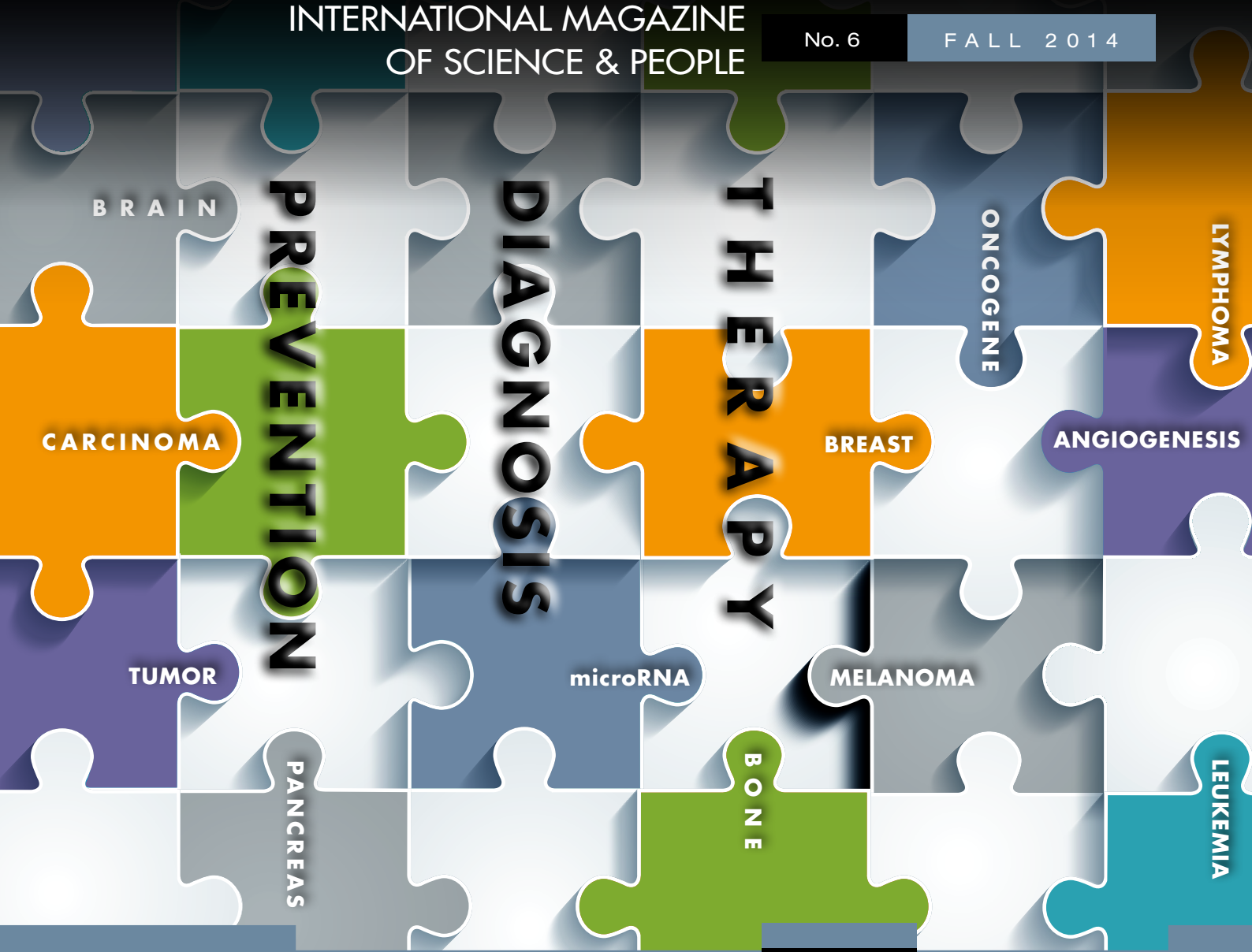


THE WEIZMANN

INTERNATIONAL MAGAZINE
OF SCIENCE & PEOPLE

No. 6

FALL 2014



Profile: Lorry Lokey

PAGE 10

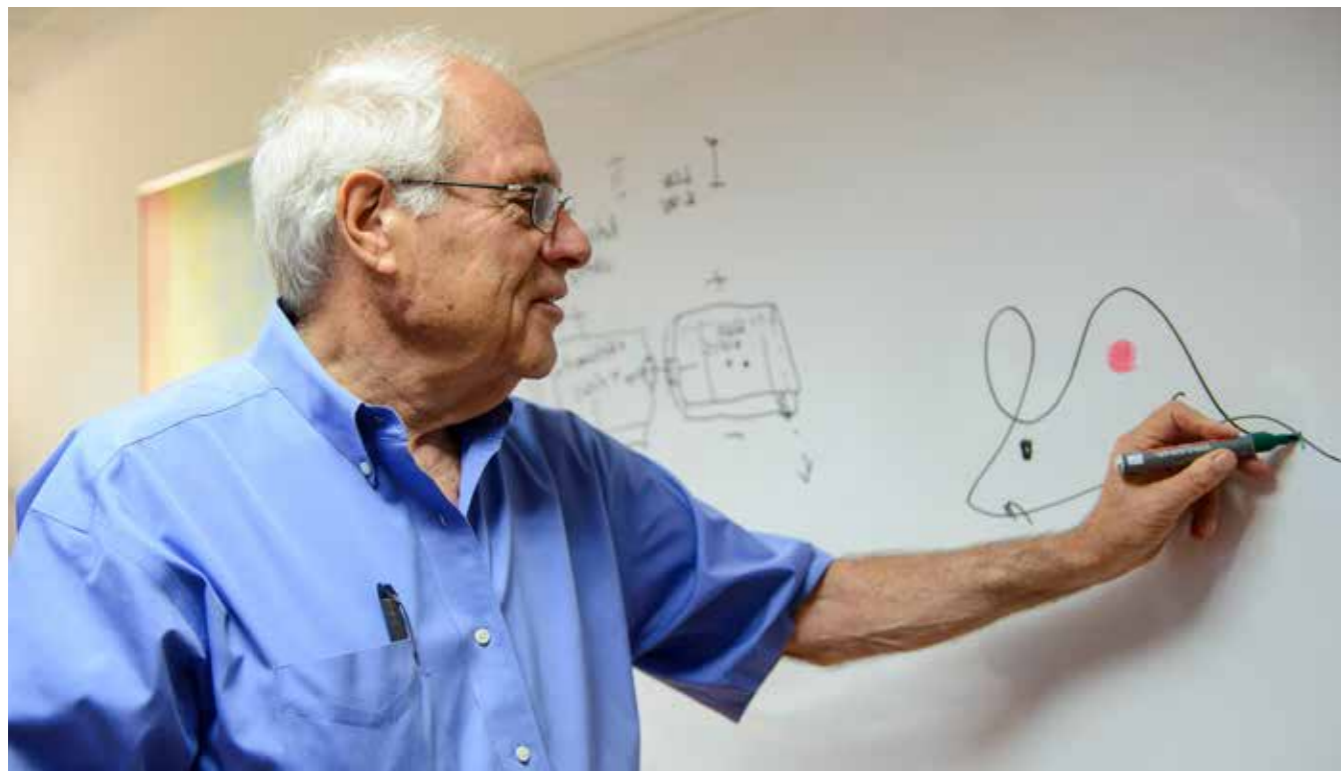
A Tribute to David Azrieli

PAGE 26

Cover Story

The Integrated Cancer Center

PAGE 16



"We know that the immune system's T cells have the ability to destroy tissue," says Prof. Zelig Eshbar, pictured above. "The question, as an immunologist, was how to convince them to attack cancerous tissue, which they do not normally recognize as foreign or harmful." More about Prof. Eshbar's designer T cells, which are now in clinical trials for leukemia and lymphoma on p. 21. Prof. Eshbar recently won the Massry Prize; nine winners of this prize have gone on to receive the Nobel Prize.

A publication of the Department of Resource Development and Department of Public Affairs and Media Relations

Editorial board • Prof. Israel Bar-Joseph, Vice President for Resource Development and Public Affairs • Kelly Avidan, Director, Department of Resource Development and Secretary of the Association • Yivsam Azgad, Head, Media Department • Tamar Morad, Head, Donor Communications and Editing
Photo research • Heidi Shulman and Naama Pessó
Data research • Irit Oz
Photography • Itai Belson, Ohad Herches, and Haim Ziv of the Weizmann Institute Photolab, Weizmann Institute Archives, Stephen Epstein
Graphic design • Irit Sher
Print • A.B. Offset Ltd., Israel

C O N T E N T S

2 **OPERATION PROTECTIVE EDGE**

4 **SCIENCE BRIEFS**

NEW SCIENTISTS

- 6 Dr. Michal Rivlin on the eye-brain connection
- 8 Dr. Ran Budnik's lab is the universe and the target is dark matter

SPOTLIGHT ON

10 Lorry Lokey

COVER STORY:

THE INTEGRATED CANCER CENTER

- 16 New era in breast cancer research
- 19 Prof. Moshe Oren on the new ICC
- 21 Designer immune cells: Prof. Zelig Eshhar

22 **SPECIAL SECTION ON THE GLOBAL GATHERING**

From the President



Dear Friends,

This summer was a difficult one, and with Operation Protective Edge behind us, we grieve for the lives lost and look forward to more peaceful days. Surely countless lives were saved by the Iron Dome system, a feat of science and technology. But while I always say that science is a stabilizing factor in that it requires collaboration across borders and solutions for saving and improving lives, on the flip side science requires an environment of stability and plenty to truly flourish.

At the Weizmann Institute we tried our best to operate as usual, with labs busy and productive, and international scientific conferences going on as planned during the conflict. However, some conferences were cancelled for this academic year.

As you will read on the next page, all 80 participants in the Bessie F. Lawrence

International Summer Science Institute were here when the conflict began, and none left. But the war hit home; four soldiers who lost their lives were family members of our scientists and staff (two nephews, two grandsons). Though the communities in the vicinity of Gaza bore the biggest brunt of the rocket attacks, here in Rehovot we experienced many sirens and took shelter in the protected areas on campus.

We were compelled to postpone the launch of our first Weizmann International Network (WINE) project, whose primary goal is to bring together a leading group of scientists from around the world, thereby allowing them to have a significant impact on a central scientific problem. The first WINE project, funded by the Rothschild Caesarea Foundation, is in systems biology, and is to be led by Prof. Amos Tanay. We expect this project to be up and running soon, and for it to be replicated in other areas of science in which Weizmann scientists have a prominent world standing. By building an international network around particular areas of expertise, WINE will serve to increase the visibility and impact of Israeli science in general and the Weizmann Institute in particular.

Meanwhile, amidst all this, we—like many of you—struggled with the onslaught of negative reporting against Israel and harsh condemnations in the media and beyond, surprising and often shocking in its force. It came straight to the doorstep of our international

scientific community, with an article published in the highly esteemed scientific journal *The Lancet*, as you can also read about in greater detail on the following pages. At the same time, we experienced a tsunami of support from our friends around the world, and we were buoyed and strengthened by this to an immeasurable degree.

Yet against this backdrop, the scientific research being conducted at the Weizmann Institute is moving along rapidly as are our many plans for the year ahead. We are thoroughly involved in establishing the Integrated Cancer Center, the new major flagship project which will encompass all cancer research here, with an emphasis on collaborative research with the medical community. This is the subject of our cover story in this issue.

With our International Board meetings around the corner, we are looking forward to many dedications and celebrations. Among them are the new Siem Childcare Center and the David Moross Fitness Center, gifts of Karen Siem and David Moross to honor their father Mandy in his last year as Chairman of the Board, after nine excellent years.

With very best wishes for peaceful, productive times ahead,

Sincerely,

Daniel Zajfman

TRIBUTE

26 David Azrieli: architect, philanthropist, lover of Israel

ON CAMPUS

- 28 Celebrating a mentor of Nobel laureates
- 29 Israel Science Day at Weizmann
- 30 TEDx at the Weizmann Institute
- 31 Women in Science

SCIENCE FEATURE

32 DNA's powerful accomplice

PROFILE OF A PAIR

34 Bob and Renee Drake and their professorial chair duo

OFF CAMPUS

- 36 Weizmann UK Gala Dinner Dinner at Harry's Bar Science on Tap in Seattle
- 37 Karnit Flug, speaks to Israeli Friends Science on Tap

ALUMNI

38 Aviad Maizels of PrimeSense

EDUCATION

- 40 Dissect, explore, compute: The School of Contemporary Science
- 42 Smart way to spend a day

VISITING SCIENTISTS

44 Prof. Retsef Levi of MIT; Putting math to work for efficiency's sake

46 **THANK YOU TO OUR SUPPORTERS**

The Weizmann Institute and Operation Protective Edge

The war touched home at the Weizmann Institute, and it was felt well before the first official day of fighting this summer.

