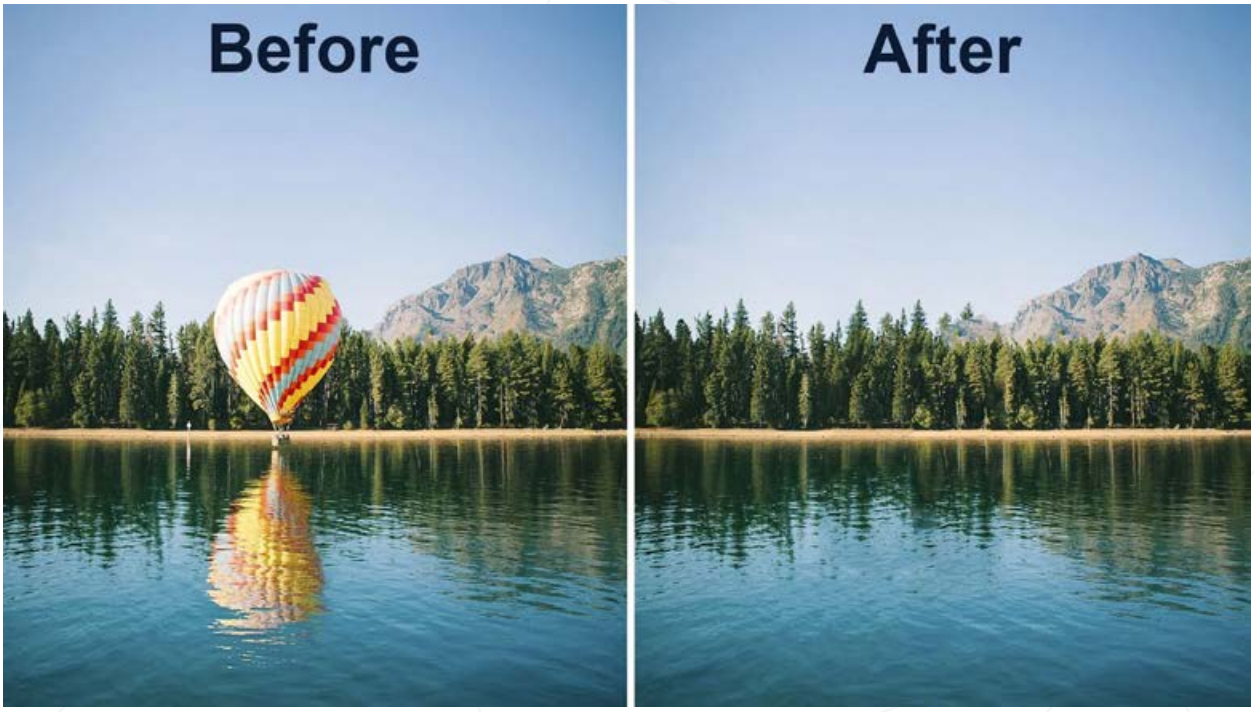
Far from "settled" science—and in fact, some find the entire concept distinctly unsettling—artificial intelligence presents a complex social challenge. Stephen Hawking, the Cambridge University astrophysicist who is one of the world's pre-eminent scientists, has warned that the creation of powerful artificial intelligence will be "either the best or the worst thing ever to happen to humanity."

Prof. Shimon Ullman

From the fear that robot-powered industries will create human unemployment, to the risk that decision-making algorithms could compromise data privacy or even human rights, artificial intelligence could conceivably affect our ability to exercise judgment and promote shared values. Academic stewardship is needed to ensure that AI progress will lead us toward utopia (imagine no more house cleaning!) rather than a dystopian world in which we humans are booted from the driver's seat and lose control of our collective future.

Prof. Ronen Basri

"What are the human-like capabilities that can be programmed into machines?" asks Prof. Ullman, whose own scientific work bridges the gap between computerized systems and neuroscience. "Once such machines are built, how will they interact with humans? Can we program for creativity and ingenuity? And how will these technologies impact society as a whole? Weizmann Institute scientists together with experts recruited from industry will establish 'ground rules' needed to guide artificial intelligence responsibly

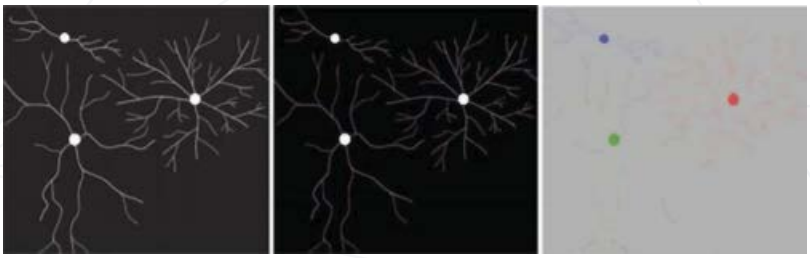


Prof. Michal Irani's research led to a computerized tool, now part of Adobe Photoshop, that makes intelligent inferences about how to fill in missing or corrupted parts of images. In this example, a balloon is obsuring trees in the original image; the 'after' image was created by extrapolating data from the rest of the picture and determining that, once the balloon was removed, the trees would logically replace it.

into the future. This will ensure Israel's status as a high-tech powerhouse for generations to come."

Expanding the limits of sight

The term artificial intelligence was first coined in the 1950s to describe the programming of autonomous capabilities into machines. But such machines can only serve as partners to humankind if they can perceive the world around them, and—based on their programming code—use the data they gather for autonomous decisions. The Weizmann Institute has emerged as a leader in this emerging area of research, with the work of Prof. Ullman providing a case in point.



Prof. Ronen Basri's Neuromath system, which filters out "white noise" from an image and homes in on objects of interest. The transition from original image to final image is shown from left to right.

Comparing the way in which humans and computer vision systems process visual data, Prof. Ullman discovered a sharp cut-off point between recognition and non-recognition of images that is structurally hard-wired into the human brain—something that, he says, "has no parallel in our current technologies." He also found that, unlike the typical "bottom-up" algorithms by which computerized systems first gather low-level data in order to identify a complex object, the human brain processes simple and more complex visual data simultaneously to establish object recognition.

"By incorporating this two-way analysis into automated systems, it may be possible to narrow the performance gap between humans and the AI systems they build," he says.

AI also promises change in the medical arena. In some medical images, like the scans produced by MRI, CT, or ultrasound, useful information is obscured by irrelevant visual data. Computer scientist Prof. Ronen Basri is developing an algorithm that makes it possible to filter out "noise" and zero in on objects of interest. It works for both

Academic stewardship is needed to ensure that AI progress will lead us toward utopia rather than a dystopian world in which humans are booted from the driver's seat.

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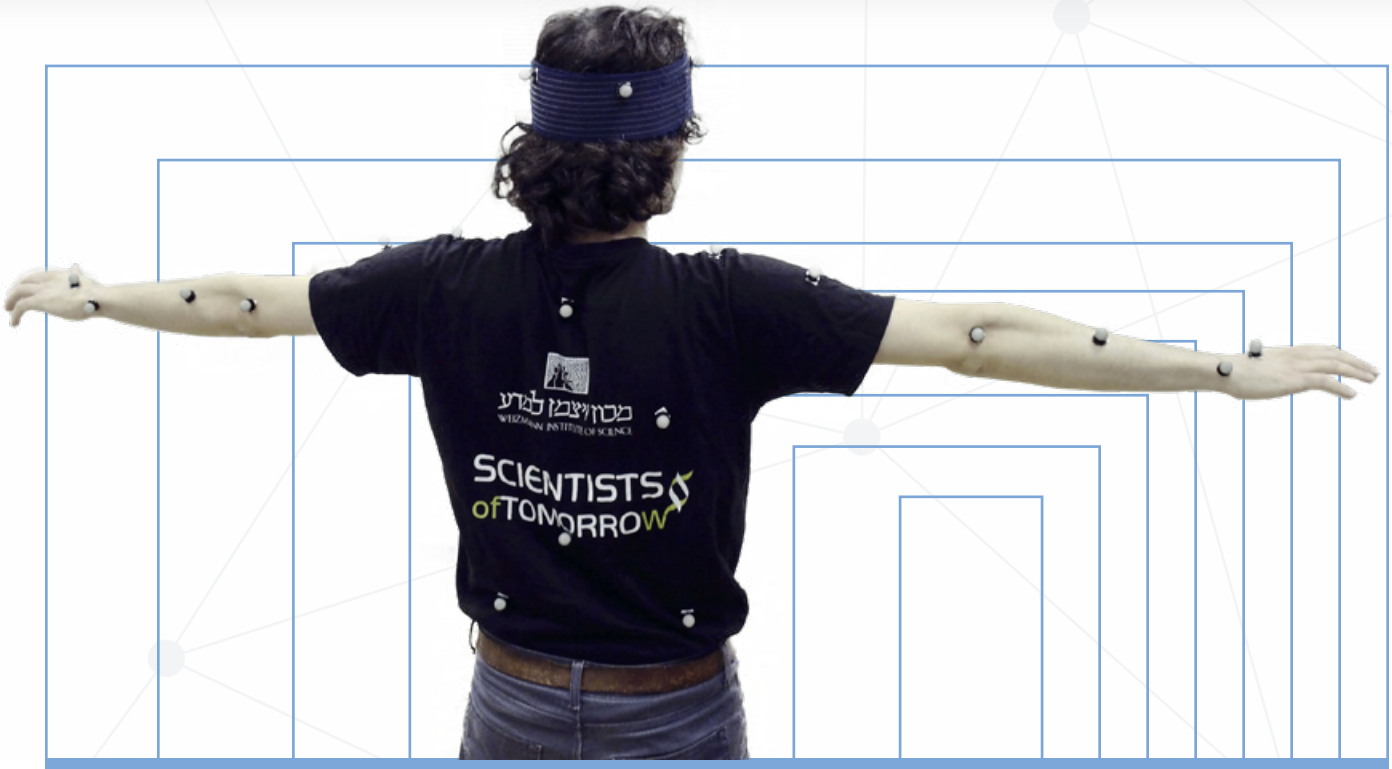


How does the brain perceive and generate movement?

It's one thing to build systems capable of intelligently completing tasks within a computer-simulated environment. It's quite another to create autonomous, intelligent machines that can move among us in the physical world. This is the research focus of AI and robotics pioneer, Prof. Tamar Flash, whose work has implications for Parkinson's and other other diseases involving loss of motor control.

Joining the computer science faculty soon after she completed her doctorate at MIT in the mid-80s, Prof. Flash went on to build a unique research facility on the Weizmann campus, where data drawn from the precise observation of motion reveal how the brain perceives and generates movement. She then translates the mathematical underpinning of these processes into algorithms capable of generating movement in robots.

From identifying 'tricks' that enable a robotic hand to reach out, grasp, and draw, to exploring how the brain processes emotion perception and virtual reality, Prof. Flash's most recent work focuses on human subjects. But she has also gone further afield, modeling the many-splendored movement of a particularly flexible biological system: the octopus.

"With so many degrees of freedom, the octopus is a useful model for the 'soft' robots being designed for everything from search and rescue operations, to rehabilitation clinics," she says, adding that—flexible yet strong—some soft robots can lift a thousand times their own weight.

"In the world of autonomous machines, AI is the software, and robotics is the hardware," she says. "By translating brain-based motion control into computer-based language, we are contributing to the ability of robots to gather information about their environment, and eventually, independently, plan their next move."

A new recruit

Much of the world's top AI talent, including programmers and research scientists, is concentrated in the industrial research centers that make data giants like Google and Amazon such an important part of our day-to-day lives. The Weizmann Institute is now actively recruiting such scientists and technical experts, who will work alongside the Institute's academic faculty to define and establish the AI protocols of the future.

One recent recruit is Dr. Daniel Harari (pictured above), an expert in computer vision who worked at some of Israel's leading high-tech companies, and who, after completing his PhD at the Weizmann Institute, continued his training at MIT's Center for Brains, Minds and Machines before returning to Weizmann as a research scientist. He was recently promoted into a role in which he will help design and advance the planned Institute for Artificial Intelligence, as the first Neustein AI Fellow.

A computer vision expert who is also fascinated by cognitive development, Dr. Harari has studied how infants first learn visual concepts, such as the identification of objects in their visual field, without external guidance. His findings may be incorporated in future AI systems designed to learn independently, based on data gathered from the surrounding environment.

two-dimensional and three-dimensional structures. In this and other ways, he's establishing the theoretical limits of what a computer vision system can distinguish, something that will offer new ways in which future AI machines might achieve the best possible visual performance.

Prof. Basri's work is already having a practical impact on scientific research. A computer vision system based on his approach and developed by staff scientist Dr. Meirav Galun scans neurons both in culture and in live animal models, providing automated and highly accurate accounting of how the axons of nerve cells re-grow after injury. The system, called WIS-Neuromath, can quantify the overall growth of complex assemblies of multiple neurons. Downloaded hundreds of times and contributing to the work of neuroscience teams around the world in addition to researchers at the Institute, the WIS-Neuromath system provides data that may someday contribute to clinical strategies for nerve repair.

In the future, Prof. Basri hopes to solve other dynamic problems in computer vision, like getting computers to visually identify actions such as walking, running, and jumping, something that will make future AI systems more adept at identifying the needs of the humans they were created to serve.

Seeing the invisible

Inducing automated systems to make intelligent inferences based on limited data is the focus of another Weizmann scientist, Prof. Michal Irani. An expert in video information analysis, Prof. Irani has discovered how repeating visual patterns—hidden to the human eye but easily identified by her original algorithms—can allow computers to fill in the blanks of an incomplete picture.

"One of the central goals of AI research is to achieve unsupervised learning: to create computer systems that can learn from what they see for the first time, rather than comparing what they see to huge numbers of examples previously fed into the system," she says. "We have found that, by exploiting the natural computational redundancy in visual data—tiny patterns that repeat consistently, both in 2D images and in video—we can give computers everything they need to perform very complex visual inference tasks, even if the system has not been trained using prior examples."

Prof. Irani's work forms the basis of an AI-based approach that exceeds the physical and optical limitations of today's most advanced sensors, providing new visual capabilities. It also allows computers to do something that sounds almost magical: to "see" the invisible.

"The internal redundancy of visual data gives computers the ability to identify patterns within an image, and, based on statistical analysis, fill in missing information," she says.