On June 12, three Israeli teenagers were kidnapped while hitchhiking in the West Bank, and were brutally murdered in an action for which Hamas later claimed responsibility. One of them was Naftali Fraenkel z"l, the grandson of Prof. Aviezer Fraenkel of the Department of Computer Science and Applied Mathematics. A Palestinian boy from East Jerusalem was beaten and burned to death by Jewish youths later that month. When Hamas operatives began firing rockets from Gaza to Israel, Operation Protective Edge began in earnest on July 8. A total of 4,500 rockets were fired over 50 days.

Rehovot, 50 km north of Gaza, is in the Shfela region, just north of the Eshkol region which was heavily bombarded by rocket fire. A total of 29 Red Alert sirens sounded on campus over this seven-week period, and the Institute's 3,000 scientists, staff, and students took cover in the many protected areas on campus. Some were called to reserve duty in the IDF.

On July 26, Second Lt. Roy Peles z"l, 21, an infantry officer in the Nahal Brigade, was killed when the armored vehicle he was in was attacked by an anti-tank missile. He was the nephew of Prof. Elijor Peles of the Department of Molecular Cell Biology. Just four days later, on July 30, Staff Sgt. Matan Gotlib z"l, also 21, was killed. He was the nephew of Batya Zarmi of the Department of Biological Chemistry. Matan was a combat soldier in Maglan, an elite IDF unit. He was killed along with two other soldiers in a

booby-trapped building thought to be a UNRWA health clinic. The soldiers had entered in order to destroy an underground tunnel that started from inside the clinic—and thereby exposed Hamas' mega-terror plot planned for Rosh Hashana to send 200 Hamas operatives through its network of tunnels into Israel to kidnap and kill Israeli civilians in the kibbutzim surrounding Gaza.

One of the other soldiers who was killed in that incident was Guy Algranati, 20, also in Maglan, whose grandfather Maurice is a former employee of the Institute in the Faculty of Physics. Maurice, a Holocaust survivor, said at the funeral, "According to what [Hamas] planned, the use of the word 'holocaust' is not far-fetched." He went on to say that after surviving the Holocaust, he hoped that his children and grandchildren would know no war.

If not with some degree of surrealism, much continued as usual on campus. Profs. Adi Stern and Moti Heiblum of the Department of Condensed Matter Physics oversaw a conference at the David Lopatie Conference Centre that included multiple foreign scientists that continued as planned—minus a cancelled day trip off campus and an interruption by a Red Alert siren. "No one cancelled and no one left and we all benefited greatly from the conference," says Prof. Stern.

The conflict began a week after 80 outstanding science-oriented youth from around the world arrived for the four-week Bessie F. Lawrence International Summer Science Institute (ISSI). Most of their time was spent in labs and in lectures, which went on as

planned—with a few intermissions thanks to sirens sounding in reaction to rockets launched into the area. The students briskly took shelter, often with guitar in hand, riding out the tension with song and chatter. ISSI director Michal Simovich said some of the travel plans were adjusted for security reasons, but that the students were eager to travel and none of them returned home.

A second war front for Israel, however, emerged in the media. For the Weizmann Institute, that conflict came to its doorsteps on July 23, when the prestigious UK science journal *The Lancet* published an article furiously attacking Israel for its war on Hamas in "An open letter for the people of Gaza." The Weizmann Institute and other institutions in Israel and elsewhere viewed the editorial, which had 24 signatories, as a one-sided, irrational attack not only on Israel, but also on science.

A response penned by six scientists including Nobel Laureates and university heads, among them Prof. Daniel Zajfman, expressed deep concern for *The Lancet's* article and set the record straight on the key facts of the conflict. The response—which included a statement of regret for all lives lost on both sides and offered a harsh rebuke—was published after nearly two weeks of heavy pressure from key figures around the world, but the incident disturbed the many individuals who care about Israel and science. On August 19, Prof. Zajfman published his views on the incident in the Israeli newspaper *Globes* (see following page for the full translation).

Tunnels of attack against the world of science

By Prof. Daniel Zajfman

The following is a translation of the article published in Hebrew in *Globes* on August 19.

Scenes of war such as those coming out of Gaza naturally arouse emotions, including in "objective" reporters. Despite this human tendency, there is one end of the media spectrum—the end occupied by established, peer-reviewed, scientific journals—where we would normally expect to read articles that are impartial, unbiased scientific reports. Publishing based on scientific merit alone is one of the cornerstones of global science; without it, science could not advance as a coherent global endeavor. But in the emotional shockwaves of the war in Gaza, the medical-scientific journal *The Lancet* has exhibited a political, racist agenda that threatens to subvert the scientific method. This conduct should be sounding alarms to all those who value unbiased scientific publishing.

On July 22, "An open letter for the people of Gaza," by Manduca et al, was published in *The Lancet*. The lead author of the piece is a doctor and political activist. Her "facts" seem to be provided by an organization that most of the Western world has defined as terrorist. Nowhere does the author mention, for example, the stated aim of Hamas to destroy Israel, nor does she deem it relevant that for the past 14 years, this organization has been shelling Israeli civilian villages and cities with deadly rockets and missiles.

When a shrill, one-sided diatribe like this appears in a partisan tabloid, it does not move us. But to see the same words printed in the pages of a respected scientific journal was surprising and saddening, to say the least. This piece raises the specter of another dark day in the history of scientific publishing: In 1937, the scientific journal *Nature* published an article by Johannes Stark, Nobel Laureate in physics and President of the Imperial Physical-Technical Institute. In "The Pragmatic and the Dogmatic Spirit in Physics," he claimed that Jewish scientists, among them Albert Einstein, purposely sabotaged the advance of science. Stark, an active member of the Nazi party, called the Jews a "disease."

The publication of the letter in *The Lancet* led several of us—including three Nobel laureates (Dan Shechtman, Aaron Ciechanover and Avram Hershko), a Muslim female scientist working in England and the U.S. (Qanta Ahmed), an Israeli scientist working at UCLA (Alon Avidan) and three presidents of top Israeli research institutions (Peretz Lavie, President of the Technion, Uriel Reichman, President of IDC Herzliya, and myself, President of the Weizmann Institute of Science)—to write a response, thinking that *The Lancet* would be interested in open discussion. So we were sorely disappointed, and yes, even surprised, when the lead author of our piece received a standard, dry rejection letter. We noted that *The Lancet* took only 3-4 work days to accept the letter of Manduca et al, while rejecting the letter of three Nobel laureates, three presidents [of institutions of higher learning], and two respected researchers took no less than 12 days.

Just based on this, the grave threat to

The Lancet's credibility is clear. But there is more. Several of us expressed our concern about the decisions to publish one article and not the second—decisions of *The Lancet's* editor, whose anti-Israeli sentiments are known—in letters sent to leaders in the world of science publishing. None of us could have predicted what happened next: Qanta Ahmed awoke one morning to find in her inbox a message that the editor of *The Lancet* was "pleased to inform her" that the article had been accepted for publishing. It appeared on the 15th of August—with no peer review.

We should, of course, be pleased: Our goal was achieved: the article was published. But in fact, what we uncovered, by accident, are "attack tunnels" like those dug by the Hamas into Israel, which weaken the foundations of science. We realized just how much the personal, political, or even economic preferences of the editor of this esteemed journal may dictate its contents—rather than peer review, as we had assumed. And if peer review is not the sole basis of publishing in *The Lancet*, we start to wonder to what extent we can trust the merit of articles published in other scientific journals.

Stark's 1937 article passed all the editorial hurdles of *Nature*. When such unfounded drivel gets into scientific journals—those beacons of rationality and scientific reason—we should all be worried. The previous time, it presaged destruction on a continental scale and the death of many millions. That time, after a long, bloody world war, the side of reason and sanity won out. But if we are not vigilant, if we do not at least insist on a balanced view, there is no guarantee that the next time the result will be the same.

Profs. Wallach, Ullman win EMET Prize

The Weizmann Institute's Prof. David Wallach of the Department of Biological Chemistry received the prestigious 2014 EMET Prize in the life sciences category, and Prof. Shimon Ullman of the Department of Computer Science and Applied Mathematics received the award in the exact sciences category.

Prof. Wallach was one of the first researchers to isolate the protein known as "tumor necrosis factor," or TNF, a natural immune hormone crucial in the inflammatory process and other immune-defense mechanisms. These new insights are informing our understanding of inflammatory and autoimmune diseases, as well as cancers, including neuroblastoma, small cell lung carcinoma, multiple myeloma, and pancreatic carcinoma.

Prof. Ullman is an expert on the human visual system and computer vision; he is a world leader in defining how the human visual system operates and how to construct artificial systems with visual and cognitive capabilities. His research has led to insights about how people use vision to recognize objects and people in the scene in front of them, and understand what they are doing and how they interact with each other.



L to R: Profs. Ullman and Wallach

Explosive discovery

When a robotic telescope based in Southern California spots a transient event—a light in the night sky that was not there before—it sends a message to a scientist on the other, daytime, side of the world. And then the race is on: The scientist on the receiving end must quickly decide if the event is significant, and then alert his colleagues at telescopes around the world.

So when Dr. Iair Arcavi, who was then in the group of the Weizmann Institute's Prof. Avishay Gal-Yam, sighted such a potentially significant event, he called Dr. Assaf Horesh, then a postdoctoral fellow at the California Institute of Technology



Prof. Avishay Gal-Yam

(now at of the Weizmann Institute). By acting quickly and training the spectroscopic equipment of the Keck Observatory in Hawaii on what was a new supernova, the Weizmann/Caltech team caught a rare glimpse of the stellar wind that had been blowing off the star before it exploded.

Sometimes these sightings are false alarms, but in this case it wasn't: The light was the onset of a supernova explosion in the UGC 9379 galaxy. That's too far off to imagine, but for Prof. Gal-Yam and Dr. Arcavi of the Department of Particle Physics and Astrophysics and other astronomers, this is their backyard—the distant universe that occupies their thoughts and minds every day.

As opposed to our sun, which emits a weak solar wind containing mostly hydrogen, the massive star that had exploded had a gale-strength stellar wind composed of such heavier elements as carbon, oxygen, and nitrogen. Analyzing these elements, says Prof. Gal-Yam, can give us clues to the life stories and explosive deaths of such large stars, as well as the processes of nuclear fusion in which most of the heavy elements in the universe are formed.



Artificial sweeteners could lead to diabetes, says new study

A new study by Prof. Eran Segal and Dr. Eran Elinav of the Weizmann Institute published in September in *Nature* reveals that certain gut bacteria may induce metabolic changes following exposure to artificial sweeteners—and actually lead to weight gain and diabetes. Their findings upend the food industry's advertising and individual assumptions about diet products by revealing that the widespread use of artificial sweeteners in drinks and food may contribute to obesity and diabetes, which have become worldwide epidemics. The study set off a major buzz in the media worldwide.

For years, researchers have been puzzling over the fact that non-caloric artificial sweeteners do not seem to assist in weight loss, and some studies have suggested they may even have an opposite effect. Research undertaken by Dr. Elinav of the Department of Immunology and Prof. Segal of the Department of Computer Science and Applied Mathematics and the Department of Molecular Cell Biology shows that artificial sweeteners—promoted as aids to weight loss and diabetes prevention—could actually hasten the development of glucose intolerance and metabolic disease by changing the composition and function

of the gut microbiota—the substantial population of bacteria residing in our intestines. The findings were the results of experiments in mice and humans.

Graduate student Jotham Suez in Dr. Elinav's lab, who led the study, collaborated with graduate students Tal Korem and David Zeevi in Segal's lab and Gili Zilberman-Shapira in Elinav's lab in revealing that artificial sweeteners, even though they do not contain sugar, nonetheless have a direct effect on the body's ability to utilize glucose. Glucose intolerance—generally thought to occur when the body cannot cope with large amounts of sugar in the diet—is the first step on the path to metabolic syndrome and adult-onset diabetes.

Weizmann Institute #1 in Life Sciences grants from the ERC for 2013

Weizmann Institute of Science researchers received the highest number of grants from the European Research Council (ERC) for a single institution in Life Sciences in 2013. Institute principal investigators (PIs) won 15 grants in the Life Sciences category, more than any other institution that received ERC grants within the framework of the ERC's granting program for basic science

research, during the Seventh Framework Program (FP7). The Weizmann Institute also won 12 grants in the Physical and Engineering Sciences category. The ERC offers grants to scientists in the European Union and EU-associated countries, including Israel.