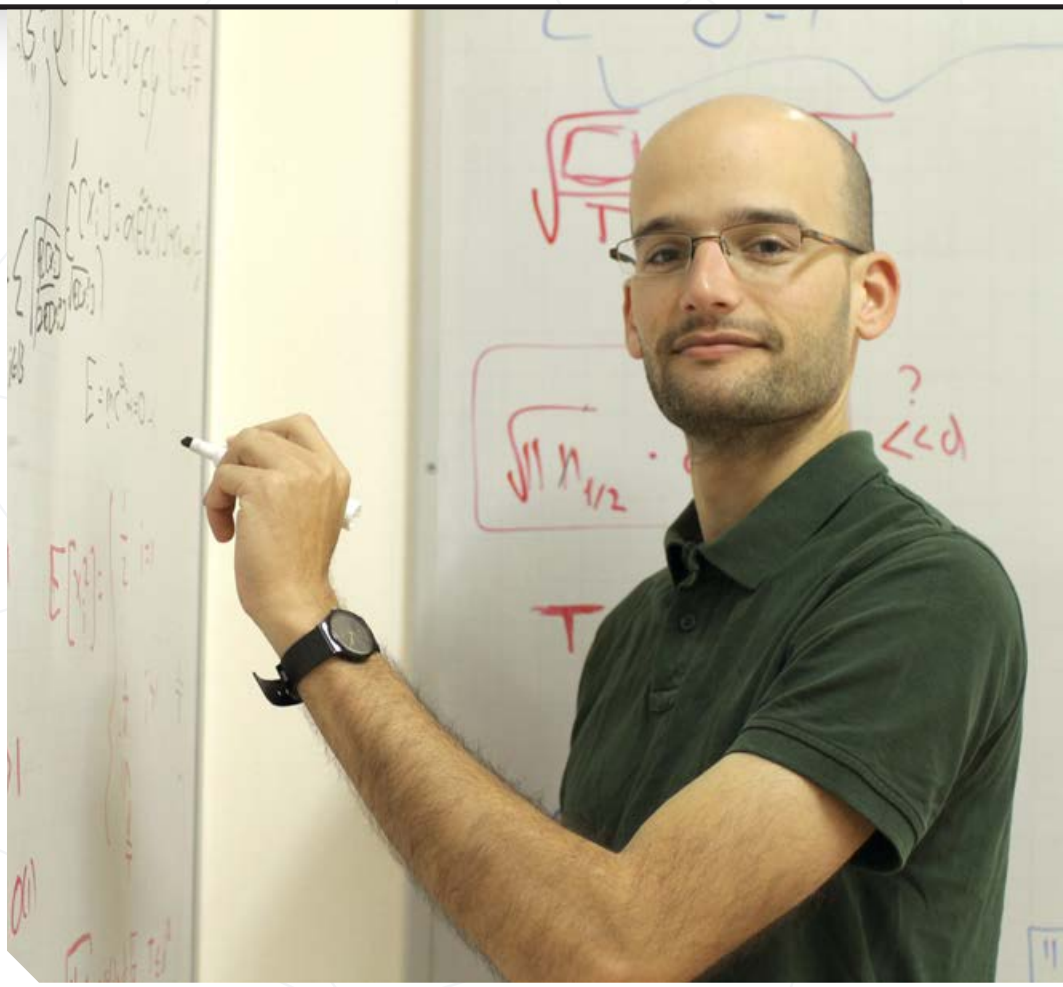
Weizmann Institute scientists will establish "ground rules" needed to guide AI responsibly into the future. This will ensure Israel's status as a high-tech powerhouse for generations to come.

16–17

"Part of this unsupervised internal-learning approach, for which we have been granted a series of patents, is now built into Adobe Photoshop, where it forms the basis of 'Content-Aware Fill'—a tool that makes intelligent inferences about how to fill in corrupted or totally missing parts of images."

Beyond what meets the eye

Fundamental findings in computer vision are applicable to other high-priority AI goals—from speech recognition, to automated translation, to the operation of networked fleets of autonomous cars. Dr. Ohad Shamir is an expert in machine learning—an approach to artificial intelligence that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. He says that the future of AI depends on scientists achieving a more complete understanding of the system architectures that underlie today's ever-more-successful AI approaches.



Dr. Ohad Shamir is an expert in machine learning, an AI approach that provides systems the ability to automatically learn and improve from experience without being explicity programmed.

Deep learning, for instance, is a type of machine learning based on neural networks—a complex, biologically inspired programming paradigm that enables a computer to learn independently from observational data. "The neural network approach has led to dramatic improvements in computer vision and other AI tasks," he says, "but such tasks are carried out in a 'black box' of computation that we, as human programmers, cannot penetrate. That means that when something goes wrong, it's hard to pinpoint why. A basic research challenge is to reverse-engineer successful machine learning, something that would give us the means to replicate the powerful AI algorithms that the computers have figured out on their own."

Deep learning's success can be traced to rapid expansion in computing power. "Today's very large computer networks have a mathematical advantage, because they offer many possibilities for learning optimization. And as our networked AI systems get larger, they will become even easier to train."

A Boston beginning

The Teplows, Dewey Stone, and the origins of the Weizmann Institute

Spotlight On

18–19

In the depth of winter in 1940, Dr. Chaim Weizmann flew to Boston to garner support for a future Jewish state and raise money for the Sieff Institute, the precursor to the Weizmann Institute of Science. From his perch as head of the World Zionist Organization, he spoke to an audience of Boston Jews about his vision. When the event ended, three men—Dewey Stone, Harry Levine, and Meyer Weisgal—accompanied Dr. Weizmann to his hotel room, where the group brainstormed together until 3 a.m. about specific steps to realize his vision.

There, they hatched a plan for a nucleus of donors from New England to support the Daniel Sieff Institute, to raise the first $5 million from America, and for this group to expand nationwide to what would eventually become the American Committee for the Weizmann Institute of Science. They also discussed specific ways they and their circle of friends would help advance the establishment of the Jewish state, using their political and business ties and their personal wealth.

All three men went on to play key roles in the Institute: Weisgal, a journalist from New York who had published the first English translation of the works of Chaim Nachman Bialik and had already served as head of the Zionist Organization of America, moved to Israel and became Dr. Weizmann's right-hand man.

Dewey Stone (at left) with Dr. Chaim Weizmann (center) and Victor Potamkin, who brought Dr. Weizmann the Lincoln car

Harry Levine, who ran a thriving plastics business in Leominster, Massachusetts, committed large sums of his own fortune to the Institute's development. And Dewey Stone, who formally founded the American Committee in 1944, made his first move on behalf of the Institute by purchasing an additional 50 acres for the five-acre Sieff Institute, expanding its reach across the fields and orchards of Rehovot.

The story of Dewey Stone is that of a successful businessman from Brockton, MA, who used his personal fortune, political connections, and special touch to help Dr. Weizmann establish the State of Israel and the Weizmann Institute. He was a "behind-the-scenes mover who wanted the best for his family and for Israel and never sought fame for himself," says his nephew, Ted Teplow, of Cambridge, MA. Dewey and his wife Anne had no children of their own, but they had 17 nieces and nephews. The Teplow family, led by Ted and his son David Teplow, has advanced the Stone legacy through its own special connection to the Institute.

Ted, who received an honorary doctorate from the Institute in 2002, has served in a series of leadership roles for the American Committee, and David, of Weston, MA, became President of the American Committee last year. The father-son duo are co-chairs of the Weizmann Institute's Global Gathering taking place in Boston in June. Through their family foundation, they have given generously to the Weizmann Institute in a range of scientific areas—from scholarships and research support to a career development chair and funds for facilities. Their most recent gift supported the renovation of the Stone Administration Building, which was named in honor of Dewey Stone in 1966.

"Few individuals have had such a profound influence on laying the very foundations of the Weizmann Institute as Dewey Stone," says Weizmann Institute President Prof. Daniel Zajfman. "And the Teplow family has carried his torch forward, ensuring through their generosity and friendship that his legacy and that of the Teplow family will remain an important piece of the Institute for years to come."

"Dewey became enamored by the vision of Chaim Weizmann, and took it on as his own personal mission," says Ted. "Because he and Anne had no children, I have always felt my task in life was to keep my uncle's life story alive. What he did was exceptional, and he mustn't be forgotten."

The man who always asked: 'Do you need anything?'

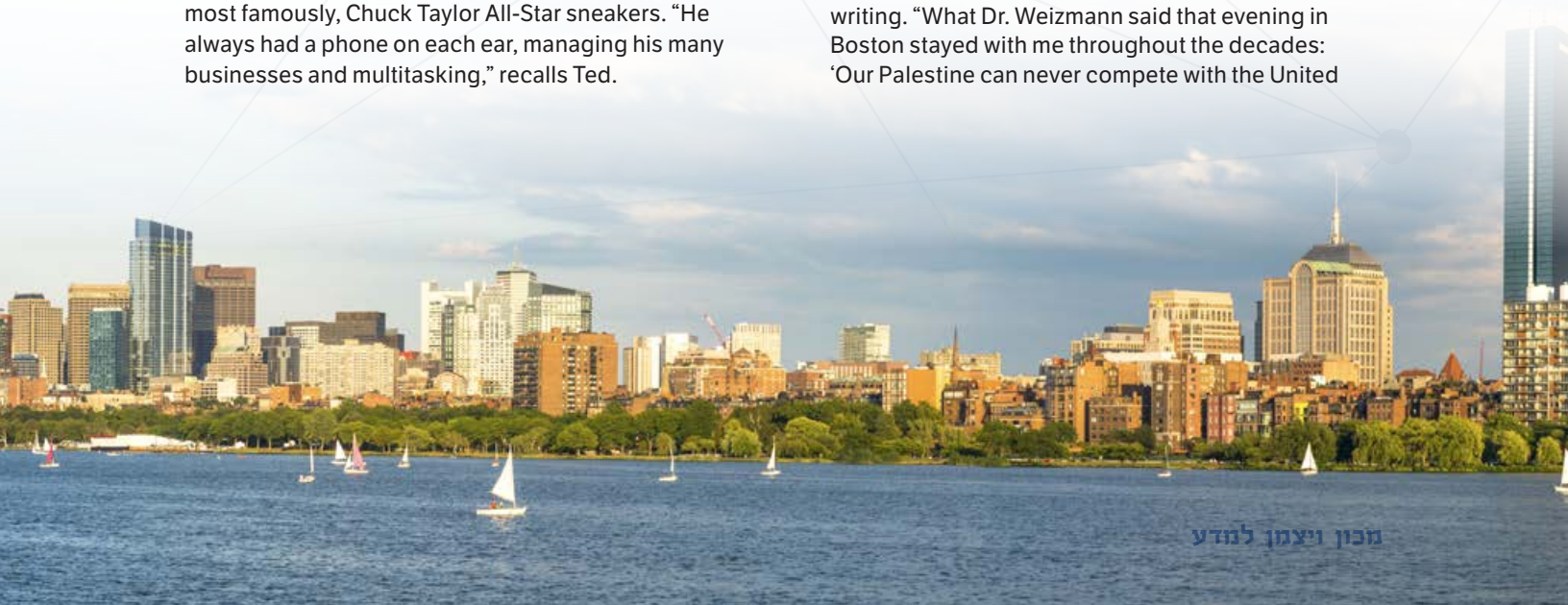
Dewey Stone was born in 1900 in Brockton, then a poor migrant town. He ran a series of thriving textile and other businesses, and installed his nephews at the helm of many of them. The most well-known among the companies was Converse Rubber Co., maker of raincoats and shoes and later, most famously, Chuck Taylor All-Star sneakers. "He always had a phone on each ear, managing his many businesses and multitasking," recalls Ted.

He was also extraordinarily generous with his family members. "Dewey would end every phone conversation with his relatives with the question, 'Do you need anything? Do you want anything?'" says Ted. He had a gift for forming close personal relationships, which served every aspect of his life. "He was a great success as a fundraiser because

The famed Exodus immigrant ship was funded by Dewey Stone

he would sit you down, connect with you, and go on to tell you how much you are going to give, whom you are going to give it to, and when to give—and everyone listened."

That cold January night spent with Dr. Weizmann, Levine, and Weisgal was a turning point in Stone's life. Years later, Stone reflected on that moment in writing. "What Dr. Weizmann said that evening in Boston stayed with me throughout the decades: 'Our Palestine can never compete with the United



David and Ted Teplow

States Steel Corporation or General Motors and the making of cars, but in the quality of its human material. In creativity, in arts and science, the Jewish people of Palestine, given the opportunity, will match all other nations and bring joy and pride to Jews throughout the world.'"

On that Boston visit, Stone took Dr. Weizmann on a drive along the banks of Charles River, from Boston to Cambridge, so that he could see Harvard University. On the way, they passed MIT. "At his request," Stone later wrote, "I stopped the car, and he looked long and longingly at [MIT's] new buildings. As he gazed at them, I knew he was thinking of Palestine and what might be done if research facilities like these existed there. It was at that moment that the seed of hope that this dream might really be achieved was planted in me, sitting in a stationary car with a silent visionary."

Stone and Levine assumed a central role in the clandestine activities of the Haganah, the Jewish underground, including the acquisition of 10 boats to ferry European refugees to Palestine. The friends purchased surplus U.S. military equipment, which they secretly shipped to Palestine. Levine acquired arms and ammunition, and Stone, through his Weston Trading Company, funded the purchase of the boats, including the famed Exodus.

Aware that the FBI was tapping his phone, Stone often made calls from the home of his sister Evelyn. "He bought the Exodus on my mother's telephone," recalls Ted.

The fate of the Exodus—attacked by the British as it neared the shores of Palestine and its passengers returned to camps in Germany—marked a turning point in the international sympathy for the establishment of a Jewish state, and soon afterwards, the UN agreed to vote on partitioning Palestine between the Jews and the Arabs. But Stone's work had just begun: he was also instrumental in securing the vote for the Partition Plan in November 1947. He and his brother, Harry Stone, a judge, had become friendly with the Nicaraguan dictator, Anastasio Somoza, when he came to Boston for surgery in the

1930s. As the clock ticked down to the UN vote, the brothers asked Samoza to generate support among other Latin American countries for the future Jewish state. It worked, and 13 Latin American countries voted in favor, bringing the final count to 33-13 and helping secure the partition.

Truman's about-face

A few months later, in early 1948, President Harry Truman, under increasing pressure from the State Department, decided to reconsider his policy about the creation of a Jewish state—even going so far as closing off the White House to Zionists. With the expiration of the British Mandate nearing, Dr. Weizmann flew to New York in March in a last-minute attempt to meet with Truman, to ask him to reinstate his support for the partition, but the President wouldn't meet with him. Dr. Weizmann expressed his frustration to Stone, who returned to Boston, despondent.

That night, Stone connected with Eddie Jacobson, Truman's former business partner in Independence, Missouri. Eager to help, Jacobson traveled to Washington and asked the President for a first and only favor: a few minutes of his time in the Oval Office.

The meeting was successful, and Truman agreed that Dr. Weizmann could visit him at the White House—albeit through the side door. The two had a long meeting, and Truman did an about-face, agreeing to recognize Israel. The presidential recognition of the Jewish state gave the Jewish leadership in Palestine the green light to declare independence, which it did on May 14.

Stone continued to work toward fully actualizing Dr. Weizmann's dream. After Israel's establishment, Stone visited Prime Minister David Ben-Gurion, and suggested that Israel raise money for development and immigrant absorption through issuing bonds; Israel Bonds eventually raised more than a billion dollars for Israel's fledgling economy. Stone went on to serve in many leadership and fundraising roles in Israel's early development.

The original building of the Daniel Sieff Research Institute at its inauguration (top) and today (below)

He devoted his greatest time and resources, however, to the Sieff Institute, and it became "his number-one philanthropic priority," says Ted. When Stone and Harry Levine flew to London to request Lord Marcus Sieff's permission to honor Dr. Weizmann by renaming the Institute for him, "Sieff not only agreed, but said he'd give the first $1 million," says Ted. "He sat down and, right there, wrote a check." When Ted and David attended the International Board meetings in 2013 at which they were presented with a scroll of appreciation, Ted told this story to the audience. "After I came down from the podium, I shared an incredibly emotional moment with David Sieff," the son of Marcus, whose father founded the Sieff Institute, recalls Ted. "It is one of my fondest memories."

In November 1949, the Weizmann Institute of Science was inaugurated. Stone became the founding Chair of the Weizmann Institute's Board of Governors.