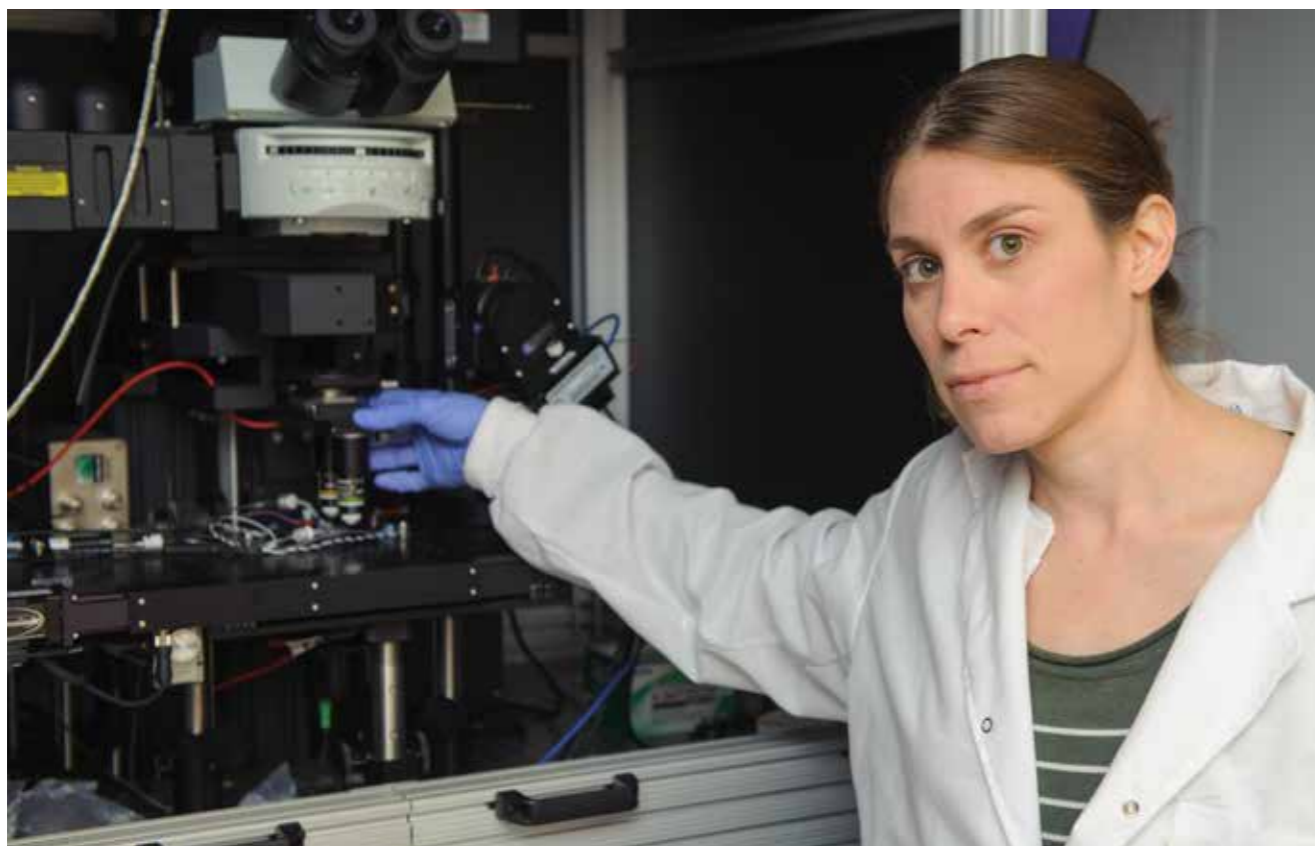
The Weizmann Institute was also ranked third in the overall number of ERC grants (27) for the 2013 calls, surpassed only by the National Center for Scientific Research in France (CNRS, 31) and the University of Oxford (29), both of which are larger institutions than the Weizmann Institute.

The FP7 grant program, which was launched in 2007 and ended in 2013, awards research funds based on proposals across all research fields on the sole criteria of scientific excellence; the ERC's Horizon 2020 program (PF8) will do the same starting in 2014. The Weizmann Institute's young scientists, in particular, were highly successful in 2013 in attaining Starting and Consolidator Grants, a category for PIs in the first two- to 12 years after receiving their PhDs; they received 20 grants.

Altogether, Israeli institutions obtained 66 ERC grants—the largest number of grants per country from an associated EU country. Israeli institutions also rank third overall in the number of Starting Grants per country. Israeli women also did particularly well, with the country ranking second for Starting Grants given to women scientists; nine female Israeli scientists received grants in 2013 alone.

The eye-brain connection

In this niche in neuroscience, Dr. Michal Rivlin is seeing things few others have



Dr. Michal Rivlin

Does anatomy define the destiny of nerve cells? Or can nerve cells actually change their function in response to the environment or other demands placed on them? Dr. Michal Rivlin, who joined

the Department of Neurobiology at the Weizmann Institute last year after a postdoctoral fellowship at the University of California at Berkeley, has found evidence that, indeed, the anatomy of the

nervous system isn't predestined.

Dr. Rivlin showed in her postdoctoral research that one can get specific neuronal cells in the retina to change the property they encode. For example, she

has discovered that direction-selective cells that encode the direction of motion in the visual field make a 180-degree U-turn in their detection "settings" by exposing them to certain repeated visual stimuli. She has found that many other retinal neurons can be coaxed to switch the property dictated by the anatomy of their circuits by applying sensory stimulation. Now in her new lab, Dr. Rivlin wants to understand this phenomenon, by rooting out the biological mechanisms underlying these changes.

The intriguing biology of the eye

Our eyes are marvels of function and form. A mere three layers of nerve cells in the retina receive and begin processing a wealth of visual stimuli. The third layer is an output layer in which the visual information gets split into separate channels: Different retinal nerve cells encode color, edges, motion, or other properties of the visual field. The organized structure of the retina makes its anatomy a vital tool for research.

For example, there are neurons that detect motion which have been thought to rely on local input in order to sense one of the cardinal directions (up, down, left, right). These cells are said to function asymmetrically: An inhibitory

signal from one side turns their attention to a particular direction. In other words, the behavior of such a cell should, first and foremost, be based on one-sided anatomical input.

Dr. Rivlin intends to go after some of the bigger questions about sensory perception and brain function. For example, where does anatomy end and plasticity—the capacity to change—begin for such a nerve cell? Both are clearly important, but how? If the directional cells in the retina can alter their function, which other nerve cells might have similar plasticity? If the nerve cells in our eyes are subject to change, how does this affect our visual system? And ultimately, how is our visual perception shaped by those changes? Says Dr. Rivlin: "My aim is to study the limits of anatomy—how neurons can overcome their apparent destiny."

Dr. Rivlin works with transgenic mice, in which the various cells in the retina are genetically labeled with fluorescent dye. Among other techniques, she uses two-photon microscopy combined with electrophysiology to detect activity in the various cells in response to light stimulation.

Michal Rivlin was born and grew up in Jerusalem. After her army service, in which she worked with foreign volunteers in the Israel Defense Forces' Sar-El program, she studied mathematics

Dr. Michal Rivlin has provided key evidence that the anatomy of the retina is not predestined: the nerve cells are subject to change throughout our lives

and computer science at the Hebrew University of Jerusalem. She then moved to the University's Interdisciplinary Center for Neural Computation, where she conducted research on the pathology of the neuronal activity in Parkinson's disease.

While pursuing her degree, she married Yedidya Etzion, and their first three children, David, Naomi and Miriam, were born during her PhD studies. When she completed her doctorate, they moved to Berkeley. The family's move was made possible, in part, by an Israel National Postdoctoral Award for Advancing Women in Science, which gives outstanding young women scientists a two-year grant on top of the one they receive from their institutions. The program is administered by the Weizmann Institute and open to PhD graduates of all institutions; to date, more than 80 percent of grantees who have completed their postdocs have attained faculty positions at Israeli institutions of higher education, a key goal of the program.

Back in Israel, Dr. Rivlin and her family live in Mazkeret Batya, near Rehovot. There has been a recent addition to the family, Itay. On raising four children and getting a new lab at the Weizmann Institute up and running, she says: "Everyone faces various challenges, and I am happy to face this one."

Setting a Trap for Invisible Matter

Dr. Ran Budnik's lab is the universe and the target: dark matter

How can we find something if we don't know what we are looking for? That is a question that Dr. Ran Budnik of the Department of Particle Physics and Astrophysics deals with every day. His query is one that, so far, has eluded all attempts to even prove its existence: dark matter. Dark matter can't be seen with our best telescopes; it has not yet been detected with our most sensitive instruments. So how do we know it is even there?

What we do know is this. When all the mass needed to keep galaxies and galaxy clusters in synchronized motion is added up by researchers, they find that the stuff that can be seen is only a small part of the total. These calculations, based on simple physics, indicate that there is about seven times as much dark matter as the matter we can account for. In addition to being completely invisible to all our wavelengths, the most advanced models say that dark matter must be cold. And it should be spread out all over the place, so that the Earth moves through clouds of the stuff.

Astrophysicists like Dr. Budnik want to know about dark matter because, like other knowledge gained in the study of



Dr. Ran Budnik

the universe, it may tell us more about ourselves—the physical elements that comprise our world—and the mystery of human existence.

So the search for information continues. Dark matter investigators including Dr. Budnik know that if dark matter is made of particles, and if it is all around us, it must be something that pretty much never interacts with visible, tangible matter. Among the many particles proposed for dark matter, so-called Weakly Interacting Massive Particles (WIMPs) pop up in the best models; these also neatly fit the widely accepted models of the history of the universe—beginning with the Big Bang.

Creating a trap for such a particle is, needless to say, a formidable task. For one thing, the detectors must be buried deep underground, so as to filter out 99.999 percent of the particles that constantly bombard the Earth's surface. In the international XENON 100 experiment, a container filled with 161 kilos of pure xenon, the heaviest inert element, sits quietly underneath the Gran Sasso mountains in Italy at the San Grasso National Laboratory waiting for a

Dark matter may tell us more about ourselves—the physical elements that comprise our world—and the mystery of human existence

WIMP to interact with one of its atoms. When it does, detectors will pick up the tiny flash of light as the interaction causes photons to be ejected from the xenon, as well as a small bunch of electrons that are released in this process of its atoms accidentally.

So far, no WIMPs have been detected, but that does not mean they do not exist. "It could take 20 years for an interaction to be recorded," says Dr. Budnik.

He is now taking part, along with physicists from the U.S., Italy, Germany, France, Portugal, Israel, and Abu Dhabi, in the planning and installation of a much bigger trap—containing several tons of xenon—that could conceivably sight WIMPs within a year or two. In this endeavor, he is joined by several other Weizmann Institute faculty members, including Profs. Ehud Duchovni, Amos Breskin and Eilam Gross, and Drs. Hagar Landsman, Daniel Lellouch and Lorne Levinson.

Rim Shot

Dr. Ran Budnik grew up in a farming village in the south of Israel, among peach trees and dairy cows. When

he was 11, his parents enrolled him in an after-school math class at the Weizmann Institute, and he decided to become a mathematician. In high school, he discovered another passion—basketball—but rather than being drafted for the local team, he was asked to participate in the Israeli National Physics Olympiad. Dr. Budnik took first place in the competition, which was held at the Institute, and went on to receive a silver medal and an honorable mention in the International Physics Olympiad held in Beijing.

After an extended service in the Israel Defense Forces's Talpiot army-study unit, he came to the Weizmann Institute for his PhD research under the guidance of Prof. Eli Waxman. He completed a short postdoctoral stint in the lab of Prof. Breskin before continuing on to a second postdoc at Columbia University in New York, where he became involved in the XENON experiment. He joined the Department of Particle Physics and Astrophysics at the Weizmann Institute in 2013.

Dr. Budnik is married to Netta and is father to three young children. He still enjoys playing basketball.

Lorry Lokey

For this California philanthropist, Israeli science is an obvious beneficiary for his lofty goal of giving away 99 percent of his wealth

When he was 12 years old, Lorry Lokey was asked to pick a topic to research and write about as a student in Congregation Beth Israel's Sunday school in Portland, Oregon. He chose Dr. Chaim Weizmann. The year was 1939—well before the founding of the State of Israel, Dr. Weizmann's term as Israel's first President, and the establishment of the Weizmann Institute of Science.

"I chose Chaim Weizmann because of his invention of acetone and what that did for World War I," recalls Lokey, referring to acetone's use in explosives which were mass-produced by Britain in the war effort against Germany. Dr. Weizmann's invention won him favor in the eyes of the British government, which gave him access to senior cabinet members and British Foreign Secretary Arthur Balfour, and he worked with Balfour to issue the Balfour Declaration of 1917 in support of the creation of a Jewish state in Palestine.

It was Dr. Weizmann's invention of the fermentation process and subsequently acetone that primarily intrigued the young Lokey, and he spent hours at the local library researching the topic. Additionally, he says, "I was impressed by the fact that he asked for something

for a group of people and not for himself."

Lokey, who is 87, went on to build a thriving business that enabled him to become the philanthropist he is today—with a stated goal of giving away \$1 billion in his lifetime. He's pretty close, at \$740 million to date. Throughout the years, his admiration for Dr. Chaim Weizmann remained with him, and his

His parents consistently gave away about five percent of their annual income of \$2,200

keen sense of the value of science and technology grew in proportion to his snowballing business success. And out of that, his connection with the Weizmann Institute of Science took root and has grown. He has given generously to the

Institute, most notably for the establishment of the Lorry I. Lokey Research School for Biochemical Science in 2007, and the Lorry I. Lokey Preclinical Research Facility in 2011. The Institute awarded him a PhD *honoris causa* in 2008.

Education and technology

Lorry Lokey grew up in Portland during the Great Depression years, where he remembers what were called "hobo jungles"—Depression-era lingo for encampments of homeless, penniless Americans. He recalls men selling apples for a nickel each, and pencils and shoelaces for pennies. "My parents barely made it through the Depression," he recalls. "Their bank closed and they lost all their savings—all of \$150. They barely held onto their house." Luckily, his father continued to hold down a job, first as a flour salesman, then a canned foods salesman at Del Monte Foods, Inc., while also working in a shipyard. His father's ability to hold down not just one but two jobs during the Depression forever stuck with Lorry who took pride in it and was inspired to work hard throughout his life.

In his first days as a student at Stanford University in Palo Alto, Lokey picked up



Lorry Lokey during a recent visit to the Weizmann Institute

a copy of the *Stanford Daily News*, and promptly fell in love with journalism. He started at “the very bottom” at the paper, he says, later working his way up to editor-in-chief in his senior year. After his freshman year, at age 18, he was drafted into the army to serve in WWII. Stationed in Tokyo, he was assigned to be the feature editor of the Pacific edition of the U.S. military newspaper *Stars & Stripes*. He returned to Stanford and graduated in 1949.

His first job out of college was for United Press, the news wire service that later became United Press International (UPI). He later moved into public relations. When working for General Electric Corp. in San Francisco, he attended a conference in Los Angeles at which he saw a teletype machine; he was surprised and intrigued to see one at a PR event, where it was being used to transfer financial news. In 1961, he started Business Wire to serve companies wishing to publicize their press releases, on the one hand, and news organizations on the other, eager to receive and report on company news.

The network he had built at GE gave him his first seven clients, and they were big ones: GE, Bank of America, Standard Oil, and American Airlines were among them. On his first day on the job, he processed seven news releases. That didn't generate him a paycheck. But four months in, with 20 clients, he had his first payday with a check for \$800. For years, he personally reviewed every release that went out. Fast forward three decades: In the years before he sold Business Wire to Warren Buffet's

Berkshire Hathaway in 2006 for close to \$500 million, the company had 28 offices around the world and he was earning \$2 million a month. Today, hundreds of releases go out in a single minute.

In running Business Wire, he says, “I was, of course, very aware of the importance of continually advancing technology, so that news could move faster,” he says. The company's edge, he says, was its ability to identify the latest technology and leverage it to get releases out faster and faster.

***"Israel has accomplished so much in science and technology and so much of it is because of Weizmann and the Technion."
—Lorry Lokey***

The story of scientific development excites him. Living most of his life in Silicon Valley—he resides in Menlo Park, California—he says he had a “front-row seat” to some of the most thrilling scientific developments. “By the 1980s, science began moving forward very fast and especially so in Israel, because Israel had a ‘little’ matter to deal with called ‘survival,’” he says, adding, “Israel has accomplished so much in science and

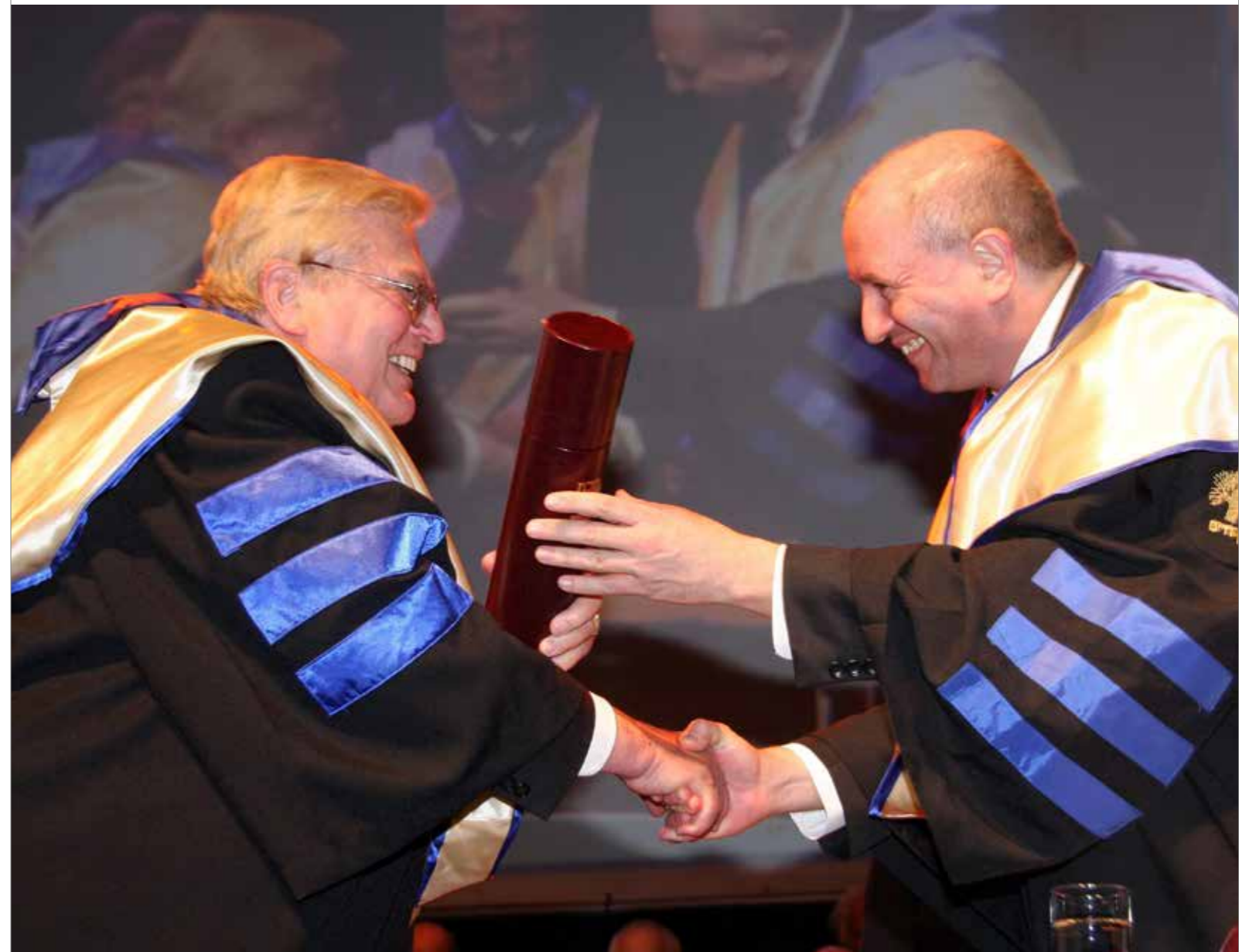
technology and a lot of it is because of Weizmann and the Technion. If you would subtract Weizmann from the Israeli scientific scene could you imagine what you would not have in this world?”

It was this “real love,” he says, for education and research that led him to the Weizmann Institute. “I love research institutions, and that's why I'm so in love with Weizmann. It is a major building block of higher education in Israel—as good, or better, than any school we have in the U.S.,” he says. In May, he and his partner of 23 years, Joanne Harrington, visited the Institute and brought with them three professors from the University of Oregon, with the aim of initiating scientific collaborations.

Early lessons

If one theme in his life was the value of scientific development, another was the value of philanthropy, which was instilled in him at a young age. His parents consistently gave away about five percent of their annual income of \$2,200. “When my mother wrote a check for \$100 to the United Jewish Appeal in the Depression years—which was a lot of money then—I challenged her on it, worried that we couldn't afford it, and she said it was her duty and she wanted to make the contribution.”

He has passed on the value of philanthropy to his children, mainly through example, he says. Lorry has three daughters, seven grandchildren, and seven great grandchildren; and Joanne has four children and four grandchildren.



Lorry Lokey receiving his PhD honoris causa from Prof. Daniel Zajfman in 2008.



At the dedication of the Lorry I. Lokey Preclinical Research Facility

For the last 65 years, he has given away 98 percent of his earnings. Several years ago, Warren Buffett approached him to join the Giving Pledge, a commitment by the world's wealthiest individuals to give away more than half of their wealth to philanthropy during their lifetimes or in their wills. Lokey—who says he spends modestly and typically flies coach—joined immediately. “My ambition is to see my giving get to \$1 billion,” he says. “It will be very satisfying to see this happen.”

Beyond Lokey's relationship with the Weizmann Institute, he has given widely, mainly to education. He still gives to his elementary school, and supports the Technion, the Leo Baeck School in Haifa, Ben-Gurion University, Tel Aviv University, and Hadassah Medical Center. He has given to his favorite U.S. institutions, including Stanford and its School of Medicine, the University of Oregon, Mills College, and Portland State

“The Weizmann Institute is a major building block of higher education in Israel—as good, or better, than any school we have in the U.S.”
—Lorry Lokey

University. He serves as a trustee on the board of Bellarmine College Preparatory and the San Francisco Opera Association. He is an emeritus trustee at Santa Clara University, the University of Oregon Foundation, and Mills College.

In making his first gift to Weizmann, for the Lorry I. Lokey Research School of Biochemical Science, he says, “I wanted to make a difference in

educating the next generation of Israeli scientists.” On its heels came the establishment of the Lorry I. Lokey Preclinical Research Facility. It is the largest core research facility on the Institute's campus and unique in the variety and sophistication of its imaging capabilities. Research conducted in the building spans the medical spectrum and includes studies on cancer, genetic disorders, neurodegenerative diseases, diabetes, bone and muscle development, and immune system disorders. It will be a key component of the Weizmann Institute's new flagship project, the Integrated Cancer Center (see story, p. 16).

In making the gift for the facility, he called the donation “one of the best investments of my life.” He says he hopes to make another major gift to the Weizmann Institute for a second building adjacent to the Lokey Preclinical Facility.



Lokey and his partner, Joanne Harrington

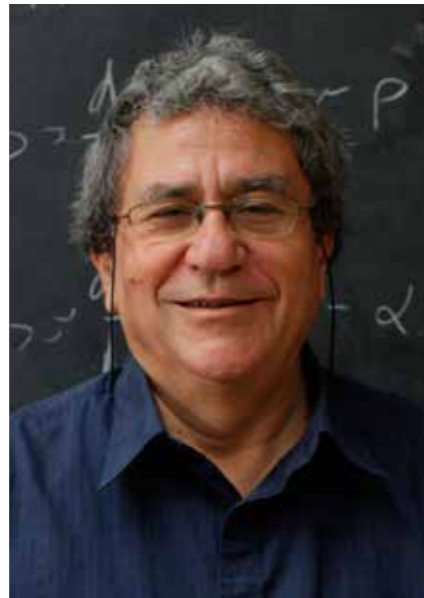
New era in breast cancer research

Integrating a range of insights in breast and other cancers is the next step for treating, curing cancer

When Prof. Eytan Domany discusses cancer research, he speaks of success and hope, but also of frustration. In spite of decades of research in the best labs around the world, the finding of a universal cure for cancer remains distant. If anything, those years of study and experiment have taught us that cancer is many diseases, each tied to a highly complex and often varied series of errors in the gene code. And the fact that cancers arise from the body's own cells make them extremely hard to target without causing debilitating side effects in the healthy tissue.

And yet there have been some notable successes, for example, the drug Herceptin. While this drug only helps a small subset of breast cancer patients, for those women it has meant a complete remission of their cancers for a number of years. For Prof. Domany, a member of the Department of Physics of Complex Systems, hope lies in the ability to understand which patients have cancers that will respond to such drugs as Herceptin and which require different approaches. New research on breast cancer in his lab, for example, has identified several subsets of patients whose cancers arise from widely different malfunctions.

To attain this future vision, says Prof. Domany, scientists may need to revise their frame of reference, zooming out from the study of individual genes or proteins to that of systems. The launch of the Weizmann Institute's Integrated



Prof. Eytan Domany

Cancer Center thus comes at an opportune moment, as the need for the integration of a range of insights and approaches is necessary and urgent. He compares the system-wide approach to car mechanics: A person might have intimate knowledge of every nut, bolt, and metal part that goes into a car, and still have no idea what makes it go. A mechanic, in contrast, does not check the individual parts, but rather systems: the engine, fuel injection, brakes or steering.