When Stone retired from the Board of Governors in 1970, the Institute threw him a grand farewell party, which honored Harry Levin as well. Golda Meir spoke. "I don't know a thing that was done in Israel of value, of importance, that these two... boys didn't have a hand in," she said. "I don't know if they worry about their business. About Israel they worry. About Israel they do everything they can. There are some things that still cannot be told... Someday somebody, I hope, will tell it."

When Stone died in 1977, Meir said, "No American Jew did more for Israel."

"No American Jew did more for Israel," Golda Meir said about Dewey Stone after his passing in 1977.

A homecoming

Ted Teplow was born in 1928 in Brockton and graduated from the Merchant Marine Academy, then went on to get his MBA at Harvard Business School. He and his wife Charlotte had five children. He had been all over the world in the U.S. Merchant Marine, which offered him familiarity with the rules of commerce in many countries. So when his uncle installed him and his cousin Hugh Stone as heads of Crosby Valve Co., a maker of safety valves for nuclear reactors, it felt natural to expand his business globally. The company gained a near-monopoly on the market, and its biggest clients were General Electric, Westinghouse, and the U.S. Navy.

Crosby was acquired in 1980 and Ted served as a consultant to the company for 19 years. The employee stock ownership program he and his cousin Hugh created led to a substantial windfall upon Crosby's sale for each of the employees—including several mentally and physically disabled men and women who lived in a nearby institution and whom he employed in whatever capacity they could manage.

For David Teplow, the Weizmann Institute has been a natural attraction that goes beyond his family's connection. "I was always interested in math and applied math, which is why I went into computers," he says. "Weizmann has three Turing Award winners. They are rock stars to me." David, a Dartmouth alum who studied computers with some of the field's pioneers in the late 1970s, founded two database companies that became market leaders, Database Technologies and Integra Technology Consulting, which is focused on big data.

Ted says he is looking forward to the completion of the Stone Building renovation as eagerly as the President and Vice Presidents, whose offices will be housed there. "Every time I am on campus and I look at the Stone Building, I realize this is something that will outlast us," says Ted. "And it will keep the Stone name recognized."

The symbolism of hosting the next major Weizmann Institute gathering—on the 75th anniversary of the establishment of the American Committee—isn't lost on the father-son duo. "Having the Global Gathering in Boston is like a homecoming," says David. "This is where it all began."

Late Night at Weizmann

At the Opening Gala of the 69th International Board, Prof. Daniel Zajfman thanked Abraham Ben-Naftali for his time as Chair of the International Board and welcomed Prof. Jehuda Reinharz as the new Chair. The evening also presented an opportunity to thank Prof. Michael Sela and Sara Sela for their magnanimous gift to renovate the Michael and Anna Wix Auditorium where the event took place and where the annual honorary PhD ceremony is held. The auditorium will be renamed for Prof. Sela.

Through a *Late Night with David Letterman* format of lighthearted fun and question-and-answer sessions, Dr. Yifat Merbl, Dr. Liran Shlush, and Prof. Eran Bouchbinder presented their research in protein studies, leukemia research, and theoretical physics, respectively. TV and radio personality Hila Korach and Dr. Ofer Firstenberg of the Department of Physics of Complex Systems hosted the show.

Special Section

24–25

Inaugurating New Chairs

The Maurice Lévy Research Fellow Chair in Science Teaching was established during the 2017 International Board, with Dr. Yael Shwartz of the Department of Science Teaching as its first incumbent. Mr. Levy, who chairs the French Committee for the Weizmann Institute of Science, said the Institute is "a new light in my life... I am impressed by the incredible strength and passion here and I am proud to be part of the Weizmann Institute."

The Aharon and Ephraim Katzir Memorial Professorial Chair was established in the presence of the donor, Dr. Merry Sherman of San Francisco. Prof. Michal Sharon of the Department of Biomolecular Sciences is the first incumbent. "I had the great fortune of being the PhD protégé of Aharon and of living with Ephraim's family," Dr. Sherman said. "So, 24-7 I was exposed to these brilliant brothers, and it was a unique opportunity. Ephraim's home welcomed Nobel laureates, brilliant scientists, artists, and musicians from all over the world." By coincidence, Prof. Sharon occupies Ephraim's former lab.

The Mondry Family Professorial Chair was established in the presence of Ira and Gail Mondry of Detroit, Michigan. Prof. Eran Hornstein of the Department of Molecular Genetics is the first incumbent. "I feel very lucky and fortunate to be able to support something like this here at Weizmann, and it has been the most meaningful philanthropic relationship that I've had," said Mr. Mondry, pictured at right with Prof. Hornstein on the left.

Q&A

Prof. Jehuda Reinharz

Prof. Jehuda Reinharz became the new Chairman of the International Board of the Weizmann Institute on January 1. Born in Haifa, he received his high school education in Germany and moved to the U.S. as a teenager. Prof. Reinharz established the Judaic Studies program at the University of Michigan where he was a professor for 10 years, and joined the faculty of Brandeis University in 1982. He served as President of Brandeis from 1994 to 2010 and became President of the Jack, Joseph, and Morton Mandel Foundation the following year.

Prof. Reinharz is the author of an award-winning two-volume biography of Dr. Chaim Weizmann, and is soon to release the third and final volume, which he co-authored with Prof. Motti Golani of Tel Aviv University.

Q: How did you become interested in the life of Chaim Weizmann?

A: I was in Israel in 1973 to do research, and when the Yom Kippur War started my plans were upended. A relative of mine, Prof. Yehoshua Arieli, a great historian of American history, told me that the Weizmann Archives was compiling the Chaim Weizmann letters [which became *The Letters and Papers of Chaim Weizmann,* in 23 volumes]. He said, 'If you are interested, I'll make the connection.' I said 'yes', and edited volume 9. So I started coming to the Weizmann Archives on a regular basis and during sabbaticals.

Then, in 1975 I got a call from Walter Laqueur [the prolific historian and author], who had been my teacher at Brandeis University when I was a graduate student and who had been asked by Meyer Weisgal [a former President of the Weizmann Institute and a close confidant of Chaim Weizmann] to become Chaim Weizman's official biographer. Walter asked me to do it with him and I agreed. But within a short time, he got busy with other things and changed his mind, and suggested I do it myself. It became clear to me from the beginning that one volume didn't make sense—there was so much to be said. It required a great deal of research over many years, and the Weizmann Archives was extremely helpful to me every step of the way.

Then I began to meet other people on campus, and I realized early on that I'd have to know something about chemistry in order to write about Chaim Weizmann. It seemed overwhelming, but I did it anyhow with the help of some outstanding chemists. At some point I was asked by Prof. Aryeh Dvoretzky [the seventh President of the Institute] to give a lecture on Chaim Weizmann's chemistry. And in a moment of total insanity, I said, 'sure'. Giving a talk on Chaim Weizmann's chemistry to a bunch of Weizmann scientists was one of the craziest things I have ever done—I never sweated so much at a lecture.

Q: Has the public perception of Chaim Weizmann changed as a result of your biography?

A: I have been doing an experiment with Israelis where I ask them: 'When I say 'the founder of the state of Israel', what name comes to mind?' Everyone says David Ben-Gurion. Chaim Weizmann's name is never the answer. But I did not

write the biography because I wanted to return Chaim Weizmann's honor and secure his place in history; that's not my role. I'm an historian, and I was simply interested in him.

But I'm now convinced more than ever—and I believe that Prof. Motti Golani and I prove it in the third volume of the biography—that without Chaim Weizmann, there would be no State of Israel. There would also be no Weizmann Institute. And I don't say this to diminish Ben-Gurion's contributions. However until 1946, Ben-Gurion was not a critical figure in the Zionist movement outside of Israel; he was an important leader of the Yishuv [the Jewish settlement in Palestine]. We have gotten used to the idea that Ben-Gurion was the prime mover of the State of Israel. But in the international arena, there was no match for Chaim Weizmann.

How does someone who has no army behind him, doesn't even have the entire Jewish people behind him—how does one man accomplish what he did? The answer is his personality: it's all about the 'who', and he was the 'who'. No one came close to achieving what he did. Even as Britain withdrew from its obligation to the mandate, Weizmann was able to summon the British Prime Minister and members of cabinet, and spoke to American leaders about the importance of creating a Jewish state in Palestine. It was Weizmann who persuaded President Harry Truman to do so something about the DP camps in Europe, include the Negev in the prospective State of Israel, and to loan $100 million to the fledgling state—which in 1947 was an untold fortune. And it was Chaim Weizmann who convinced Truman to recognize the State of Israel.

"How does someone who has no army behind him, doesn't even have the entire Jewish people behind him—how does he accomplish what he did?"

Q: So why hasn't Chaim Weizmann received his due recognition until now?

A: First, because he was a one-man band. He was an elitist, a benevolent dictator who had a coterie of people around him who were totally devoted to him, but the moment they got in his way, he got rid of them. He didn't believe in creating a party, so there was no institutional way of creating a legacy. Second, because all the events around and after his removal from the Zionist leadership [as President of the World Zionist Organization in 1946], were so overwhelming—the War of Independence and the subsequent wars—he became overshadowed by the enormous achievements of Ben Gurion, [Moshe] Dayan, and [Yitzhak] Rabin. Chaim Weizmann was never part of the Yishuv; he had a house in Rehovot, but spent very little time here in the early days. In fact, when he was named President of the State of Israel, he was in Switzerland.

Thanks to Meyer Weisgal and his decision to compile the Weizmann Letters, Chaim Weizmann's memory was rekindled. But that was not enough.

Q: Do you see your new role as Chairman as a continuation of your dedication to the legacy of Chaim Weizmann?

A: There is something fortuitous in that I'm becoming Chairman as I'm finishing the biography. The Weizmann Institute is synonymous with excellence. If Chaim Weizmann were alive today, I'm certain that he would say that the Weizmann Institute is by far his greatest legacy. He would see that not only does the Institute attract the best minds who are leaders in their fields, but its discoveries and inventions improve the lives of tens of millions of people all over the world. And it is educating Israel's future leaders in science, which he repeatedly said upon his creation of the Sieff Institute would be the backbone of the state. We must remember that he is responsible for the establishment of the Hebrew University of Jerusalem and, to some degree, the Technion, too. And if those institutions aren't the creative backbone of the state, what is? So I'm extremely proud and honored to have been asked to serve as Chairman, which in some small way will continue Chaim Weizmann's legacy. On a personal level, I feel very attached to the Weizmann Institute and the Weizmann Archives. The Institute is run by a great President and Executive Board, and it is on sound financial and academic footing. My hope is that I can contribute to helping it become an even greater institution.

Prizes for excellence

At the annual Clore Lunch during the International Board, Dame Vivien Duffield presented the Sir Charles Clore Prize to Dr. Merav Parter, who recently joined the Department of Computer Sciences and Applied Mathematics. Dr. Parter is also a former recipient of a postdoctoral fellowship grant through the Israel National Postdoctoral Award Program for Advancing Women in Science, of which the Clore Foundation is an anchor supporter.

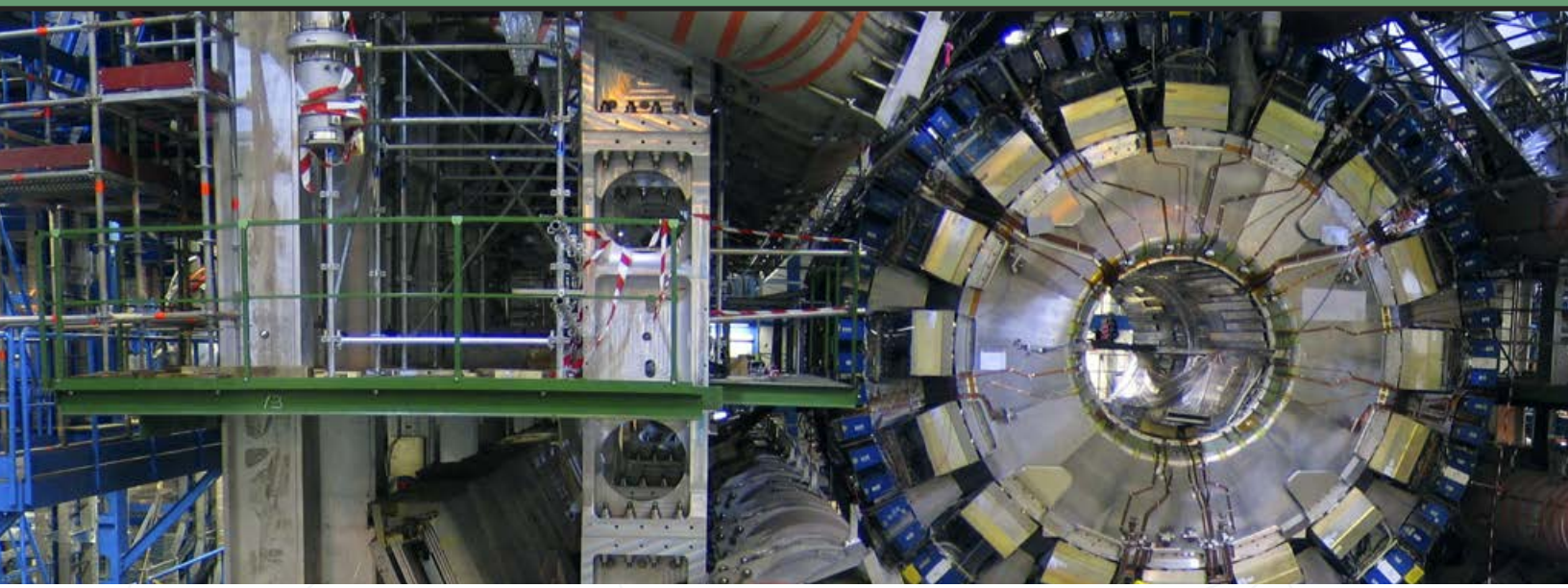
Dr. Micah Goodman, director of the Midrasha Ein Prat and author of *Catch 67*, discussed the aspirations of the original Zionist dream and the tug-of-war between Left and Right in Israel in actualizing those aspirations through the creation and advancement of the State of Israel.

Prof. Nirit Dudovich of the Department of Physics of Complex Systems received the Helen and Martin Kimmel Award for Innovative Investigation.

Prof. Nachum Ulanovsky from the Department of Neurobiology received the André Deloro Prize, awarded annually by the Adelis Foundation. Said Rébecca Boukhris, a Trustee of the Adelis Foundation: "I am so happy that we are a good friend of Weizmann—advancing not only science and Israel, but humanity as well."

Six honorary PhDs

The Institute bestowed honorary doctorates on six distinguished individuals whose contributions to society have had a tangible and celebrated impact. Pictured clockwise from top left: Heather Reisman of Canada, who gave the keynote address; Milvia Perinot of Switzerland; Prof. Peter Jenni of Switzerland; Yoni Rechter of Israel; and Gerald Schwartz of Canada. Not pictured: Mortimer Zuckerman of the U.S.



Physics at the frontier of knowledge

Honorary doctorate recipient Prof. Peter Jenni

For most of his professional life, Prof. Peter Jenni has been at the center of a global scientific adventure: the search for missing pieces in the Standard Model of Particle Physics. A leader on a successful experiment conducted at CERN's Large Hadron Collider (LHC), Prof. Jenni's scientific leadership has paved the way to seminal discoveries about the fundamental building blocks of the universe. He was awarded a PhD *honoris causa* at the International Board meeting.

"Physics is all about collaboration, and Israelis were behind some of the LHC's fundamental technologies," he says. "The friendships I've built make it a special pleasure to come to Rehovot and receive this honor. I mean it when I say that I share this honor with my colleagues here on campus."