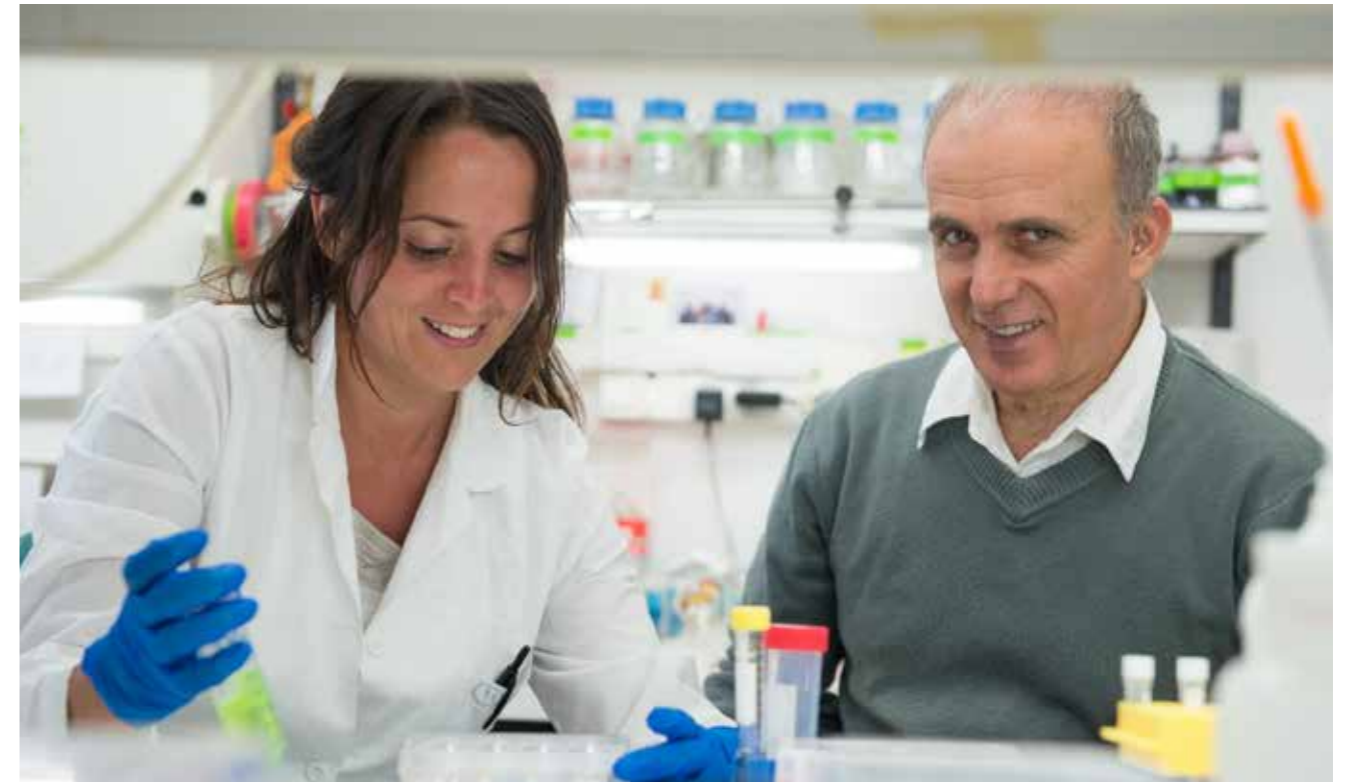
In the cell, those systems are pathways—groups of interrelated genes and biological molecules that work

together to produce particular events and actions in the cell. Some of the cell's pathways are even analogous to a car's systems, for example engines that drive growth processes or brakes that keep growth in check. Prof. Domany and his group have developed a technique, called Pathifier, to analyze and compare those pathways.

In a recent breast cancer study, he and his team used 1,000 samples of tumor tissue and an additional 140 healthy samples, from which they identified, sorted and analyzed 500 different pathways. Arranging the samples according to pathway activity revealed distinct patterns. For example, a group of samples showing a striking amount of abnormal activity in one set of interrelated pathways were all from tumors that respond to Herceptin. Yet another group of tumors that had, until now, been identified as belonging to the same "basal" type, actually exhibited different levels of dysfunction in pathways related to immune activity. Thus these tumors actually belong to two groups of breast cancers; the analysis showed that one group had better prognosis than the second.

All together, the team identified nine main groups of tumors according to pathway dysfunction, including some patterns of abnormal activity in pathways that had not previously been associated with breast cancer. This type of analysis may, in the near future, lead to personalized cancer treatment that is

Today, one out of every nine women will have breast cancer; and she is likely to undergo surgery, followed by expensive, aggressive chemotherapy that may harm her long-term health, since her doctor does not know which of the available therapies—if any—may actually help.



Prof. Yossi Yarden and Dr. Mattia Lauriola in the lab

rationally planned for each individual.

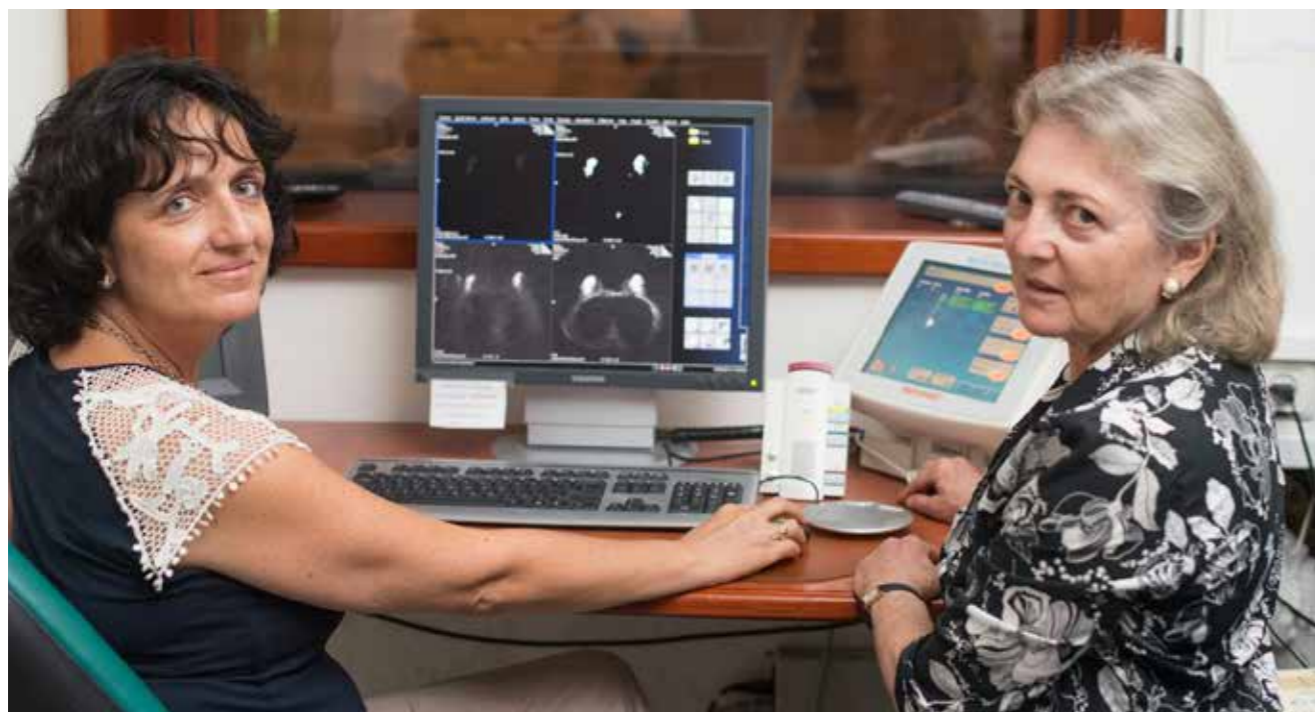
In the long run, of course, the idea is to work out ways to target the individual pathways that play central roles in the malignant process and return their activity to normal. If that sounds like a costly, time-consuming proposition, consider that fact that today, one out of every nine women will have breast cancer; and she is likely to undergo

surgery, followed by expensive, aggressive chemotherapy that may harm her long-term health, since her doctor does not know which of the available therapies—if any—may actually help.

Double attack on a triple negative

One type of breast cancer that does not respond well to chemotherapy is

known as triple negative: Its cells do not have any of the three receptors that are blocked by the current drugs. These receptors—proteins on the cells' outer membranes or within the cancer cells—are those that receive growth signals from such hormones as estrogen or other signaling molecules, and pass them into the cell. Triple negative breast cancer involves the hyper-expression of



Dr. Edna Haran-Furman (left) with Prof. Hadassa Degani

a different growth receptor—EGFR—but this protein has, until now, resisted the drugs designed to block its activities.

Prof. Yosef Yarden of the Department of Biological Regulation and his team, working together with Prof. Michael Sela of the Department of Immunology, have come up with a possible solution to the problem. Their idea is to attack the receptor with two different antibodies, each of which attaches to a different site on the EGFR molecule. When they tested this tactic on triple-negative breast cancers in model animals, they found that the method was even more effective than they had foreseen. According to Prof. Yarden, the weight of the two antibodies together may have caused the receptors to collapse inward into the cell membrane, thus completely depriving the tumor cell of its growth signal.

In previous research, he and his team had developed a similar approach to the

HER2 receptor. This receptor, which is overexpressed in around 20 percent of breast cancers, is targeted by the drug Herceptin. But some cancers don't

Prof. Degani and her team recently developed a new method of MRI-based detection that is completely non-invasive

respond or may become resistant to the drug. Using molecules that mimic the actions of the body's own immune system, Prof. Yarden and his team treated HER2-positive tumors with two different

antibodies. These antibodies acted synergistically, grabbing onto two "arms" of the receptor and pulling them together until it collapsed inward.

Better detection

Early detection of breast cancer can be crucial, yet today's methods are far from perfect. A high rate of false results in standard mammography—both positive and negative—means that some cancers are missed, while many women needlessly undergo stressful, painful biopsies.

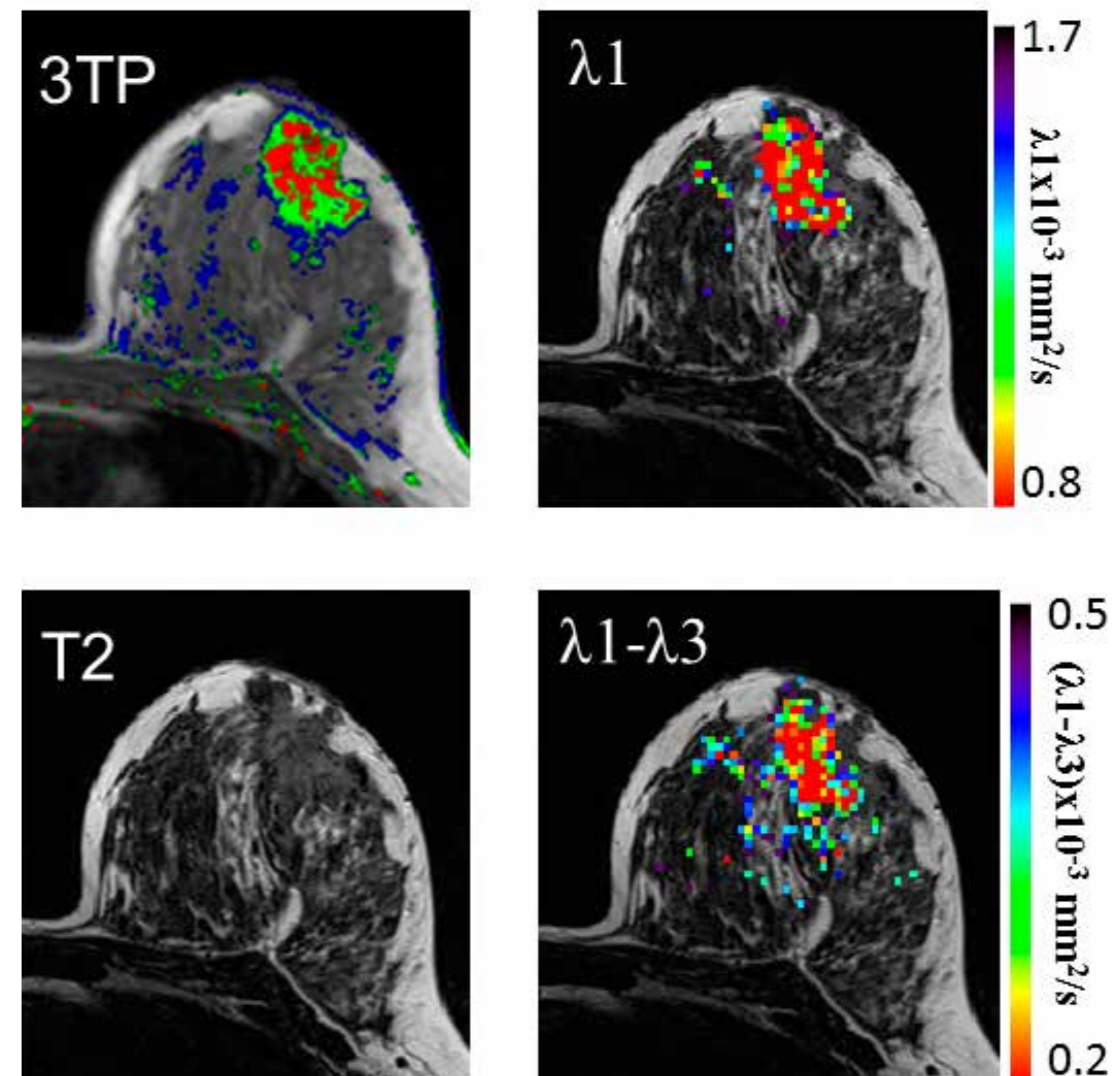
To address this problem, Prof. Hadassa Degani, also of the Department of Biological Regulation, created 3TP—an MRI-based approach to breast cancer diagnosis. This method, which has already made its way to the clinic, employs a contrast material and scans at three time points to reveal blood flow into the breast tissue. The new blood

vessels in the nutrient-hungry tumors exhibit accelerated growth and distinct properties, and thus they show up highlighted in the scan. Cancer detection with 3TP method is highly sensitive, and it can also distinguish between malignant and benign growths, so it can avert the need for biopsies in many cases.