For decades, Prof. Jenni has been associated with the LHC, a 27-km (19-mile) long circular accelerator, dug 100 m (328 feet) below ground on the border between France and Switzerland. The largest machine ever built, the LHC employs thousands of magnets to keep subatomic particles moving at nearly the speed of light along this circular race-track, and then smash them together to examine their components. Prof. Jenni served as the spokesperson (project leader) of ATLAS, a massive detector partially based on Weizmann research, which was involved in detecting a long-predicted particle called the Higgs Boson in 2012.

"One of the questions left unanswered by the Standard Model is how subatomic particles —the basic constituents of matter—acquire mass," he explains. "The discovery of the Higgs Boson, based on collision data gathered by the ATLAS detector, helps explain this, which is why it generated so much excitement."

Prof. Jenni says that steady advancement in accelerator technology makes discovery possible.

"Back in the 1980s, CERN's Super Proton Synchrotron, a 6.7-kilometer accelerator, allowed us to identify fundamental particles known as the W and Z bosons. But to get to the Higgs, we needed to reach much higher energy levels. Our concept for the ATLAS experiment at the LHC was first submitted in a letter of intent in 1992, and five years later construction began. Today, the LHC accelerates particles to 99.9999991% of the speed of light at an energy level of 13 trillion electron volts. It recorded its first collisions in 2009."

The Swiss-born scientist trained at the University of Bern and the Swiss Federal Institute of Technology in Zürich, and also worked at CERN during graduate school. But progress also relied heavily on Prof. Jenni's natural talent for diplomacy, and for bringing the right people and resources together.

"The ATLAS team just got bigger and bigger," he recalls. "It was difficult, in the sense that you really have to find a consensus, rather than ordering people to do one thing or another. It was also not an easy task to acquire the very expensive equipment. That's how the LHC became a collaboration, not just between scientists, but between countries."

And one of these countries, of course, was Israel.

"Scientists from the Weizmann Institute—as well as Tel Aviv University and the Technion— were involved in ATLAS from the beginning, but some CERN member states were reluctant to have Israel involved," he recalls. "I wasn't part of the council that makes these decisions, but I did find opportunities to improve the atmosphere, and eventually Israel came on board."

Prof. Jenni still believes in the power of science to break down barriers. He points out that at CERN, scientists talk to each other even if the countries they represent do not. He is similarly proud of the fact that women scientists are increasingly taking charge of what was once an entirely male-dominated field. One is Fabiola Gianotti, an Italian particle physicist who did her PhD with Prof. Jenni and later worked with him on the ATLAS experiment, and who recently became first woman to be named CERN's Director General.

Currently consulting on projects around the world, Prof. Jenni still sees the future as a wide-open scientific adventure.

"Look at it this way: our work at CERN's LHC is a bit like figure skating. There's the 'short program' where you know exactly what you're aiming for. That was the Higgs. Now, I predict that for the next 15 to 20 years we'll be doing the 'free program'—exploratory science that has no limit on fantasy and creativity. While we still need the very best instruments to move forward, this is where the fun really begins."

New Gladys Monroy and Larry Marks Center for Brain Disorders

L to R: Larry Marks, Prof. Yoram Groner, and Gladys Monroy

The Gladys Monroy and Larry Marks Center for Brain Disorders, directed by Prof. Alon Chen, Head of the Department of Neurobiology, was celebrated at a luncheon during the International Board.

"To make the next big jump forward in brain research," said Prof. Chen, "we need to not only have the most brilliant neuroscientists on the planet and recruit those who aren't already here. We also need the right infrastructure and a multidisciplinary approach. The new Center for Brain Disorders will accelerate our progress."

Prof. Alon Chen

Gladys Monroy and Larry Marks are co-chairs of the American Committee's Bay Area region. As regional leaders, they have spearheaded efforts to develop philanthropic support for the Weizmann Institute.

"We support Weizmann because of its curiosity-driven approach, the atmosphere that fosters collaboration, and the extraordinary principal investigators and their teams," said Gladys Monroy. She first came to know the Institute when she and Prof. Yoram Groner were postdoctoral fellows together at the Albert Einstein College of Medicine in New York.

"I saw how Yoram had been taught to think analytically and how creative he was, and it was an amazing introduction to the Weizmann Institute of Science," she recalls. Then the Yom Kippur War broke out and he disappeared. "He was gone for several weeks. I needed his notebooks to find out what he was doing, but they were in Hebrew. Luckily I was at Albert Einstein—part of Yeshiva University—so I quickly and easily got his notes translated. And later, our joint work was published in good journals." Gladys went on to become a research scientist, and then leveraged her scientific knowledget to become a leading intellectual property lawyer.

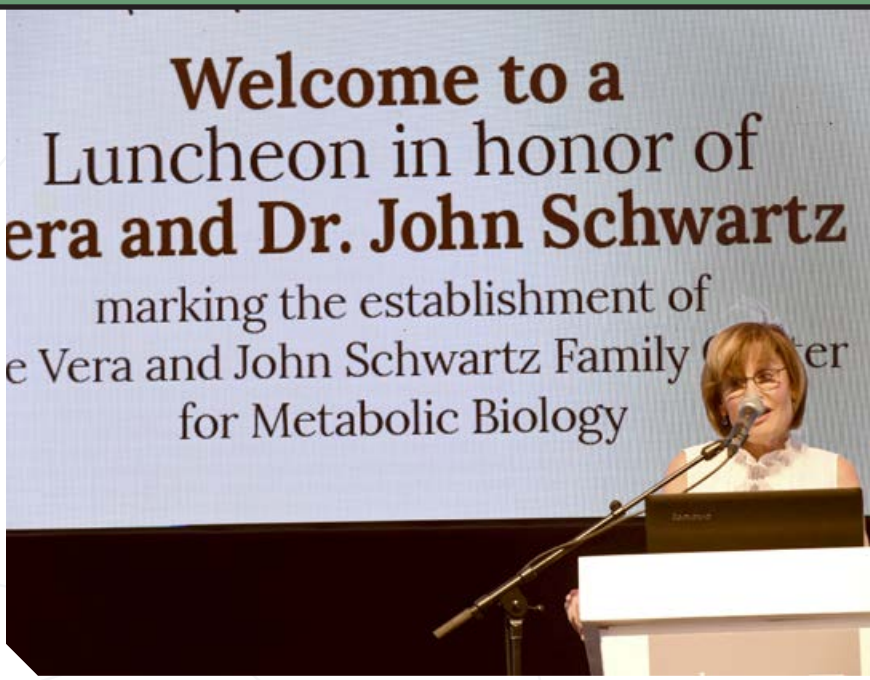
For Larry, the couple's participation in the Global Gathering in Montreal in 2012 was a turning point, and the duo became increasingly engaged with the Institute ever since.

Part of their impetus for the gift to establish the center was the knowledge that some of their friends were affected by neurodegenerative diseases, said Larry, adding, "We have witnessed the devastation these diseases have on patients and their families."

One of the things Gladys appreciates about the Weizmann Institute "is that it is scientist-oriented," she says. "It recruits scientists and just says: 'Be creative.'

Spotlight on metabolic biology

The establishment of the Vera and John Family Center for Metabolic Biology was celebrated at the International Board, honoring Vera and Dr. John Schwartz of Pacific Palisades, California. The new center, headed by Prof. Asaph Aharoni will strengthen the Institute's ability to identify and monitor metabolites, and advance diagnostics, treatment, and new strategies for disease prevention. "Vera and John's support will make available a whole new set of research tools that will put Institute scientists at the forefront of metabolic studies worldwide," said Prof. Aharoni.



Advancing Alzheimer's Research

The Institute celebrated a major gift by the Adelis Foundation to support Prof. Michal Schwartz' research on Alzheimer's disease. One of Prof. Schwartz' key contributions to the field is the concept of "protective immunity": that the immune system plays a central role in maintaining brain health and combating neurodegenerative diseases including Alzheimer's. She identified a specific gateway within the brain's blood cerebrospinal fluid barrier that permits the entry of immune cells into the brain when they are needed for repair following acute injury or neurodegenerative damage. Pictured from left to right: Prof. Daniel Zajfman, Prof. Schwartz, Adelis Trustee Rebecca Boukhris, and Sidney Toledano.

Kushner Family Lab inaugurated

Martin and Miriam Kushner of Mexico, together with Prof. Daniel Zajfman, President of the Weizmann Institute, and Dr. Shikma Bressler of the Department of Particle Physics and Astrophysics, dedicated the new Kushner Family Particle Detector Laboratory during the 2017 International Board. "I have always been in love with science and fascinated by the constitution and characteristics of matter," said Martin Kushner.

Funding for Fragile X research

The latest gift from the Azrieli family to the Weizmann Institute funds research by Prof. Irit Sagi on Fragile X syndrome. Pictured here with Prof. Daniel Zajfman is Danna Azrieli, who spoke movingly about her family's personal connection to the disease and their wish to advance research toward a cure.

Focus on women in science

The Israel National Program for Advancing Women in Science, started in 2007, marked its 10-year anniversary this year and was celebrated at the 2017 International Board. To date, 69 percent of program recipients who have completed their postdoctoral fellowships have attained faculty-track positions in Israel. The remainder have gone on to positions in industry or academia abroad.

Opening remarks were given by Prof. Daniella Goldfarb, the President's Advisor for Advancing Women in Science, and Ellen Merlo, Chair of the American Committee who spearheads the Committee's Women *for* Science Program, spoke about her commitment to this area.

The session included a panel discussion of six past award recipients and was moderated by Dr. Liat Mudrik of Tel Aviv University.

New laboratory for brain research

The new Dr. Daniel C. Andreae Laboratory for Brain Research, established through a gift from Dr. Dan Andreae of Toronto, was celebrated with Dr. Ivo Spiegel of the Department of Neurobiology. who will run the lab. Dr. Andreae, a professor of psychology with doctorates in neuroscience and education, spoke about his commitment to science and his particular interest in Dr. Spiegel's focus on the 'nature versus nurture' quandary: to what extent do experience and environment dictate brain function, and to what extent do our genes do so.

Closing gala

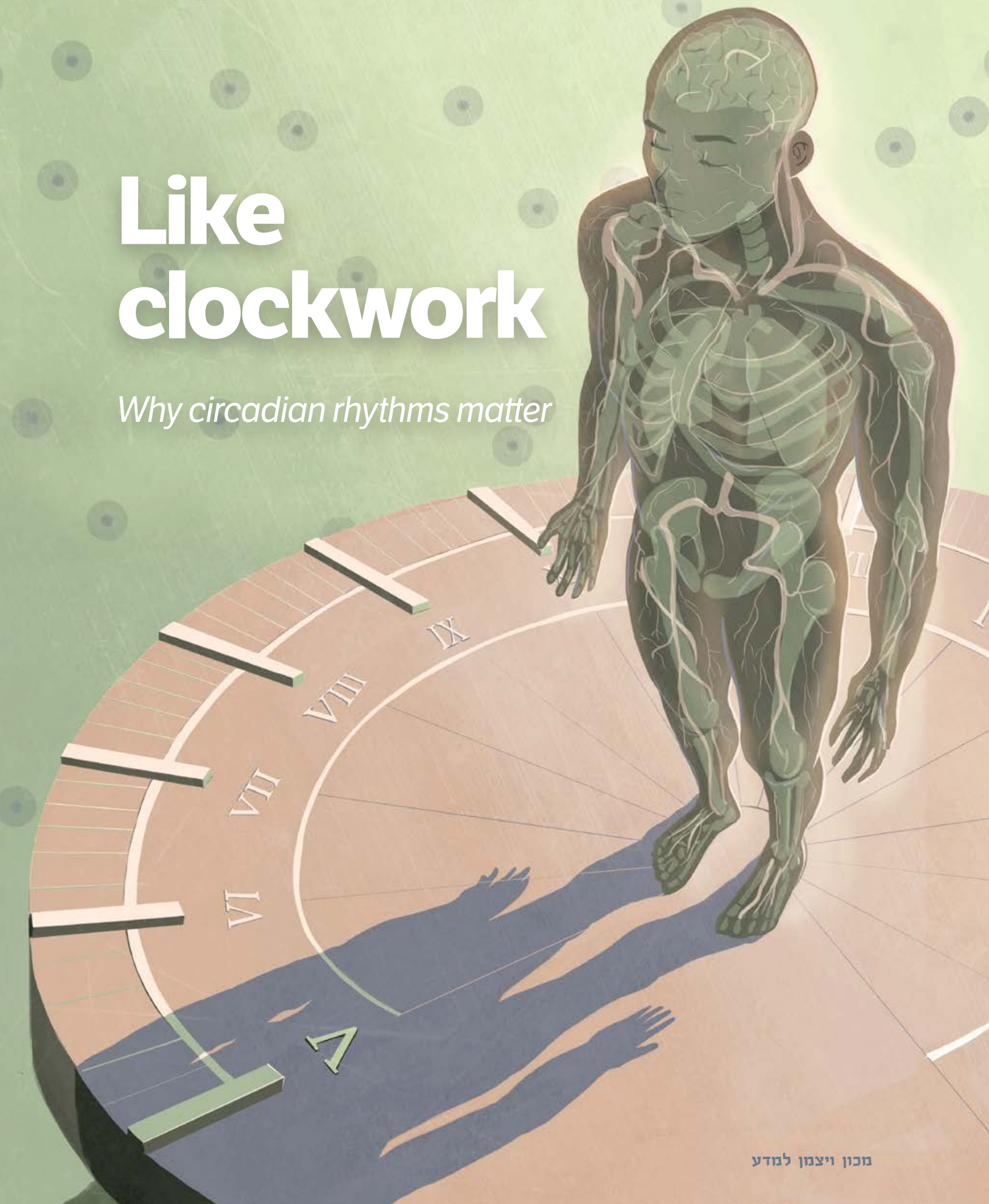
Focus on science education

The closing gala of the 69th Annual General Meeting of the International Board focused on the longtime support and friendship of the William Davidson Foundation of Detroit, marking its most recent gift for *i*Science. The new initiative will enrich science literacy through modern technology. In attendance were Karen Davidson and Ralph Gerson of the Davidson Foundation. (Mr. Gerson is pictured above left with Prof. Zajfman).

The gala was also an opportunity to thank Ido Dissentshik, the outgoing chair of the Executive Board. Special thanks also went out to Lester Crown, the outgoing Vice Chair of the International Board, and Bob Drake, outgoing Vice Chair of the Executive Board and the new Vice Chair of the International Board. (Mr. Dissentshik is pictured above right with Prof. Zajfman).

Like clockwork

Why circadian rhythms matter



Science Feature

The Earth takes approximately 24 hours to rotate on its axis, and all light-sensitive life on Earth has internal, biological clocks that anticipate and adapt to that daily cycle. Wake, work, eat, play, sleep; lather, rinse, repeat. From rose to rhinoceros, from mushroom to man, we all have a round-the-clock rhythm—scientifically known as the circadian rhythm, from the Latin *circa diem*, meaning 'around the day.'

In recent years, the body of knowledge on circadian rhythm has grown dramatically. Scientists now understand that circadian rhythm regulates sleep patterns, and affects hormone release, metabolism, body temperature, and other functions. Biological clockwork that runs too fast or too slowly can result in irregular rhythms, which in turn can lead to a variety of health problems, including insomnia, mental illnesses, obesity, and diabetes. In fact, circadian rhythms affect everything from athletic performance—world records are more likely to be smashed in the afternoon than in the morning—to analytical agility.