To improve and extend the usefulness of MRI-based detection, Prof. Degani and her team recently developed a new

method that works without contrast material; it is completely non-invasive. Known as Diffusion-Tension Imaging (DTI), the technique makes use of cutting-edge advances in MRI and analytical technology. Each breast is imaged in 60 thin slices. An algorithm then analyzes each pixel in each slice, alert to any one in which the diffusion of water is reduced as well as disordered—signs of abnormal cell growth.

The resulting diffusion parameters are then translated into shades ranging from blue to red, yielding a 3-D image of the breast in living color. Cancer stands out in orange and red. This method may be especially useful for women with dense breast tissue, those taking hormones or who need a scan at the wrong point in their menstrual cycle, or pregnant or lactating women who want to avoid the contrast material.



Images of a breast tumor using the 3TP and DTI technology from Prof. Degani's lab

The Weizmann Institute Integrated Cancer Center

Despite decades of extensive research, and despite several successes in treating some cancer types and dramatically increasing survival rates, cancer is still one of the most common and deadly diseases worldwide. Battling cancer is so difficult because of the diversity of cancer cells and cancer types, and the continuous evolution and diversification of tumors as they grow. In all cancers, the function that regulates the multiplication of cells goes awry. This process occurs in many different ways, so that within a single tumor, there can be many types of cancer cells. As a result, finding a complete cure is a formidable challenge.

To address the immense challenges posed by this complex and deadly disease in all its forms, the Weizmann Institute is establishing the Weizmann Institute Integrated Cancer Center (ICC). This will be a flagship project of the Weizmann Institute. It will be headed by Prof. Moshe Oren of the Department of Molecular Biology, a world-renowned cancer researcher with vast experience and wide networks in his field.

A major challenge of contemporary cancer medicine is to harness the vast amount of basic research knowledge towards devising the most effective treatment for each individual cancer patient, rather than providing all patients with a similar standard treatment protocol. The overarching goal of the ICC is thus to move toward personalized cancer medicine also known as precision cancer medicine. The ICC will allow for the insertion of the results of basic cancer research into the patient-doctor loop in a more efficient and timely manner to produce an individualized approach for the patient.

What makes the ICC particularly unique is its exceptional ability to recruit the expertise of top researchers from outside the field of biomedicine, such as computer scientists, physicists, and chemists, to deal with the high complexity of cancer and with the huge amount of cancer patient-derived information that can be generated thanks to the top-end technologies available at the Weizmann Institute. This builds on the strong track record of the Weizmann Institute in multidisciplinary collaborations.

The ICC will have a solid basic research component comprised of the Institute for Cancer Prevention Research, the Institute for Cancer Diagnosis Research, and the Institute for Cancer Therapy Research—all of which will integrate the multidisciplinary strength of the Weizmann Institute to elucidate cancer and devise innovative approaches to combat it.



Prof. Moshe Oren, head of the ICC

The second component of the ICC will involve state-of-the-art infrastructure, namely an Advanced Preclinical Cancer Laboratory, a Tumor Bank, and a Live Cell Imaging and Sorting Facility. Both the basic research component and the infrastructure of the ICC will utilize a Clinical Collaboration Fund which will enable the sharing of patient samples for research purposes and foster close interaction with hospital physicians treating cancer patients. This Fund will enable the implementation of basic research discoveries and improvement of medical oncology practice.

The ICC will work hand-in-hand with the The Nancy and Stephen Grand Israel National Center for Personalized Medicine, which will provide the infrastructure and technologies like DNA sequencing, bioinformatics, protein profiling, and drug discovery platforms. In addition, the Lorry I. Lokey Preclinical Research Facility will provide researchers with state-of-the-art facilities to investigate cancer in experimental animal models, along with powerful imaging technologies.

Connecting basic research to translational research is one of the biggest challenges in finding a cure for cancer. This is precisely where the ICC will step in by linking cutting-edge basic cancer research to translational research in cancer prevention, early diagnosis, and treatment.

Designer immune cells

A new promising cancer therapy based on a Weizmann lab invention is entering clinical trials

The idea that the immune system—with its robust T cells that play a central role in the system—holds the keys to beating back cancer emerged several decades ago. One of the first scientists in the world to begin designing T cells that can fight cancer was Prof. Zelig Eshhar of the Weizmann Institute's Department of Immunology, in the late 1980s. Fast forward to 2014 and his research insights are now the basis for a new drug that, in early testing, has shown full remission in patients with end-stage leukemia and lymphoma.

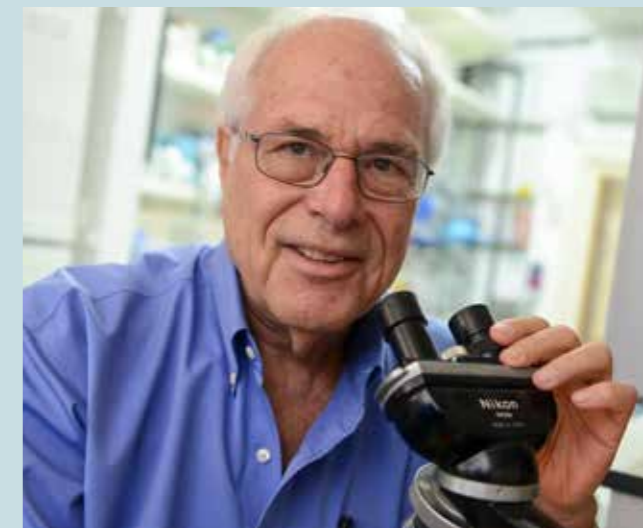
"We know that the immune system's T cells have the ability to destroy tissue," says Prof. Eshhar. "The question, as an immunologist, was how to convince them to attack cancerous tissue, which they do not normally recognize as foreign or harmful." For more than two decades, he has been doing just that: designing T cells that can fight cancer.

The designed cells are the patient's own T cells, taken out of the body and genetically modified in such a way that they can home in on tumors and mostly leave the healthy tissue alone. This process, so-called adoptive cell transfer, involves removing the cells from the patient and engineering them with new receptors (now generally known as chimeric antigen receptors, or CARs) that are designed to recognize proteins specifically found on tumors. The modified cells are multiplied outside the body and then re injected into the patient. The engineered cells then seek out the tumor, accumulating at the tumor site and rejecting it from the body. These cells can also multiply further inside the body, going after the cancer in numbers.

As Prof. Eshhar has continued to perfect the method over the years, his success rate—at least on the mice in his lab—has been phenomenal. Recently, Prof. Zelig Eshhar was awarded the highly prestigious Massry Prize by the Meira and Shul G. Massry Foundation.

To the bedside

The unorthodox idea of using the immune system to fight cancer was initially slow to catch on. That changed in late 2010, however, when Dr. Steven Rosenberg of the National Cancer Institute in the U.S. with whom Prof. Eshhar had spent a sabbatical year 20 years earlier, reported, for the first time, curing patients with blood cancer. This was followed by an article in the *New England Journal of Medicine* describing three patients with end-stage leukemia who were in complete remission following CAR T cell treatment. The treatment, administered by oncology professors at the University of Pennsylvania, was based on Prof. Eshhar's adoptive cell transfer method.



Prof. Zelig Eshhar

Now Prof. Eshhar has joined with Kite Pharma Inc., a firm based in Santa Monica, California, to bring his groundbreaking approach to fruition. He chose the company, he says, because several of its members—including the company's founder and CEO Dr. Arie Belldegrun—have ties to the Weizmann Institute. With Kite, Prof. Eshhar aims to adjust the cell processing and manufacturing process so as to accommodate a greater number of individuals in future clinical studies.

Kite is launching clinical trials on leukemia and lymphoma patients based on earlier clinical studies conducted by Dr. Rosenberg's NCI team. Those NCI studies have recruited end-stage patients—those with advanced cancers who have exhausted all other treatment options. Among this group, says Prof. Eshhar, the long-term, complete remission rate has reached an astounding 50-60 percent.

In addition to the trials in blood cancer patients, Prof. Eshhar is hopeful that his pioneering method will soon be adapted for other cancers as well. Work in his lab suggests that the approach may be effective against almost any type of cancer. Even better, there are signs that treatment with CAR T cells could grant long-term immunity to the cancer being tested. More recent work in Prof. Eshhar's lab at the Weizmann Institute on animal models of breast cancer has revealed the presence of anti-cancer memory T cells—the cells that remember foreign molecules (for instance, in an infection) and stand guard against future cancers. This, he says, is a sign that the CAR T-cell treatment can truly work like a vaccine, not just attacking the cancer, but arming the immune system to prevent its recurrence. Prof. Eshhar, who now serves as Chair of Immunology Research at Tel-Aviv Sourasky Medical Center, hopes that this treatment will also be realized in Israel.

"We are enjoying the recognition our work is now receiving," he says. "But being able to cure patients is the real reward."

The 2014 Global Gathering of the Weizmann Institute of Science

The 2014 Global Gathering of the Weizmann Institute of Science brought together more than 400 supporters and friends of the Institute from 16 countries on May 18-21 in New York City. The Global Gathering, held every two years, celebrates science and the role of philanthropy in advancing science at the Weizmann Institute. From inductions into the prestigious President's Circle to scientific talks and cultural events, the Global Gathering was a major success and planning for the 2016 Global Gathering is already underway.

On May 18, the Intrepid Sea, Air & Space Museum—set in a World War II aircraft carrier—was host to more than 400 people at the opening dinner celebrating the induction of a record 25 donors into the President's Circle. The President's Circle is an elite group of individuals who have given \$1 million or more to the Weizmann Institute of Science. It was established by the American Committee in 1997 and is today an international cadre of more than 200 members.



At an event at Pier Sixty in Chelsea on May 19 that highlighted recent insights from cancer research, Weizmann Institute President Prof. Daniel Zajfman presented the concept for the planned Integrated Cancer Center at the Weizmann Institute. From left to right: guest speaker Dr. Siddhartha Mukherjee, author of "The Emperor of All Maladies"; Prof. Eytan Domany, Dr. Ravid Straussman, and Prof. Michal Neeman



In a brain-meets-body experience, the Vertigo Dance Company of Israel and Weizmann Institute neuroscientists came together in an exclusive, contemporary performance at Alice Tully Hall at Lincoln Center on the evening of May 19. The research of Prof. Yadin Dudai, Prof. Noam Sobel, and Prof. Elad Schneidman—on memory, olfaction, and sensory processing, respectively—came alive on stage, as the scientists interacted with the dancers in a one-of-a-kind performance that conveyed the richness, complexity, and beauty of the human mind.



The critical importance of investing in young scientists and their impact on the future of the Weizmann Institute, Israel, and international science was the focus of a May 20 event at Rockefeller University on Manhattan's East Side. Dr. Eran Elinav (second from left) discussed the role of intestinal microbes in health and disease and his joint research with Prof. Eran Segal on the Personalized Nutrition Project; Dr. Gad Asher (left) presented his insights on the body's circadian clock; Prof. Deborah Fass discussed protein structure and function; and Prof. Avishay Gal-Yam (second from right) talked about the cosmic elements and their relevance to life on earth.



Prof. Israel Bar-Joseph, Vice President for Resource Development and Public Affairs, described the Institute's efforts to recruit the best and brightest scientists to join its faculty, including building a state-of-the-art lab for each new hire and providing him or her with start-up funding. These first years, he added, are critical in establishing the research agendas of young scientists and enabling them to prove the value of their ideas.



At a session on May 21 at 583 Park Ave., Prof. Shafi Goldwasser, winner of the prestigious A.M. Turing Award for 2013, spoke about the challenge of "big data" and the next generation of cryptography. The insights from her research and from this field as a whole are enabling safe storage and exchange of information in the cloud, which has major implications for banking, commerce, medicine, and science, and more. Prof. Goldwasser has a joint appointment at the Weizmann Institute and MIT and is a member of the Weizmann Institute's world-renowned Department of Computer Science and Applied Mathematics.



Participants gathered at the Metropolitan Museum of Art's Temple of Dendur on the evening of May 21 for a festive closing that celebrated the 70th anniversary of the establishment of the American Committee for the Weizmann Institute of Science. A video showcased ACWIS' impact on the Weizmann Institute throughout its history and the deep relationships it has fostered throughout the decades.

David Azrieli

Architect, philanthropist, lover of Israel

With the passing of David J. Azrieli z"l in July, the Weizmann Institute lost a distinguished member of its International Board and a true friend committed to the advancement of science and the State of Israel. The Canadian-Israeli architect, philanthropist, and international real estate magnate was 92.

"We have lost a dear friend and remarkable visionary, a man of few words but of great deeds that has left a great and lasting mark on the worlds of architecture, philanthropy, and science," noted Weizmann Institute President Prof. Daniel Zajfman.