It is clear today that the 24-hour nature of our Earthly existence is truly fundamental to our lives. This realization was signified by the fact that the Nobel Prize in Physiology or Medicine was awarded in 2017 to Jeffrey Hall, Michael Rosbash, and Michael Young for their discoveries of molecular mechanisms controlling the circadian rhythm. Prof. Gad Asher, a self-described 'chronobiologist' in the Department of Biomolecular Sciences who has made major insights in this area as well, anticipates that the Nobel Prize will inspire much-needed awareness among scientists of the impact of circadian rhythms on all aspects of science—especially in medicine and health.

"The importance of our bodies' circadian clocks on every aspect of our physiology and behavior has always been anecdotal," he says. "But now there's growing appreciation of the molecular mechanisms involved—and the medical implications. It isn't just what you eat, but also when you eat it; likewise, the timing of administering certain medications. It's all about timing."

Timing is everything

While scientists and laymen alike had appreciated the impact of daylight and darkness on people and plants for hundreds of years, it wasn't until the 1970s that scientists began to understand the genetic mechanisms responsible for adapting the biological clocks of plants, animals, and humans to be in synchrony with the Earth's revolutions.

In the 1970s, Caltech's Prof. Seymour Benzer and his student Ronald Konopka first demonstrated that mutations in an unknown gene disrupted the circadian clock of fruit flies. They named this gene "period," a scientific term related to frequency. Then, in 1984, Dr. Jeffrey Hall (a protégé of Benzer) and Dr. Michael Rosbash, working in close collaboration at Brandeis University in Boston, and, in parallel, Dr. Michael Young at the Rockefeller University in New York, succeeded in isolating the period gene, and went on to make key discoveries in this area.

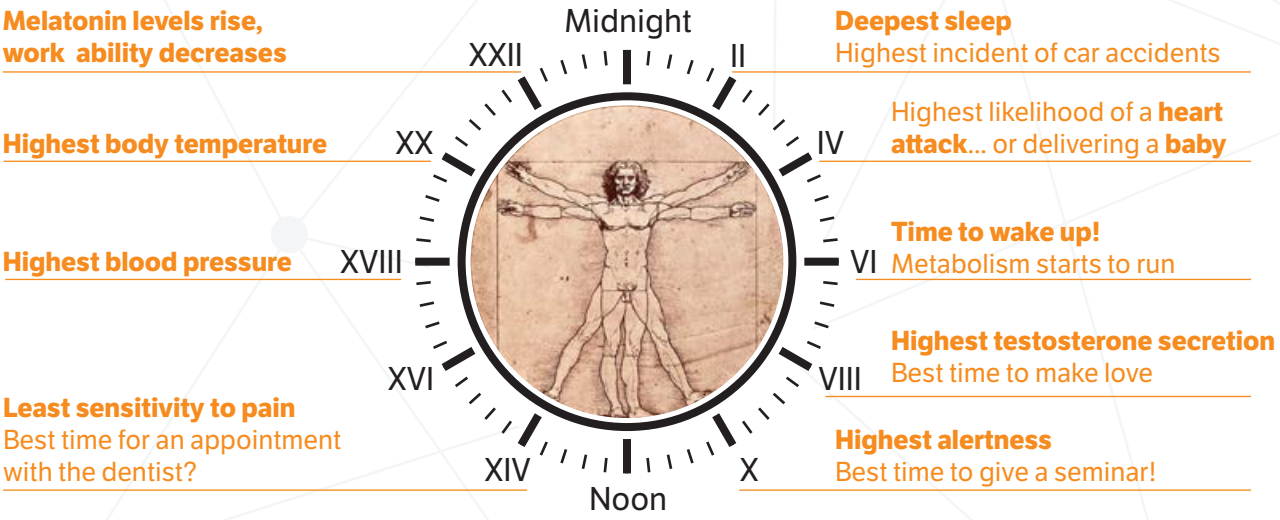
The Brandeis duo discovered that PER, the protein encoded by the period gene, accumulated in all the body's cells during the night and was degraded during the day, so its levels varied rhythmically over a 24-hour cycle. They then hypothesized that PER was in fact self-regulating: its own presence blocked the activity of the period gene. But how? How can a protein that is floating around in the cell affect DNA in the nucleus? The answer came in 1994, when Dr. Young discovered a second clock gene, which he dubbed "timeless" and which encoded the protein TIM. He showed that when TIM binds to PER, the dynamic duo is able to enter the nucleus where PER then acts to prevent the period gene from working.

Prof. Gad Asher

By the mid-90s, it was clear that all these cellular events contributed to creating the self-regulating feedback loop at the heart of the circadian clock. The next question that arose was: How was it so precise—the biological equivalent of Greenwich Mean Time (GMT)? Dr. Young identified yet another clock gene, dubbed "doubletime", that encodes the protein DBT which helps adjust PER and TIM levels over the course of the day. The discovery of these interactions established the fundamental principles underlying how biological clocks produce circadian rhythms and regulate their timing.

The master clock

With miniature, self-sustaining clocks in every cell, scientists wanted to know how everything is so perfectly coordinated. That is, where is a body's master clock? It turns out that every creature has one, and in vertebrate animals, including humans, the master clock is a group of about 20,000 neurons that form a structure known as the suprachiasmatic nucleus (SCN)—a big name for a tiny part of the brain in the hypothalamus. The SCN receives input from the optic tract, which carries signals from the retina.



Prof. Asher's rendering of the 24-hour circadian clock—including optimal times for activities and bodily functions

Thus, the SCN has a direct, one-way input line from the eyes, which conveys information about how much light is visible—which, of course, varies periodically every 24 hours.

In this way, our master clocks are regulated by the sun. Sunlight-signals turn different genes in the SCN on and off, resetting our master clock, and by extension, our circadian rhythms. The SCN itself controls the production of a hormone, called melatonin, which induces sleepiness. When there is less light—as at night—the SCN induces the production of lots of melatonin, causing you to become drowsy. Thus, the mini-clocks throughout the body become part and parcel of the body's overall sleep-wake cycle.

This light sensitivity explains why people get jet lag when they travel across time zones. That is, when there is a shift in the relationship between the behavioral rhythm and the light cycle, the behavioral rhythms must be re-set—a process that occurs within a few days of the shift, and as travelers well know, just in time to return home to get hit with jet lag again.

Important research is currently underway regarding the relationship between the immune system and circadian rhythms, with widespread implications. Some scientists have even suggested that due to the immune system's own functional rhythm, it may be more effective to receive certain vaccines in the morning, rather than the afternoon. And the efficacy of timing the administration of certain pharmaceuticals according to circadian rhythms also could aid patients suffering from many diseases and disorders.

Moreover, researchers have advised that synchronizing our lives to a proper circadian rhythm can have a powerfully positive impact on our quality of life—like fine-tuning when we exercise or to try to conceive a baby, as Prof. Asher suggests. In time, he adds, we may be able to determine the optimal times for drug administration (with different clocks for different types of drugs), food intake, and even surgical procedures. "So many drugs interact with enzymes that are rhythmically expressed—the activity of a large fraction of the enzymes in our bodies follows circadian rhythms," he says.

Timely science

Weizmann Institute research on circadian rhythms

Although light is the single most important influence on circadian rhythms, it is not the only one. Food consumption, temperature, and—as was demonstrated for the first time by Prof. Gad Asher—oxygen levels also play key roles in regulating the mini-clocks that reside in peripheral tissues, such as the kidney, liver, and pancreas. In a recent study, he and his team documented how fluctuations in oxygen level, through the activity of a protein called HIF1α reset the circadian clock, and located the oxygen-dependent 'reboot button' that helps the body overcome a shift in daylight hours and get back on schedule.

This study showed that changing the concentration of oxygen in cells by just three percent daily will synchronize mouse cells to a circadian rhythm. Prof. Asher is now investigating whether oxygen serves a novel, universal link between daily light-dark cycles and the resetting of the circadian clocks of all species. The impact of these studies would be extraordinary: in bacteria and plants, exposure to rhythmic changes in environmental oxygen could better synchronize their internal clocks

Because circadian rhythms affect the release of substances which help with body cell regeneration, it appears that circadian rhythms can have an effect on chemotherapy.

with the geo-physical time and thereby improve their growth, fitness, and survival. In humans, his research could help improve therapies for sleep-related disorders, as well as morbidity associated with shift workers, and the side effects of jet lag.

Circadian rhythms also play a role in the gut. Prof. Eran Elinav from the Department of Immunology and Prof. Eran Segal from the Department of Computer Science and Applied Mathematics and the Department of Molecular Cell Biology—who are doing groundbreaking research on the role of gut bacteria and nutrition—have found that bacteria living on the surface of the gut rotate their positions and functionality. When jet lag or similar sleep-wake disruptions bust the gut's microbiome rhythm, the repercussions cascade throughout the body.

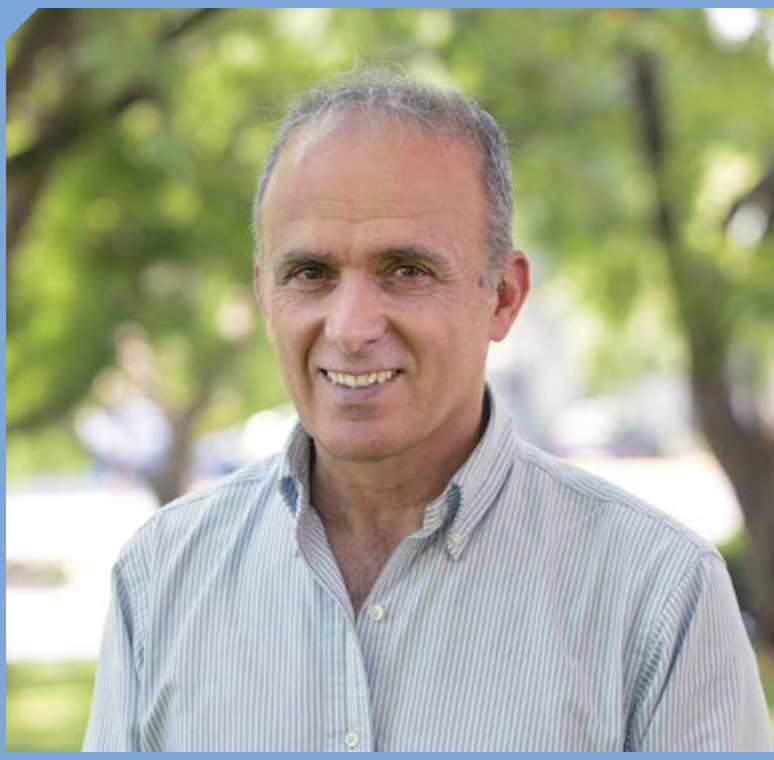
This work has implications for intervening in health problems such obesity and metabolic syndrome, which are more common in people whose circadian rhythms are frequently disrupted due to shift work or jet lag.

The clock in cancer

Because circadian rhythms affect the release of substances that help with body cell regeneration, it appears that circadian rhythms can have an effect on chemotherapy. Like healthy cells, cancer cells also regenerate themselves, especially when enduring the severe damage caused by the cancer drugs and radiation treatments used to destroy them. Scientists have found that if the drugs and/or radiation are given during the time of the circadian rhythm when cancer cells are least able to repair themselves, then they are more easily destroyed.

Prof. Yosef Yarden and his team in the Department of Biological Regulation found that that administering chemotherapy to mice during sleep hours was far more effective at reducing the size of tumors than doing so during their waking hours. The source of this difference was the body's normal daytime release of certain steroids that bind to the EGF1 receptors on cancer cells. This bonding effectively blocks cancer drugs from properly attaching to the cancer cells. In his study, not only were the sleep-treated tumors smaller after a week, but they were also weaker, indicated by less infiltration of blood vessels into the tumors.

The importance of circadian rhythms to medicine is only just beginning to be appreciated. Prof. Asher, who graduated from Tel Aviv University's Sackler School of Medicine in 1998, recalls that the impact of circadian rhythms was barely discussed when he was a medical student. In the past seven years, he says he's received a steady increase in inquiries from his Weizmann Institute colleagues, as well as from other institutions throughout Israel and abroad, asking for his team's input on whether a particular enzyme under investigation is dancing to its own unique circadian rhythm.



Prof. Yosef Yarden

When Sami Sagol was a high school student in Tel Aviv, he dreamt of being a scientist. It was 1962, and his school, a melting pot for new immigrants with few resources to challenge the most curious students, didn't quench his thirst for science. So he hopped on a bus to the Weizmann Institute of Science on a regular basis, where he took part in a youth program in which the Institute's investigators, including Prof. Michael Sela and Prof. Efraim Katchalski (Katzir)—then in the early years of their careers—lectured about their research and other areas of science.

Sami ultimately went in another direction, to business, becoming the CEO of the highly successful global company Keter Plastic. But he has come full circle, back to the Weizmann Institute as a philanthropist, where he and his wife Tova are now deeply engaged in advancing the future of brain science. Their most recent gift, which establishes the Sagol Institute for Longevity Research, was celebrated at the latest International Board meeting in November. The Sagol Institute will explore a vast range of factors that are associated with extending the human life span, including treating neurodegenerative diseases, cardiovascular disease, metabolism, and nutrition. The Institute is one of a long list of gifts to Israeli institutions comprising the Sagol Neuroscience and Longevity Network, a series of 12 centers at eight Israeli institutions doing research and clinical care in brain science, aging, and longevity.

"It amazes me to think that all those years ago I learned science from Michael Sela, and today he is my good friend," says Sami. "And because the Weizmann Institute is synonymous with excellence and innovation and attracts the best scientists, I feel

Sami and Tova Sagol, in their Tel Aviv apartment, surrounded by artwork of Shira Sagol, one of four daughters. Shira's self-portrait is at right.

Spotlight On

42–43

Sami and Tova Sagol

Furnishing the future of science

proud to have re-found my place at the Weizmann Institute, and to be associated with it all these years later."

From Izmir to Israel

Sami was born in 1942 in Izmir, Turkey, a city once known as Smyrna, on the country's Aegean coast. "At age six," he recalls, "I started to hear the first talk at home about Zionism and the establishment of the Jewish state... In 1948, several of my father's friends moved to Israel and my father, Yosef, helped them by investing in their fledgling company." They named their company Keter (Hebrew for "crown"), selling simple plastic items like soapboxes and combs from a two-room building in Jaffa.

While close to half of Turkey's Jewish population left for Israel after its establishment, the Sagol family stayed put in Turkey for the time being. Yosef Sagol ran a small but thriving textile business and was in no hurry to leave. Sami went off to an American boarding school in Istanbul. But after Israel's war with Egypt in Sinai in 1956, Sami made aliya alone, at age 15. His parents and siblings came a year after him, and his father joined his friends in running the plastics business in Jaffa.

"That first year in Israel was very difficult," he recalls. It seemed a natural choice to enroll in the Anglican

Honoring Tova and Sami Sagol

Hundreds of close friends of Tova and Sami Sagol along with Institute scientists celebrated the couple's latest gift to the Weizmann Institute at Hangar 11 at the Tel Aviv Port on November 7 during the 2017 International Board. The event highlighted the Sagol Institute for Longevity Research, which will advance key avenues of research related to slowing down the aging process and preventing diseases including neurodegenerative diseases. Prof. Gabriel Barbash, Director of the Bench-to-Bedside Program at the Weizmann Institute, gave an overview of the research that will be explored thanks to funding from the new Sagol Institute.

The Sagol Institute for Longevity Research

"I want all my friends to give too, to advance science and make a real difference in the world," says Sami Sagol.
"There's always a grander plan," smiles Tova.

School in Jaffa, but he soon felt the absurdity of having come on aliya to land in a Christian missionary school. But he didn't know Hebrew, and he was at a critical age when students were beginning to take their high school matriculation exams. And so he found himself roaming Tel Aviv's streets, knocking on school doors and asking to enroll. "No school would take me in," he says. Finally, one did, Geula High School. "It wasn't a great school, but for me, it was a gift."

After graduating, he joined the prestigious Atuda program of the Israel Defense Forces, which enables high school graduates to defer the draft until after university studies and do army service in their area of expertise. He studied chemical engineering at the Technion.

He and Tova met during his army service. Tova was from Netanya; she was born in an Italian transit camp to parents who were Holocaust survivors, and came to Israel at age one.

After Sami graduated from the Technion, he and Tova planned to move to the U.S. so that he could pursue graduate studies at MIT. But the small company in Jaffa was in decline and on the brink of closure, and Yosef Sagol asked his son to try to turn it around, so they agreed, and stayed. And turn it around he did, together with his brother Itzhak, based on a few simple but innovative premises: people like to sit outside, especially in Israel's moderate climate where there is a culture of eating and sitting outdoors; they don't want to ruin their indoor furniture; and they won't spend on the outdoors what they will on the indoors. And so the brothers changed the product to light, aesthetic, and inexpensive garden furniture, bought up competitors, and watched what international companies were producing—and then figured out how to use new technologies to make the products in a more inexpensive way.

One of the secrets to the company's success was prioritizing innovation, says Sami. He established something previously unheard of within a commercial entity: its own degree program. Together with Bezalel Academy of Arts and Design and Shenkar, Israel's two leading art and design schools, Keter launched its own in-house training school for product designers and engineers, where they learned to be creative and thrifty with plastics. Over the course of several decades, Keter became the number-one garden furniture and home improvement products company in Israel and then one of the world leaders in the field.

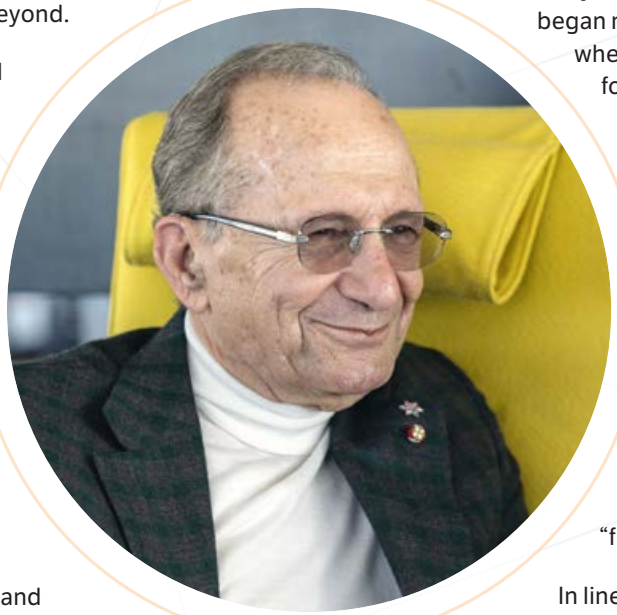
Today, Keter has more than 4,000 employees, 18 manufacturing plants, and advanced distribution centers in nine countries. In 2010, Sami started to realize that in order to maintain Keter Group's growth, the business would require new ownership and management. In 2016, the Sagol family sold its majority stake in Keter for a transaction valued at $1.7 billion. The Israeli business newspaper Globes named Sami 'Person of the Year' that year.

Children and innovation

Tova and Sami, who previously lived in Ramat Hasharon and raised their four daughters there, now live in Tel Aviv. They relish the sweeping view

The Sagol Center at Assaf Harofeh Medical Center, which is advancing the use of hyperbaric medicine for the treatment of various diseases including brain-related conditions

from their 30th floor apartment, where the city—and its visible, rapid transformation from low-slung apartment buildings to high-rises—is spread out below, with the Mediterranean Sea a beautiful blue expanse just beyond.



After Keter's sale, "my second career began," Sami jokes. But the Sagols' philanthropic work, which he is referring to, is serious stuff. At the Weizmann Institute, the Sagols have given generously to various areas, including Davidson Online, the website of the Davidson Institute of Science Education. Today, Davidson Online has become a go-to source for science news in Hebrew for schoolchildren, teachers, and the broader public, and serving as a model for online science literacy.

But Sami is investing his greatest efforts today in expanding his Sagol Neuroscience and Longevity Network, which, he says, "became a dream of mine after both of my parents died from brain diseases—my father from Alzheimer's and my mother from a stroke."

One of the research areas in which Sami and Tova feel most passionate about is the use of hyperbaric medicine for treatment of brain diseases and disorders. The Sagol Center at Assaf Harofeh Medical Center is now considered a world leader in the field, treating more than 120 patients per day, "and is seeing amazing results for the neurological cases and in particular brain injuries and fibromyalgia," says Sami.

Tova is equally busy with additional philanthropic endeavors. She is the founder of Nitzan Horim, a project she developed within the Nitzan Association, which assists children with disabilities. Nitzan Horim is a unique initiative that helps parents with disabilities care best for their children. She served as President of the Association for many years and today is Chair; her initial involvement began nearly three decades ago, when she sought assistance for one of their daughters, Mia, when Mia became a parent.

In 2016, the Weizmann Institute bestowed on Sami an honorary doctorate, recognizing his business acumen and his outsize contribution to Israeli society and science. It was an honor that Sami says brought him "full circle".

In line with Sami's business approach of canvassing the Israeli market and then going international, the Sagols' next major gift to the Weizmann Institute will fund a major multidisciplinary collaboration with MIT. The gift, he hopes, "will not only seed joint research between these two great institutions. I'm dreaming bigger," he says. "I would like this to be the starting point to seed scientific collaborations between the Sagol Network in Israel and scientists in Massachusetts, another major hub of scientific activity." And then he has a grander plan that is reminiscent of the way Keter was run by a team of his father and his friends in the company's early years.

"There is always a grander plan," smiles Tova.

"I want all my friends to give too, to advance science and make a real difference in the world," he says, "so that Israel develops a deeper connection with Massachusetts and—when we're done with that, the sky's the limit."

A Brazilian Pepper Tree. Older trees develop an exceptional sculpted appearance.

Turning 'aging' into 'longevity'

The Sagol Institute for Longevity Research will be a hub for advancing research on understanding the process of aging and finding ways to solve disorders and diseases in order to allow people to live longer, happier, healthier lives. Here's a sampling of areas of research that are likely be supported by the Sagol Institute:

- **Bone health:** Prof. Elazar Zelzer and his group in the Department of Molecular Genetics do not have a solution for the elderly falling down and breaking their hips, but they have shed interesting new light on the process that guides the repair of bones. Their research demonstrates the strong and important connection between the nervous system, muscles, and the skeletal framework of the body.

- **Cellular senescence:** Dr. Valery Krizhanovsky in the Department of Molecular Cell Biology is advancing the field of cellular senescence—a cellular state in which cells permanently lose the capacity to divide but do not die. He recently developed a test to estimate the age of individual cells. Since a number of age-related diseases have been shown to be associated with the accumulation of large numbers of senescent cells, his experiments in how to use the body's natural cell disposal systems have generated much interest, and ongoing research.

- **Cardiovascular health:** Heart disease is a leading cause of death in the world, and so learning to prevent and treat heart diseases is a major key to extending life and improving its quality. Prof. Eldad Tzahor and his team in the Department of Molecular Cell Biology recently identified a molecule associated with growth and development that appears to have the potential to unlock the ability to repair heart muscles but stops functioning after birth.

- **Neurodegenerative diseases:** Solutions for diseases like Alzheimer's, Parkinson's, and ALS can come from the oddest places—even spiders' webs and silkworms. Dr. Ulyana Shimanovich of the Department of Materials and Interfaces has shown parallels between the structure of natural silkworm fibers and the amyloid protein fibers that clog the brains of those with Alzheimer's and Parkinson's diseases. Her work suggests that amyloid proteins might even have some positive properties, and that understanding how these fibers are produced in nature can suggest ways to control their growth.

Chicago gala: Shaping a brighter tomorrow

The Midwest Region hosted a memorable Gala Dinner under the theme of "Breakthrough: Celebrating Discoveries. Shaping Tomorrow." More than 500 community and industry leaders came together at the Fairmont Chicago Millennium Park to honor Jeffrey S. Aronin, Chairman and CEO of Paragon Biosciences, LLC. An entrepreneur, innovator, and investor, Mr. Aronin received the American Committee's Weizmann Leadership Award in recognition of his work to improve patients' lives through advancements in science and technology. National Board members Dr. Marilyn and Brian Price once again served as event chairs, and WGN Radio's Ilyce Glink served as emcee.

(L-R) American Committee CEO Marshall S. Levin; Lexi, Ashley, Emily, Jeffrey, and Lisa Aronin; and Ilyce Glink.

End of an era at Wix

A long era of events held at the Michael and Anne Wix Auditorium came to close with a concert by favorite Israeli musicians on February 20. Danny Sanderson, Danny Robas, Mazi Cohen, and friends from the iconic Israeli band "Kaveret" (Poogy), played to a packed audience that crowded the aisles in dance. It was a joyful goodbye to a place that has been home to International Board gatherings, honorary doctorate ceremonies, and cultural events for Weizmann Institute staff and Rehovot residents for decades. The auditorium will undergo extensive renovation and will be renamed the Michael Sela Auditorium, honoring a major gift by Michael and Sara Sela, long-time patrons of both science and the arts.

Weizmann World

Dr. Kobi Abramson in Canada

Weizmann Canada hosted Dr. Kobi Abramson in Montreal and Toronto in October. Dr. Abramson, of the Department of Immunology, met with supporters and new friends in both cities and spoke about his research in autoimmune diseases.

His visit culminated with a keynote address at Celebrating Philanthropy, an evening of celebration and recognition in honor of donors at the Shangri-La Hotel in Toronto. Weizmann Canada President Jeff Cohen opened the program by reflecting on a successful year and thanking donors for their support, including transformational gifts from the Azrieli Foundation, the Gerald Schwartz and Heather Reisman Foundation, and Roslyn and Hymie Mida.

Board Director Francie Klein welcomed new members to the Vera and Chaim Weizmann Honour Society, including Roslyn and Hymie Mida, and Linda and Sigmund Soudack.

The annual Outstanding Leadership Award was presented to Ellen and Stan Magidson, in recognition of their passion, dedication, and tireless support of science education.

Dr. Abramson with Marika and Bill Glied (z"l), generous supporters of autoimmune disease research.

Weizmann Young European Network meets

About 100 guests were in attendance for a gathering of the Weizmann Young European Network (WYEN) in Heidelberg, Germany, in December. WYEN is the European Committee's young leadership club, which concluded its first year since its launch in Berlin in 2016. WYEN, which is chaired by Dr. Christian Tidona, has become a pan-European club for successful entrepreneurs and leaders who wish to explore science through the lens of the Weizmann Institute while networking with peers across Europe.

Weizmann Institute President Prof. Daniel Zajfman spoke about the Institute's special brand of curiosity-driven research. Dr. Özlem Türeci, Co-Founder of Ganymed Pharmaceuticals, spoke about pursuing the translation of basic science into applications for industry. WYEN is planning additional events across Europe.

Gala in Paris honoring the late Simone Veil

The Pasteur-Weizmann Council hosted a gala in Paris on December 20 in partnership with Weizmann France, which honored the late Simone Veil, founder of the Pasteur-Weizmann Council. The Council and Weizmann France are both chaired by Maurice Lévy. More than 1,500 people attended the event, which took place at Salle Pleyel.

The Pasteur-Weizmann Council oversees a longtime scientific collaboration, providing support to researchers from the two institutions. The Council was established in 1975 in large part because of the initiative of Ms. Veil, then France's Minister of Health. For the last 40 years, the collaboration has served as a model for international scientific collaboration.

At the event, Prof. Daniel Zajfman, President of the Weizmann Institute, and Prof. Christian Vigouroux, President of the Pasteur Institute, talked about the importance of collaborative research between France and Israel, while Prof. Pascale Cossart, Permanent Secretary of the Academy of Sciences, and Prof. Avi Levy, Dean of the Faculty of Biochemistry at the Weizmann Institute, spoke about current research and collaborations between the Pasteur Institute and the Weizmann Institute.

Weizmann France Chairman Maurice Lévy and Prof. Daniel Zajfman

Other speakers included Laurent Delahousse, who directed a film about Ms. Veil called *The Instinct of Life,* and French actress Isabelle Huppert, who read texts penned by Ms. Veil. Sidney Toledano, a member of the Board of Pasteur-Weizmann, discussed the results of scientific research related to cancer and antibiotic resistance. The pianist Khatia Buniatishvilli and the jazz bassist Avishai Cohen gave two recitals.

Other special guests included Agnès Buzyn, France's Minister of Solidarity and Health; Bruno Le Maire, the Minister of Economy and Finance; Valérie Pécresse, President of the Ile-de-France Region; Bernard Cazeneuve, a former Prime Minister; and Aliza Bin Noun, Israel's ambassador to France.

The event ended with a dinner that brought together more than 500 people in the restored Salle Pleyel, the "Cathedral Hall."

Honoring Ruth and Uriel Arnon in Tel Aviv

The Israeli Friends Association held an event at the Tel Aviv Hilton in honor of Dr. Uriel and Prof. Ruth Arnon to mark their contribution to the Arnon Campus for Science Education at the Weizmann Institute, which houses the Schwartz-Reisman Science Education Center.

The keynote speaker, Minister of Education Naftali Bennett (pictured above with the Arnons), acknowledged their generosity for youth excellence in science. Prof. Daniel Zajfman, President of the Weizmann Institute, led a recognition ceremony for the couple and spoke about the example they set as scientists contributing philanthropically to the Weizmann Institute.

Prof. Arnon thanked the audience and described her lifelong passion to science. Israel's future relies on educating many scientists and engineers, she remarked, adding that it is essential that we encourage the study of mathematics and physics from a young age.

Yehuda and Judith Bronicki, founders of Ormat Industries, will jointly receive the 2018 Israel Prize for industry. Israel's Minister of Education, Naftali Bennett, announced the winners in all the Israel Prize categories in March. The Bronickis are major donors to the Weizmann Institute of Science who have given generously to science education and the research of Prof. Nachum Ulanovksy of the Department of Neurobiology. Ormat is a world leader in geothermal energy systems and a pioneer in environmentally friendly technology. The Israel Prize ceremony takes place on April 19, on Israel's Independence Day.

(L-R): Vice President of the Friends Association of Rio de Janeiro, Mariano Zalis; President of the Friends Association in Argentina, Dr. Hugo Sigman; CEO of the Weizmann Institute for Latin America, Dany Schmit; Minister of Industry, Energy and Mining, Carolina Cosse; President of the Weizmann Institute, Prof. Daniel Zajfman; President of the Oriental Republic of Uruguay, Dr. Tabaré Vásquez; Ambassador of Israel in Uruguay, Nina Ben Ami; Dr. Silvia Gold, President of Mundo Sano; President of the Friends Assosiation in Brazil, Mario Fleck.