Azrieli's remarkable life story began in the town of Maków Mazowiecki, Poland. He fled the Nazi invasion into Russian-controlled territories at the age of 17, eventually arriving in Baghdad as a member of the Polish Anders Army. There, he joined the Zionist cause and traveled with Iraqi Jews to what was then British Mandate Palestine where he fought in Israel's War of Independence.

In 1954, he immigrated to Canada and established a design, real estate development, and property management business that eventually grew into the Canada-based international company Canpro Investments Ltd. that, together with its sister company, the

Tel Aviv-based Canit Investment, Management and Finance Ltd., built a string of office buildings, high-rise residences, office towers and shopping centers in Canada, the U.S., and Israel.

The architectural and design know-how which David Azrieli imported to Israel in the 1980s led to a finance and retail revolution with the rise of the closed shopping mall concept. He orchestrated

***Azrieli's passion
for his life's work
was matched
by his devotion
to Israel and
philanthropy***

the establishment of more than a dozen such malls throughout the country, most notably the iconic Azrieli Center—the largest mixed-use commercial complex in the region.

Azrieli's passion for his life work was matched by his devotion to philanthropy. He established the Azrieli Foundation through which he directed the majority of his charitable activities to the two

countries he cared for most—Canada and Israel. As part of these efforts, the Foundation helped to promote Israeli science through the Azrieli Fellows Program, which distributes competitive research fellowships to outstanding students. To date, 16 have been awarded to Weizmann Institute students.

In a tribute to his impressive life achievements and devotion to the State of Israel, science, and philanthropy, the Weizmann Institute bestowed upon David Azrieli a degree of PhD *honoris causa* in 2012. Another special moment was the celebration of his 90th birthday at the Weizmann Institute's Global Gathering in Montreal, Canada, in 2011.

In 2011, David and the Azrieli Foundation established the Azrieli Institute for Systems Biology. In making the transformational gift that established this entity, Azrieli has already influenced the work of some 150 scientists and students on campus in a highly innovative field.

The example set by David and his wife, Stephanie, is not lost on their four children, Naomi, who heads the Azrieli Foundation; Danna, who is Chairman of the Azrieli Group Ltd.; Sharon, a well-known opera singer; and Rafi, who are all committed to continuing his legacy.



David Azrieli upon accepting his PhD honoris causa from the Weizmann Institute in 2012



L to R: Profs. Arieh Warshel, Dean of Chemistry Gilad Haran, and Michael Levitt

Celebrating a mentor of Nobel laureates

Conference shines a spotlight on Prof. Shneior Lifson, the scientist and the man

Prof. Shneior Lifson, who died in 2001, did not live to see two of his former students receive the Nobel Prize in Chemistry in 2013. Those students, Profs. Michael Levitt and Arieh Warshel, were recently at the Weizmann Institute to speak at a conference in honor of the 100th anniversary of Prof. Lifson's birth, on May 12.

Shneior Lifson's life encompassed so many elements of the historical Israeli narrative—from kibbutznik to army man to scientist and teacher. He was born in Tel Aviv in 1914. A member of the HaShomer HaTzair youth movement, he helped found Kibbutz Tel Amal (today Kibbutz Nir David) in the Bet She'an Valley, taught science at the kibbutz

school, and joined the Palmach, then an underground army prior to the War of Independence. During the War, he served in the Israel Defense Forces' science corps under the command of Prof. Aharon Katzir-Katchalsky, the brilliant biophysicist who was then head of the Department of Polymer Research at the Weizmann Institute of Science.

In 1949, Prof. Lifson joined the Weizmann Institute, beginning his PhD studies under Katzir. He began to investigate the dynamic properties of large molecules such as biological molecules, using the principles of statistical mechanics. Originally, these studies were done with static classical chemistry methods. But Lifson was one of the first to recognize the power of computers to analyze the dynamics of large molecules on the atomic level. In 1964, the Weizmann Institute installed its second computer, called Golem, one of the most advanced computers for its time. The Institute was already a leader in computer technology, having built Israel's first computer a decade earlier.

In the 1960s, Prof. Lifson began

developing the theory that would eventually garner Profs. Levitt and Warshel the Nobel Prize. Prof. Levitt joined the lab in 1967 while waiting for a position promised to him in the lab of Sir John Kendrew at Cambridge University. Prof. Kendrew recommended that he spend the intervening period at the Weizmann Institute with Prof. Lifson. The British biochemist (who won the Nobel Prize in Chemistry himself, in 1962) had just heard of Prof. Lifson's initial ideas on the consistent force field (CFF), and he was impressed.

Prof. Warshel was a PhD student in Prof. Lifson's lab when Levitt arrived. Within a year, the lab produced the first energy minimization of an entire protein structure—an accomplishment that would soon enable scientists to model how a protein folds. Lifson, Levitt, and Warshel continued to develop this work, both at the Weizmann Institute and at Cambridge, Stanford, and the University of Southern California (Profs. Levitt and Warshel are on the faculty of Stanford and USC, respectively). Today, their insights and methods are fundamental to



Four Israeli Nobel laureates on stage, L to R: Profs. Ada Yonath, Aaron Ciechanover, Dan Shechtman, and Yisrael Aumann. Science and Technology Minister Ya'acov Perry, far right, led the discussion.

almost all inquiry into biological molecules.

In addition to his many scientific accomplishments, Prof. Lifson remained an educator. He headed a national committee to examine the need for a university in Israel open to all, with no acceptance process. When the Open University was founded, he became its first rector, in 1974.

Accolades

In his talk, Prof. Levitt called his mentor a "towering hero of science" and said that Prof. Lifson and his wife "were like family to me" when he came to Israel and the Weizmann Institute. Prof. Levitt, who is a frequent visiting scientist at the Institute, credits his former mentor's influence on his work. He described a man who liked jokes and discussion, and who "unrelentingly insisted on understanding, integrity, and purpose" to the point of "telling things as they are, no holds barred."

Prof. Lifson was "a true renaissance man who showed interest and knowledge in fields outside science

including music and other art forms, politics, and public education. He would require consistent agreement among many experiments, which could, of course, only be obtained with major effort. I also remember that he could be gracious in admitting when he was wrong."

Israel Science Day at Weizmann

On March 25, the Weizmann Institute was the launch pad for Israel Science Day, the first in what is expected to become an annual day-long celebration of Israeli prowess in science and technology. In its early stages, Zionism was nurtured by scientists, noted Prime Minister Benjamin Netanyahu, including physician Dr. Max Nordau, mathematician Leo Motzkin, botanist Dr. Otto Warburg, the agronomist Dr. Aharon Aaronsohn, and Dr. Chaim Weizmann.

"Scientific progress has accomplished amazing things and led us to develop novel capabilities—things that we could not have dreamt of, not only 100 years ago, but even five or 10 years ago," said Prof. Daniel Zajfman, President of the Weizmann Institute. "Will we, as a society, use these capabilities wisely? In order for this to happen, we must invest in scientific education, because there is no point in creating new knowledge if the members of society do not know how to use it."

Also in attendance were the Minister of Science, Technology and Space, Ya'acov Peri; UK's Minister for Universities and Science David Willetts; and four Nobel laureates: Profs. Yisrael Aumann, Aharon Ciechanover, Dan Shechtman, and the Weizmann Institute's Ada Yonath. Said Willetts: "For science to flourish, it must be blind to race, nationality, and religion. Science crosses the borders that politicians can't easily bridge; it breaks down barriers and brings us together in a common endeavor."



Noam Ottolenghi, a leukemia survivor, describing his experiences in Davidson Institute programs



Prof. Daniella Goldfarb, President's Advisor for Advancing Women in Science

TEDx at the Weizmann Institute

What happens when a neuroscientist and a juggler teach together? Sounds like the beginning of a joke, but it is one of the many questions and answers—in this case, an explanation of how the brain enables a juggler to juggle—that arose during the TEDx event at the Weizmann Institute on May 20. TEDx events are local, independently organized conferences based on the TED model, which aim to stimulate discussion and ideas. TEDxWeizmannInstitute, an event organized by the Davidson Institute of Science Education and supported by the Trump Foundation of Israel, featured 10 speakers: scientists, science teachers and students who shared their unique passion for the subject of science education.

The talks were broadcast live on the event website and uploaded onto the TEDx site. All the speakers—from a robotics student from the Negev to a teacher who uses mime to depict a helium balloon on the moon—gave their talks in English.

The standing ovation of the evening went to the final speaker, 19-year-old

Noam Ottolenghi, who survived three bouts of leukemia and is confined to a wheelchair following complications from a bone marrow transplant. Ottolenghi, who “went to school” via his computer screen when he could not join the classroom, has a passion for physics.

A project he conducted through at the Davidson Institute of Science Education, on estimating the mass of the Higgs boson, won fourth prize in the international Intel ISEF competition for high-school students.

Women in Science

At the meeting of the Executive Board of the Weizmann Institute in April, Prof. Daniella Goldfarb spoke about the success of the Israel National Postdoctoral Award Program for Advancing Women in Science, which is funded and operated by the Weizmann Institute. The program, launched in 2007, has funded 75 women postdocs in their postdoctoral studies abroad as a means of encouraging Israeli women to pursue careers in academia. The

overarching goal of the program is to assist the country's most exceptional, newly minted women scientists to attain faculty positions at Israeli universities, thereby enriching Israeli science and leveraging Israel's scientific brainpower. Prof. Goldfarb, a member of the Department of Chemical Physics, is the President's Advisor for Advancing Women in Science and heads the program.

Anniversary celebration for the Mexican Committee

On August 27, the Mexican Committee of the Weizmann Institute of Science celebrated its 30th anniversary at a festive dinner in Mexico City. The event honored the past presidents and current president of the committee, in the presence of the Israeli ambassador to Mexico, Rodika Radian Gordon. Some 60 friends were in attendance. Past presidents were Leon Schidlow, Lazaro Becker, Mauricio Gerson, Stella



L to R: Dany Schmit, Martin Kushner Schnur, Prof. Israel Bar-Joseph, Dr. Alberto Huberman, Dr. Angelina Muñiz-Huberman, and Benito Lasky

Rayek, Jacques Zagury, Max Saad, and Luis Stillman. The committee's current president is Martin Kushner.

“The Mexican Friends of the Weizmann Institute has been a wonderful and important source of strength for the Institute throughout three decades. Our generous friends from Mexico have supported a wide range of areas of science and education and tonight it is our turn to say thank you,” says Israel Bar-Joseph, Vice President for Resource Development and Public Affairs. Dany Schmit, CEO for External Affairs for Latin America, was in attendance.

Major showing for summer alumni family meetings

The Weizmann Institute Alumni Association held four events in August for alumni and their families on campus, with a total of 550 people in attendance. A single event was scheduled for early August, but was postponed as a result of Operation Protective Edge. But interest in the event continued to surge, leading to four events to meet demand. The program in each case included a stop at

the new Levinson Visitors Center, a visit to the Clore Garden of Science's new Brain Exhibit, and a torch-lit night tour of Weizmann House. “I was proud and excited to participate in this event and the children really enjoyed themselves. I am grateful for the investment in the alumni, which is based on the understanding that the alumni strengthen the Institute and contribute to its future development,” says Dr. Dafna Frenkiel-Krispin, who received her PhD in chemistry in 2004. For more information on the Alumni Association and future alumni gatherings, write to alumni@weizmann.ac.il.



DNA's powerful accomplice

Weizmann Institute research on epigenetics is revealing the plethora of codes that shape us



L to R: Dr. Ido Amit, Prof. Amos Tanay

Each cell in the human body contains a gene code. Alongside each gene code is a notation of sorts, which is known as the 'epigenetics' of the cell. This arrangement enables the same basic 20,000-gene sequence to serve for every cell type in our body. This notation is highly susceptible to change—from copying mistakes to environmental interferences. Over the past decade, scientists are revealing a growing body of evidence that epigenetic change and regulation can have far-reaching

consequences for nearly every aspect of our health.

Recent Weizmann Institute research on epigenetic phenomena is challenging some of the prevailing ideas in the field.

To ensure that only the genes relevant to each cell's function are available for its use, its DNA is wrapped, packaged, and marked. The sequences are wound around proteins called histones to organize the genes in compact structures, allowing them to be activated or repressed. Small chemical markers

known as methyl groups can prevent specific genes from being accidentally activated. These patterns—as well as any changes to them—are copied along with the genome when cells divide and, in some cases, can even be passed on to the next generation.

Take stem cells for instance. They differentiate into different cell types—a daily process for blood stem cells, which need to generate a trillion blood cells a day to maintain our health. When this happens, histone changes enable

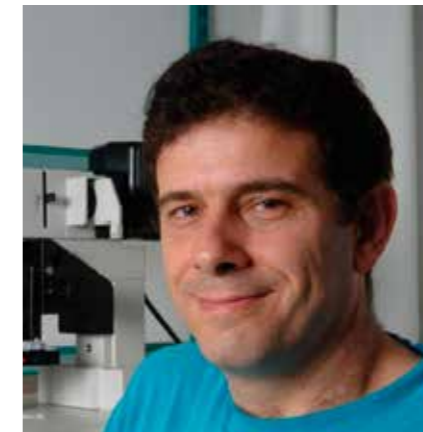
particular genes to be turned "on" or "off," determining whether the end product will be a red blood cell or one of the various immune white blood cells.