Uruguayan President launches postdoctoral fellowship at Weizmann

On January 22, the President of Uruguay, Dr. Tabaré Vázquez, and the President of the Weizmann Institute of Science, Prof. Daniel Zajfman, participated in an event to launch a fellowship for Uruguayan postdoctoral fellows at the Weizmann Institute and to celebrate a growing partnership between that country and the Weizmann Institute in science and education.

Presidents of the Latin American Committee's Friends Associations in Brazil and Argentina as well as officials from Uruguay and Israel, and other Latin American friends were in attendance.

President Vázquez , who was a student at the Weizmann Institute, said, "I dream that young Uruguayan scientists can study in Israel, attend the Weizmann Institute, and enrich themselves from a scientific and human perspective and bring back the knowledge they have acquired to enhance and enrich the life of all Uruguayans."

"Science can contribute to that end, and indeed the Weizmann Institute can contribute, and we now have an important door that has been opened for Uruguayan scholars to go to Israel and for Israelis to come to us."

Prof. Zajfman discussed the scientific research conducted at the Institute and the strengthening of the Institute's relationships with several Latin American countries. "Science is not done in a vacuum, in solitude," but rather is "a universal language, which is why cooperation is so important," he said.

UK: Ambassadors' Lecture

Three Weizmann Institute scientists spoke at Weizmann UK's Annual Ambassadors' lecture, "From Research to Reality," at the IET London on November 28. About 150 guests attended the event.

Dr. Michal Leskes from the Department of Materials and Interfaces discussed investigations into extending the lifetime of rechargeable batteries, as well as advances in battery power technology.

Prof. Ron Milo from the Department of Plant and Environmental Sciences discussed the hidden secrets in making food production more efficient. And Dr. Ulyana Shimanovich from the Department of Materials and Interfaces described her research on how ultra-fine fibres such as spider webs and silk from silkworms are offering hope towards the treatment of Alzheimer's disease.

Weizmann UK Chairman Martin Paisner CBE introduced the event, which was moderated by science communicator Dr. Emily Grossman.

Drs. Leskes and Shimanovich both completed their postdoctoral studies at Cambridge University. During their visit to the UK, they joined Weizmann UK and a small number of special friends and supporters who have a connection to Cambridge for an informal lunch at St. John's College, Cambridge.

Dr. Ulyana Shimanovich, Sheridan Gould, Prof Ron Milo, Dr. Michal Leskes, Martin Paisner CBE, and Dr. Emily Grossman.

The scientists also took part in the How To Academy's "How to Change the World" conference at the Royal Institution on November 30. Weizmann UK sponsored that day-long conference which provides insight into the innovations that are predicted to change our lives. Weizmann scientists were joined by other leading experts from academia and industry to explore subjects ranging from emotion-reading computers to the exercise pill of the future.

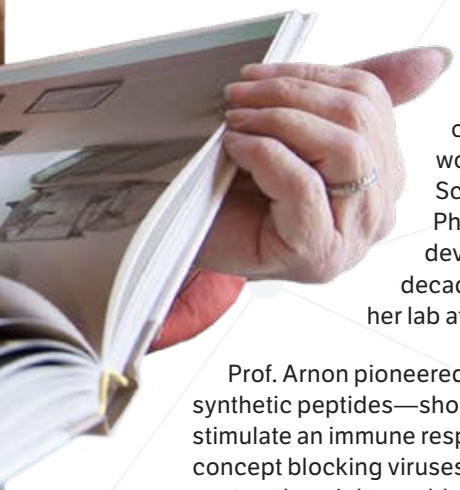
One-shot strategy

Prof. Ruth Arnon's universal flu vaccine enters Phase III trials

Prevention is better than cure when it comes to any illness, and influenza (the flu) is no exception. Between five and 20 percent of the U.S. population is infected by the flu every year, and thousands die from flu-related illnesses. Fear of the flu is in the numbers: American drug companies plan to manufacture over 160 million doses of injectable flu vaccine in the coming year alone.

Beyond the Bench

The need to produce so many doses stems from the fact that the flu—unlike other infectious diseases—changes every year, forcing the annual design of new vaccines. However, a new approach developed by Prof. Ruth Arnon, a member of the Department of Immunology and a former President of the Israel Academy of Sciences, has resulted in a vaccine potentially capable of protecting people from the flu for many years and against all strains of the virus in a single shot.



No stranger to pharmaceutical innovation, Prof. Arnon is the co-developer of Copaxone®, a multiple sclerosis (MS) drug that commands a third of the market worldwide. Today, she is Head of the Scientific Advisory Board of BiondVax Pharmaceuticals Ltd., which has developed a universal vaccine based on decades of peptide research conducted in her lab at the Weizmann Institute.

Prof. Arnon pioneered a form of drug therapy that uses synthetic peptides—short chains of amino acids—to stimulate an immune response. After achieving proof-of-concept blocking viruses that attack bacteria, Prof. Arnon next set her sights on blocking viruses that attack people.

"We chose influenza because so much was already known about it," she says. "We knew that some regions of the virus change, while others do not. So we decided to target the non-changing areas with the assumption that these regions might be essential for infection, and also anticipated that—if the non-changing regions appeared in many flu types—this approach could be widely effective."

Both assumptions proved correct. Vaccinating mice with the synthetic vaccine, Prof. Arnon's team achieved 100% protection from several strains of the flu virus. Moreover, the mice remained disease-free for seven months—the equivalent of decades of flu-free health in humans. Later, in collaboration with her departmental colleague Prof. Yair Reisner, working with "humanized mice," the results were similar: although these vaccinated engineered mice were exposed to the influenza virus, they remained disease-free.

Patented by Prof. Arnon and Dr. Tamar Ben-Yedidia—a former student and research associate in the Arnon lab—the universal vaccine technology was licensed to BiondVax.

Following a series of successful clinical trials involving close to 700 participants, the vaccine will soon be tested in several thousand people in a Phase III trial to determine the vaccine's clinical efficacy—the final barrier to FDA approval.

"If people once thought it impossible to eradicate the flu in humans, we now believe that this goal can be realized in the coming years," says Dr. Ron Babekoff, the company's Founder and CEO. "We named our company BiondVax—that is, beyond vaccines—because the research indicates that this approach will lead to less flu-related hospitalization and less mortality."
Dr. Ben-Yedidia, now the company's Chief Scientist, adds: "The universal vaccine will respond to a significant need by providing multi-season protection against both seasonal and pandemic influenza strains."

"The flu is a truly global threat," Prof. Arnon says. "While our vaccine is still not yet available in the pharmacy, I'm optimistic. In scientific research, the very highest satisfaction is to know that you can help people."

Milvia Perinot and Prof. Michal Neeman

A partnership that is advancing cancer imaging research

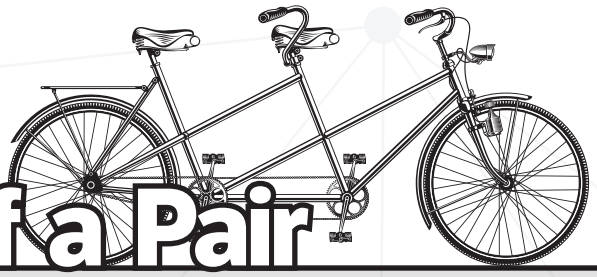
After years of navigating across a multitude of country lines and languages in Europe with her late partner, Italian-born Milvia Perinot has found a home at the Weizmann Institute of Science.

"I think research is the future for every one of us," she says. "I came here and fell in love."

While Milvia has become one of the foremost supporters of cancer research at the Institute, her path from the northeastern mountains of Italy to south-central Israel has been far from ordinary.

During a post-graduation summer holiday in 1961 at age 18, she and a friend were relaxing on a bench along the northern Italian coast when three young men in an Alfa Romeo Spider pulled up beside them. The least dapper, but most intriguing, of the trio—according to Milvia—sported long hair and uncharacteristically causal clothes for the Italy of the 1960s. This was Henry Krenter, who became her life partner.

The couple spent nine months out of every year traveling across Europe for the refrigeration company



Profile of a Pair

that Henry represented, taking turns navigating and driving through the rolling green hills and rustic villages of Ireland, Austria, Switzerland, Belgium, Great Britain, and France. While they ultimately ended up settling with Henry's parents in Lugano, Switzerland—where she lives today—it was Israel that always remained on Henry's mind.

Born in Dresden, Germany, and raised primarily in Yugoslavia, Henry and his parents escaped on the eve of the Nazi invasion in 1941, boarding a train bound for Palestine. Henry spent his teenage years in Tel Aviv, and lied about his age in order to join the army in 1948 and fight in the War of Independence. After working as a salesman in a Judaica factory in Tel Aviv, he left Israel in 1951 to join his mother and father in Trieste, Italy. But Israel always stayed with him, and he frequently expressed to Milvia his desire to return. He came back only once, in 1996, for a four-day trip with Milvia.

After a brave struggle with lung cancer, Henry passed away in 2008 and Milvia made it her mission to fulfill her beloved partner's dream. With the help of longtime Israeli friends, she buried Henry at Kibbutz Einat. Describing the kibbutz as a "Garden of Eden," filled with flowers, trees, and birds, Milvia makes a point of visiting Henry's gravesite there daily during her now-frequent visits to Israel.

Milvia also wanted to ensure that Henry's legacy would positively influence the country he so loved, through the foundation they established together, Fondazione Henry Krenter. She found the Weizmann Institute to be the perfect place to honor his memory, and she naturally chose to support cancer research. She herself had overcome endometrial carcinoma in 2005, and her nephew succumbed to kidney cancer the next year.

She established the Henry Chanoch Krenter Institute for Biomedical Imaging and Genomics in 2012, headed by Prof. Michal Neeman, Weizmann Institute Vice President, whose research in the Department of Biological Regulation focuses on angiogenesis—the formation of blood vessels—using magnetic resonance and optical imaging. She concentrates on ovarian cancer and has demonstrated that the hormonal changes accompanying menopause can indirectly promote the growth of dormant tumors and the spread of cancer, by inducing the growth of blood vessels that nourish these tumors. Prof. Neeman pioneered a method for tracking blood and lymphatic vessels to help scientists better understand how to suppress vessel growth and dormancy, thereby boosting survival rates among ovarian cancer patients.

Dozens of projects have benefited from the support of the Krenter Institute, paving the way for groundbreaking advancements in cancer research. As one example, Prof. Karina Yaniv received funding to advance her studies on the origins of the lymphatic system and its role in cancer metastasis; she is uncovering the origins of lymphatic vessels during embryonic development and the molecular players involved in this process. Such knowledge may prove valuable for treating lymphatic-related diseases and controlling the spread of metastatic tumors.

"I hope with all my heart that they will be able to find something to help cure cancer, here at the Weizmann Institute," Milvia says. "My heart is in this country," she says.

Milvia also gives to other areas at the Weizmann Institute, and recently funded a PhD scholarship for women, with the first recipient Chen Attias, a PhD student in the Department of Computer Science and Applied Mathematics.

While cementing her role in this critical scientific endeavor, Milvia also quickly developed a personal connection with Prof. Neeman.

"Milvia joined the Weizmann family and captured my heart with her curiosity and passion for science, and her wisdom and love of humanity and nature," Prof. Neeman says. "With her modest kindness and love she is able to move mountains and break through any wall. Her drive and encouragement made her a partner in the Weizmann effort to understand and fight cancer."

Says Milvia, "I don't have enough words to [describe] Michal. To me, to be like her would be a prize in life."

Safeguarding our H_2O

Dr. Vaizel-Ohayon is keeping Israel's water safe

As Israel increasingly relies on desalination to quench the thirst of its rapidly growing population—nearing 8.5 million, on a mere 8,400 sq. miles of land—microbiologists must react with unprecedented speed and precision to monitor the nation's water quality.

Among the top minds at the helm of this mission is Weizmann Institute alumna Dr. Dalit Vaizel-Ohayon, Chief Bacteriologist at Mekorot, Israel's national water company. Her daily responsibilities amount to nothing less than keeping Israel's entire water supply safe for consumption.

"We are responsible for delivering water in drinking quality to the gates of the cities," says Dr. Vaizel-Ohayon, who received her PhD from the Weizmann Institute's Department of Molecular Genetics.

Today, Israel's water supply is experiencing what Dr. Vaizel-Ohayon describes as a "total transformation." She has been in her role for a decade and has witnessed the change. Until about 10 years ago, some 50 percent of the country's drinking water originated from the Kinneret and the remainder came from aquifers. But the tables have turned, and today some 70 percent comes from the sea and undergoes a desalination process, while the remainder is pumped from aquifers. Due to prolonged droughts over the past decade, the Kinneret now supplies a much smaller fraction of the supply.

In the days when the lion's share originated in the Kinneret, the water flowed for several days through the National Water Carrier pipes before reaching homes for consumption—giving microbiologists like Dr. Vaizel-Ohayon ample time to conduct quality control. Now, however, with five large desalination plants located along the Mediterranean coast in the country's central and southern regions—Ashdod, Ashkelon, Palmahim, Sorek, and Hadera—most drinking water arrives at Israeli homes within several hours. As a result, the Mekorot team led by Dr. Vaizel-Ohayon must work fast. That means employing the most cutting-edge technologies and testing the water immediately.

Traditional examination methods take at least 24 hours to provide answers—which is too long for today's source-to-sink timeline. So Dr. Vaizel-Ohayon and her team are now using these methods in addition to employing a variety of rapid-testing

Israel's IDE Technologies desalination plant in Sorek

Alumni

"At Weizmann, I learned not to be afraid to explore new things," *says Dr. Vaizel-Ohayon.* **"Weizmann taught me to keep my mind open at all times—and to believe that we can constantly develop ourselves."**

technologies. Those include the "quantitative polymerase chain reaction" (qPCR) technique, which massively replicates segments of DNA to look for the presence of infectious agents such as fecal coliform, streptococcus, and parasites. Her team is also employing new online tools that enable real-time monitoring of bacteria as well as of pH, chlorine, and turbidity. One particularly innovative instrument that the lab has begun to use is Colifast™, an instrument from Norway that tests fecal coliform bacteria in water supply systems.

"Molecular techniques and recent breakthroughs in DNA—such as qPCR and Next Generation Sequencing—and microscopy have given us a new set of tools for microbial water quality testing, and the name of the game today is speed and a full picture," says Dr. Vaizel-Ohayon. "So we need to keep on top of the latest and greatest techniques and make sure they can give us reliable results in a matter of hours. In addition, we believe that defining the microbiome in water supply systems and treatment plants by using Next-Generation Sequencing will probably enable more precise monitoring and treatment for specific target bacteria."

When contamination is suspected—which typically occurs once every few months—Dr. Vaizel-Ohayon, together with Mekorot's water quality engineers, analyzes the possible source of the irregular result and identifies the actions necessary to eliminate it.

Dr. Vaizel-Ohayon attributes much of her scientific curiosity and drive to take on new challenges to her time spent at the Weizmann Institute. She completed her MSc in the lab of Prof. Yosef Shaul, studying the Hepatitis B virus. She

completed her PhD in 2000 on the embryonic development of drosophila fruit flies, under the supervision of Dr. Eyal Schejter, now a senior staff scientist in Prof. Ben-Zion Shilo's lab. Before Mekorot, Dr. Vaizel-Ohayon worked in a biotech startup for five years. The analytical skills she acquired while conducting her MSc and PhD projects gave her the experience necessary to build her career at Mekorot, where she became fascinated by the subjects of environmental microbiology and water quality.

"At Weizmann, I learned not to be afraid to explore new things," she says. "Weizmann taught me to keep my mind open at all times—and to believe that we can constantly develop ourselves."

Dr. Vaizel-Ohayon collaborates with the Water Authority and the Health Ministry, the government agencies responsible for determining water quality policy and management.

Her work is unique in part because Israel's water system is unique. While other countries are only beginning to employ desalination to boost their water supplies, most still rely predominantly on ground and surface water—managing their resources locally and drawing from multiple wells and rivers. Israel, meanwhile, has one national system, now based mostly on desalination, that requires transporting water across the country.

"As other countries look to Israel as leader in desalination, water reuse, and quality control, they could also learn how to create and optimize one unified structure for managing such a precious resource," Dr. Vaizel-Ohayon says.

"The thinking of Israel as a whole, as a complex, not as localities—that's what gives us the advantage," she adds. "In every house, there is always water, and always quality water."

Personalized classroom

What happens when technology and teachers meet?

In the Internet age, teachers aren't lacking topics or resources for the classroom. In fact, the vast amount of available information can often feel overwhelming. A new initiative of the Department of Science Teaching is helping teachers separate pedagogical wheat from chaff—and ushering a new age of personalized teaching into the classroom.

The new, interactive learning management system, called PeTeL, gathers real-time data from individual students—yes, during class—about what they know and do not know. Then, the system selects personalized follow-up activities and homework assignments. In this way, PeTeL allows teachers to tailor learning to each and every student. Much in the same way that personalized medicine integrates key datasets to advancing health, PeTel is poised to advance classroom education.

"We expect PeTeL to be a powerful platform with the potential to benefit instructional settings and improve learning outcomes, throughout the world," says Prof. Anat Yarden, who heads the Department of Science Teaching and is spearheading PeTeL, an acronym for Personalized Teaching and Learning.

Education

Big data for schools

The heart of the platform is a system that extracts data from student performance and tracks their learning and even apportions and grades homework online. The system doesn't leave teachers out of the equation, of course. It helps teachers verify what their students know and how well lessons have been understood through the use of diagnostic modules developed by experts in the Department of Science Teaching. This diagnostic approach in and of itself, already currently available to all schools in Israel, was named "one of the most valuable tools for teaching in the 21st century" by Israel's Ministry of Education.

Prof. Anat Yarden

But PeTeL goes even further. It supports the creation, delivery, and tracking of customized learning plans on a wide variety of advanced subjects geared toward high-school learning. With PeTeL, teachers can browse a range of digital textbooks, resources, interactive activities, and lesson plans uploaded by other instructors. Similar to an online shopping site, teachers can select the resources that best fit their needs and preferences, then design a customized learning experience by modifying the items they choose.

The lessons are delivered to the students via PeTeL's digital platform, and class assignments are completed on individual electronic devices like iPads or laptops. Then it tracks the performance of individual students and provides real-time feedback.

PeTel also enables a continuous stream of communication between experts in the Department of Science Teaching and science and mathematics teachers—creating an online community of educators who are sharing best practices and innovative ideas. Thus, teachers can use PeTeL not only to search for activities and lesson plans, but also to seek advice from their peers. They can share their classroom success stories and upload original learning materials. Every time a teacher shares, it becomes available to every member of the community, making PeTeL an engine for producing more variegated and effective classroom experiences and reaching more individual students in more schools.

A one-year pilot program in Hebrew-speaking Israeli high schools, focusing on physics, is currently underway and will eventually be expanded to support high school chemistry and biology instruction, as well as mathematics instruction in Hebrew and Arabic.

As a high school student, Chen Attias majored in physics, economics, and math for her high school matriculation exams—performing with high scores across the board—but there were no girls in the computer major, so she did not consider it an option. But that changed when she enlisted in the elite 8200 unit of the Israel Defense Forces—the military intelligence division responsible for collecting signal intelligence and code decryption—where she learned not only that she was technically adept at working with the computers, but that she enjoyed it as well.

Big data, big dreams

Meet PhD student Chen Attias

Students

Chen went on to study electrical engineering, receiving her BSc at the Technion's EMET Research-Oriented Excellence Program for outstanding students. There, she was involved in the design of fast WiFi communication systems, and developed algorithms for detecting and tracking the frequency of harmonic signals such as bat sounds and whale songs.

When she enrolled in the Weizmann Institute of Science's Department of Computer Science and Applied Mathematics for her master's studies, it wasn't the first time she had stepped foot on campus. As an undergraduate, Chen participated in the Amos de-Shalit Summer School and the Young Weizmann Scholars program, which allowed her the opportunity to spend time in Weizmann Institute labs and meet principal investigators.

"I always knew that I liked the theoretical approach at the Weizmann Institute and was interested in pursuing a research path," says Chen.

Today, she is a second-year PhD student in computer science under the joint mentorship of Prof. Robert Krauthgamer and Prof. Boaz Nadler, and supported by a scholarship from Milvia Perinot.

Chen is currently developing algorithms to analyze massive and complex datasets—otherwise known as 'big data.' Such adaptive algorithms are needed to handle the burgeoning amount of data in a spectrum of fields—from genomics to physics. Her focus now is similarity searches: algorithms that search for specific similarities in large datasets in a quicker and more efficient manner.

Opening the doors for other women

Chen has been successful not only in her computer science research and studies, receiving the prestigious Intel Academic Excellence Award in 2012, but also in promoting women in science. Indeed, her extracurricular initiatives are nearly as plentiful as her research activity. She initiated a Weizmann Institute forum for female computer scientists and mathematicians that includes faculty, postdoctoral fellows, and graduate students. Her goal was "to create a strong and supportive community for women in the department through soft skills workshops, talks with female role models, and other events and activities." She also co-organized an event with a colleague from Bar-Ilan University and in collaboration with Google, aimed at encouraging young women to pursue careers in computer science.

And that's not all: she founded a new debate club as part of the Feinberg Graduate School's career development program, and participated in the Microsoft "Women of Excellence" Program at the Microsoft Israel R&D Center in Herzliya. This is a program for outstanding students in computer science and related fields, which enables women to develop personally and professionally, network, and share advice and experiences.

Last year, Chen was one of a select group of 20 women from Europe, the Middle East, and Africa recognized by Google for their academic excellence, leadership skills, and passion for advancing diversity in computer science. She volunteers in Project Mehamemet ("Code Goddess"), which teaches high school girls about computer software coding and encourages them to reach their fullest potential in what is still a male-dominated discipline.

And that's just in Israel. In November, Chen was chosen to participate in a group of 12 alumnae from the 8200 army unit who have embarked on successful careers in academia and high-tech for a week-long visit to the U.S. to meet prospective investors and executives, as part of the 8200 Alumni Association's Woman2Woman program. The program's goal is to broker connections in the U.S. market and to provide young women with role models of women who have been successful in the Israeli business world.

Chen was paired with Dr. Orna Berry, Vice President and General Manager of the Dell EMC Excellence Center in Israel. Berry was also the first woman to serve as Chief Scientist, the highest position in the Economy Ministry's Israel Innovation Authority.

Lia Addadi

- Jeanne and Joseph Nissim Foundation for Life Sciences Research
- Prof. Lia Addadi is the incumbent of the Dorothy and Patrick Gorman Professorial Chair

Ido Amit

- Fondation Adelis
- BLG Trust
- Comisaroff Family Trust
- European Research Council
- Alan and Laraine Fischer Foundation
- Drs. Herbert and Esther Hecht
- Leona M. and Harry B. Helmsley Charitable Trust
- Estate of Lydia Hershkovich
- Estate of David Levinson
- Isa Lior
- David M. Polen Charitable Trust
- Rising Tide Foundation
- Rosenwasser Fund for Biomedical Research
- The Felix and Silvia Schnur Endowment Fund in Stem Cell Research
- David and Fela Shapell Family Foundation
- Vanguard Charitable Foundation
- The Wolfson Family Charitable Trust
- Prof. Amit is the recipient of the Helen and Martin Kimmel Award for Innovative Investigation

Gad Asher

- Adelis Foundation
- European Research Council
- Yeda-Sela Center for Basic Research

Ronen Basri

- The J&R Center for Scientific Research
- Prof. Basri is the incumbent of the Elaine and Bram Goldsmith Professorial Chair of Applied Mathematics

Elisabetta Boaretto

- The Helen and Martin Kimmel Center for Archaeological Science which she heads
- Dangoor Accelerator Mass Spectrometer Laboratory

Eran Elinav

- Adelis Foundation
- Andrew and Cynthia Adelson
- Estate of Bernard Bishin
- Valerie and Aaron Edelheit
- European Research Council
- Jack N. Halpern
- Leona M. and Harry B. Helmsley Charitable Trust
- Bernard M. and Audrey Jaffe Foundation
- Else Kroener Fresenius Foundation
- Park Avenue Charitable Fund
- Lawrence and Sandra Post Family Foundation
- Rising Tide Foundation
- Vera and John Schwartz
- Leesa Steinberg
- Yael and Rami Ungar
- Prof. Elinav is the incumbent of the Sir Marc and Lady Tania Feldmann Professorial Chair

Tamar Flash

- Prof. Flash is the incumbent of the Dr. Hymie Moross Professorial Chair

Assaf Gal

- Laurie Kayden Foundation
- The Henry Krenter Institute for Biomedical Imaging and Genomics
- Lerner Family Plant Science Research Endowment Fund
- Estate of Helen Nichunsky
- Ida Rosenman Sands Family Trust
- Barbra Streisand Foundation

Daniel Harari

- Robin Chemers Neustein

Michal Irani

- Prof. Irani is the incumbent of the Swiss Society Professorial Chair in Computer Science and Applied Mathematics

Valery Krizhanovsky

- European Research Council
- Mr. and Mrs. Bruce Kanter
- Rising Tide Foundation

Michal Neeman

- Prof. Neeman heads the following centers and institutes:
- The Dimitris N. Chorafas Institute for Scientific Exchange
- The Crown Institute for Genomics
- The De Botton Institute for Protein Profiling
- The Dolfi and Lola Ebner Center for Biomedical Research
- European Research Council
- The J&R Center for Scientific Research
- The Morris Kahn Institute for Human Immunology

Thank you to our supporters

- The Henry Krenter Institute for Biomedical Imaging and Genomics
- The Jeanne and Joseph Nissim Center for Life Sciences Research
- Sagol Institute for Longevity Research
- David and Fela Shapell Family Foundation G-INCPM Fund for Preclinical Studies
- The Wertheimer Center for Computational Biology
- The Willner Family Leadership Institute
- The Maurice and Vivienne Wohl Institute for Drug Discovery
- The Yeda-Sela (YeS) Center for Basic Research
- Prof. Neeman is the incumbent of the Helen and Morris Mauerberger Professorial Chair in Biological Sciences

Neta Regev-Rudski

- European Research Council
- Jeanne and Joseph Nissim Foundation for Life Sciences Research
- David E. and Sheri Stone
- Weizmann – UK Making Connections Program
- Dr. Neta Regev-Rudski is the incumbent of the Enid Barden and Aaron J. Jade President's Development Chair for New Scientists in Memory of Cantor John Y. Jade

Eran Segal

- Adelis Foundation
- Judith Benattar
- The Carter Chapman Shreve Family Foundation
- Crown Human Genome Center which he heads
- European Research Council
- Jack N. Halpern
- Else Kroener Fresenius Foundation
- Donald and Susan Schwarz
- Leesa Steinberg

Efrat Shema

- The Benoziyo Fund for the Advancement of Science
- The Willner Family Center for Vascular Biology

Ulyana Shimanovich

- Ruth and Herman Albert Scholarship Program for New Scientists
- Peter and Patricia Gruber Awards
- The Ilse Katz Institute for Material Sciences and Magnetic Resonance Research

Noam Sobel

- Fondation Adelis
- Norman and Helen Asher Center for Human Brain Imaging
- The Azrieli National Institute for Human Brain Imaging and Research which he heads
- H. Thomas Beck
- The Carl and Micaela Einhorn-Dominic Institute for Brain Research which he heads
- European Research Council
- Nadia Jaglom Laboratory for the Research in the Neurobiology of Olfaction
- Rob and Cheryl McEwen Fund for Brain Research
- Mike and Valeria Rosenbloom Foundation
- Prof. Sobel is the incumbent of the Sara and Michael Sela Professorial Chair of Neurobiology

Rotem Sorek

- Abisch Frenkel Foundation for the Promotion of Life Sciences
- The Y. Leon Benoziyo Institute for Molecular Medicine
- European Research Council
- Leona M. and Harry B. Helmsley Charitable Trust
- Dana and Yossie Hollander Center for Structural Proteomics
- Martin Kushner Schnur
- David and Fela Shapell Family Foundation G-INCPM Fund for Preclinical Studies

Amos Tanay

- Judith Benattar

- David and Molly Bloom
- Estate of Lydia Hershkovich
- Barry and Janet Lang
- Ilana and Pascal Mantoux Institute for Bioinformatics which he heads
- The Ruth and Samuel Rosenwasser Charitable Fund
- Edmond de Rothschild Foundations
- Steven B. Rubenstein Research Fund for Leukemia and Other Blood Disorders
- Estate of Alice Schwarz-Gardos
- William P. and Gertrude Schweitzer Foundation
- David and Fela Shapell Family Foundation G-INCPM Fund for Preclinical Studies
- Prof. Amnon Shashua
- The Wolfson Family Charitable Trust
- Prof. Tanay is the recipient of the Helen and Martin Kimmel Award for Innovative Investigation

Eldad Tzahor

- Dvora and Haim Teitelbaum Endowment Fund
- The Yad Abraham Research Center for Cancer Diagnostics and Therapy which he heads
- Daniel S. Shapiro Cardiovascular Research Fund
- European Research Council
- Pearl C. Vapnek

Shimon Ullman

- Estate of Albert Delighter
- Estate of Mary Catherine Glick
- Estate of David Sofaer
- Estate of Elizabeth Wachsman
- Estate of Sylvia Wubnig
- European Research Council
- Prof. Ullman is the incumbent of the Ruth and Samy Cohn Professorial Chair of Computer Sciences

Stephen Weiner

- Dangoor Accelerator Mass Spectrometer Laboratory
- European Research Council
- George Schwartzman Fund
- Prof. Weiner is the incumbent of the Dr. Walter and Dr. Trude Borchardt Professorial Chair in Structural Biology

Anat Yarden

- Estate of Myron H. Ackerman
- Estate of Morris Shapiro
- The Maurice and Ilse Katz Center for Science Teaching which she heads

Yosef Yarden

- Dr. Miriam and Sheldon G. Adelson Medical Research Foundation
- Comisaroff Family Trust
- Dwek Institute for Cancer Therapy Research which he heads
- Rising Tide
- Marvin Tanner Laboratory for Research on Cancer
- Willner Family Center for Vascular Biology which he heads
- Prof. Yarden is the incumbent of the Harold and Zelda Goldenberg Professorial Chair in Molecular Cell Biology

Elazar Zelzer

- Estate of Bernard Bishin for the WIS-Clalit Program
- The Kekst Family Institute for Medical Genetics
- The Dr. Erhard, Emmi, and Fred Loewinsohn Center for Pediatric Health
- The David and Fela Shapell Family Center for Genetic Disorders Research which he heads
- Weizmann-University of Manchester Collaborative Projects Program

robot

/**roh**-*buh* t, -bot/

noun

any machine or mechanical device that operates automatically with human-like skill.

origin

Czech, coined by Karel Čapek in the play *R.U.R.* (1920) from the base *robot-*, as in *robota* compulsory labor, *robotník* peasant owing such labor