Dr. Ido Amit of the Department of Immunology and his group have managed to capture this process—a fleeting "flip of a histone switch" that takes place in just a handful of cells—with ultra-sensitive technology they had developed. The result was a close-up view of how epigenetic events that control the decision-making process in differentiating cells. This enables them to identify the exact DNA sequences, as well as the various regulatory proteins, that are involved in the process of regulating blood stem cell fate.

Surprisingly, the researchers discovered that a whopping 50 percent of the epigenetic events continued to make changes in the intermediate stages of differentiation. This suggests that cell fate is more flexible than previously thought, giving the cell leeway to decide what type of cell to turn into if circumstances change. It is a finding that holds promise for the future development of personalized medicine, and perhaps even regenerative medicine.

What does this mean for diseases like cancer? Prof. Amos Tanay of the Department of Biological Regulation and the Department of Computer Science and Applied Mathematics, who investigates large datasets of DNA—the work of bioinformatics—recently looked at patterns of methylation, the

Research at the Weizmann Institute on epigenetics is challenging some of the prevailing ideas in the field



Dr. Yoav Soen

attachment of the methyl groups to the genes. His research suggests that because the copying of methylation patterns is so much more error-prone than gene copying (one in every 200-1,000 methyl tags), the copying process may play a larger role in the development of cancer than previously thought. As cells continue to divide, the errors accumulate until their "epigenetic memory" becomes garbled and senile. Though the cell may manage to keep functioning, it could, at a critical moment, misunderstand a directive to self-destruct and continue dividing instead.

Epigenetic changes have a dynamic of their own. And there are many such changes. "For every mistake in genome copying in the cell, there are approximately a million mistakes in the copying of the cellular memory—the 'epigenome,'" says Prof. Tanay.

The stress effect

How do stress and other environmental factors play a role in epigenetic changes? Dr. Yoav Soen of the Department of Biological Chemistry investigates when and how novel stressful experiences of parents can have a measurable effect on their children and grandchildren, even if no genetic mutation is involved.

For many years, most scientists believed that such epigenetic heredity—for example by persistent changes in histone marks—did not occur. But the studies in Dr. Soen's lab have shown that epigenetic changes might assist the organism in coping with unfamiliar conditions. They also revealed new ways by which some of the parental response is passed on to the offspring. His group exposed fruit flies to a toxin which had been genetically engineered with a "rescue" gene; however, these flies were missing the regulatory mechanisms required for expressing that gene in the relevant tissues.

The researchers found that the flies' stress suppressed a central epigenetic system; this, in turn, led to increased flexibility of gene expression and more efficient use of the rescue gene. A part of this response was passed on across several generations of the flies' offspring. Says Dr. Soen, a working model inspired by these and related studies explains how epigenetics can be a "missing link" between short-term responses to new environments and the longer-term establishment of new genetic adaptations.

Profile of a Pair

Bob and Renee Drake Prof. Yair Reisner and Prof. Reshef Tenne

Excellent science is almost always backed by generous philanthropy—hence the title of this section, a Profile of a Pair, which describes a friendship between a scientist and a donor who has supported him or her. This time, the story is about philanthropists Bob and Renee Drake and their support of two professorial chairs, held by incumbents Prof. Yair Reisner and Prof. Reshef Tenne.

The Drakes, who live in the Netherlands, are frequent visitors to campus, are deeply engaged in the Institute, and have donated generously to a wide variety of areas at the Weizmann Institute, including education, infrastructure, and research in addition to their two chairs. Bob, who is American and Dutch and is originally from New York, is Chairman of the European Committee of the Weizmann Institute of Science (ECWIS) and a vice chairman of the Institute's Executive Board, and has helped direct numerous gifts from other supporters to the Institute. Renee was born and raised in South Africa. The couple has four children.

From Argentina to Rehovot

The family's connection to the Weizmann Institute originated in Argentina. As a child, Bob's mother, Erica, traveled with her parents from their home in Holland to Argentina by ship on vacation; the year was 1939.



Bob and Renee Drake

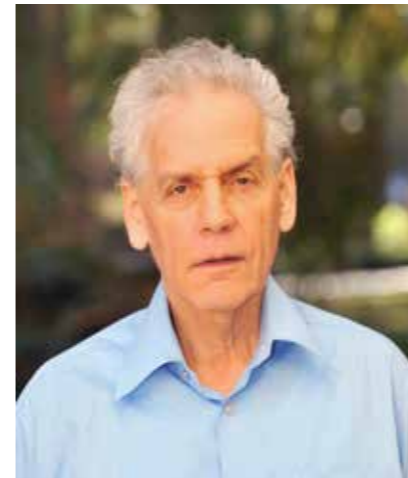
Two days into their return, World War II broke out and the British ship turned around, dropping off in Rio de Janeiro all non-British passengers, including his mother and her family, and sailed back to England. The incident surely saved their lives, says Bob, and his mother remained in Argentina for the following decade, before moving to New York. (The rest of the family remained in Buenos Aires.)

The family's home in Holland was occupied by the Nazis, then rented out and finally sold in 1959. Years later, Bob and Renee purchased the home, where they live today.

During the 1950s, the family became friendly with a man named José Mirelman, an ardent Zionist who had

emigrated before the war to Argentina from Switzerland and made aliya with his wife and children. He returned frequently to raise money for investments in Israel among Argentine Jews. José's son, David Mirelman, became a student and then a professor at the Weizmann Institute—today he is Prof. Emeritus in the Department of Biological Chemistry—and over time, he became an informal fundraiser for the Institute on his periodic visits back to Argentina. Bob's grandmother, Erna Mayer Wolf, and later his mother, were among those loyal Argentinian supporters, many of whom had never visited the Weizmann Institute.

The Drakes have supported Prof. Mirelman's work generously through an



Prof. Reshef Tenne

endowment fund established in 1999.

"My grandmother never saw the Weizmann Institute, but my mother finally said, 'I want to see this place' and so she did," recalls Drake. When Bob's father, Henry, was terminally ill and was hospitalized at the Memorial Sloan Kettering Cancer Center in New York, the family turned for advice to Prof. Reisner—who was at Sloan Kettering for a sabbatical at the time—and the scientist, a world leader in transplantation immunology and stem cells, spent time at his hospital bedside during Henry's final days. Soon after, in 1989, Erica Drake, together with Bob and Renee, decided to support a professorial chair for Prof. Reisner named for her deceased husband, the Henry H. Drake Professorial Chair of Immunology, after Prof. Reisner was suggested to him by Prof. Mirelman. "Choosing Yair was a no-brainer," recalls Bob. "His area of research was relevant to our family and we have become close friends with him and his family over the years."

"We are always excited to hear about developments in Yair's research, and his work on stem cells is so important and potentially relevant to so many areas of science. We feel strongly that he's having a widespread impact on science," says Renee.

Both Erica Drake and Bob received

PhDs *honoris causa* from the Institute: Erica in 2000, and Bob in 2008.

"Bob and Renee are very curious people and are eager to learn about developments in my work," says Prof. Reisner. The families also share a passion for art—Renee and Bob's daughter Carolyn Drake is a freelance contemporary art curator and Prof. Reisner's son Adam is a well-known artist in Israel and the U.S. Bob and Renee are avid art collectors.

From stem cells to nanotubes

About 10 years ago, the Drakes met Prof. Tenne of the Department of Materials and Interfaces on an Institute-sponsored cruise to Greece and Turkey that brought together scientists and supporters. Erica, Bob and Renee hit it off with Prof. Tenne, an expert in nanomaterials. "Reshef made a speech on board and my mother and I glanced at each other and said, 'Let's talk.'" The family made a quick decision during the trip to sponsor a chair with him as the first incumbent, the Drake Family Professorial Chair in Nanotechnology.

"I felt humbled and lucky because to me it was a sign that my research touches people—and that the Drakes understood that although my work is fundamental in its nature, it has so

many applications," says Prof. Tenne. Among other gifts to the Institute, the Drakes were instrumental in the establishment of the Ekard School of Biological Science at the Feinberg Graduate School in 2010. The intent was to help nourish the next generation of Israeli scientists, which meant a great deal to Renee in particular, who was a school teacher. The couple says they are drawn by the interdisciplinary nature of the Institute and what feels like a "small and very smart family" of scientists, many of whom they have come to know well over the years. Today, as Chairman of the European Committee of the Weizmann Institute of Science, Bob is helping nurture a new, young generation of friends throughout the continent by opening new committees and breathing new life into existing ones.

Beyond the Weizmann Institute, the Drakes are deeply engaged in a children's theater project they established called Teatron HaBarvaz that encompasses four branches throughout Israel: in Sha'ar HaNegev, Beer Sheva, Shlomi, and East Jerusalem (the latter integrates Jewish and Arab children). The couple involves their children in their giving—and in their personal relationships with Profs. Reisner, Tenne, and Mirelman.



L to R: Prof. Yair Reisner and Bob Drake



UK friends at the Eight Decades of Discovery gala in London

Weizmann UK Gala Dinner

More than 320 guests attended Weizmann UK's 80th celebration gala dinner on June 26 at the Science Museum in London. *Eight Decades of Discovery: Milestones in Weizmann Science* marked the achievements made over the last 80 years, since the founding in 1934 of the Daniel Sieff Research Institute, the predecessor to the Weizmann Institute of Science.

The evening also celebrated British philanthropic support for the Institute and paid special tribute to a number of families who were there at the beginning and are still involved today

Representatives from the Sieff, Clore Duffield, Rothschild, and Wolfson



Dinner at Harry's Bar

families along with Weizmann UK trustees, friends, and supporters appeared in a specially commissioned video in which they spoke of the special link they have with the Institute. Prof. Daniel Zajfman was introduced by Sir David Sieff, grandson of Lord Israel Sieff, who established the Daniel Sieff Institute with his wife Rebecca in memory of their son.

H.E. Ambassador Daniel Taub, Israel's Ambassador to the UK, spoke, as did H.E. Ambassador Matthew Gould, the British Ambassador to Israel, who expressed the importance of the scientific collaborations between Weizmann Institute scientists and their UK colleagues both through the BIRAX Programme and the Weizmann UK Making Connections Programme.

Prof. Eran Segal of the Department of Computer Science and Applied Mathematics and the Department of Molecular Cell Biology gave a fascinating keynote talk on recent results of the Personal Nutrition Project his lab is undertaking with Dr. Eran Elinav of the Department of Immunology.

Dinner at Harry's Bar

At a Science-on-Tap style event on March 13 at Harry's Bar in Mayfair, London, more than 80 guests heard about the new Nancy and Stephen Grand Israel National Center for Personalized

Medicine on campus. The event was hosted by Arabella Duffield and Hayley and Jonathan Sieff and was generously supported by Barry Townsley CBE.

The event aimed to engage a new generation of Weizmann supporters. Weizmann Institute President Prof. Daniel Zajfman and Nobel Laureate Prof. Aaron Ciechanover of the Technion spoke about the INCPM and how it will play an unprecedented role in advancing in precision medicine in Israel and beyond.

Science on Tap in Seattle

The Pike Brewing Company in Seattle, Washington, hosted the first-ever Weizmann "Science on Tap" event in the U.S. Dr. Roe Ozeri of the Weizmann Institute's Department of Physics of Complex Systems was the speaker. More than 70 attendees sampled local craft brews while listening to



Dr. Roe Ozeri

Dr. Ozeri's lecture on the future of quantum computing, a technology taking advantage of quantum mechanical phenomena that could improve research capabilities, crack even the most complex encryption codes, and lead to creating computers far stronger than those existing today.

With beers in hand, the audience also

heard from Dr. Adrienne Fairhall, a Feinberg Graduate School alumna and an Associate Professor at the University of Washington. Charles Finkel, founder and president of Seattle's historic Pike Brewery and longtime Weizmann Institute supporter, talked about the science of brewing beer.



Prof. Shimsbon Harel, Chairman of the Israeli Friends, with Karnit Flug

Karnit Flug speaks to Israeli Friends

The Israeli Association of Friends of the Weizmann Institute of Science hosted Karnit Flug, Governor of the Bank of Israel, on July 31 in Tel Aviv. Flug gave an overview of the Israeli economy, its characteristics, strengths, and challenges, revealing a stable economy that enjoys low inflation rates and high employment levels, with only 5.3 percent unemployment. This strength, is, nevertheless, influenced by the world around us, she added. "We are a small and open economy that is dependent on the global economy. We grow together, and when there is a global recession, we suffer from it, too," she said. Within this context, the

current slight decline in Israel's growth can be viewed as an outcome of the world's slow recovery from the 2008 financial crisis.

The conflict with Gaza, she noted, has had a limited and temporary impact on the country's economy, and the projection is that the economy will exhibit swift resilience. She compared it with the Second Lebanon War in 2006, when the GDP temporarily dropped by two percent, but in each of the consecutive two quarters there was a sharp surge of almost 10 percent, which compensated for the prior decline. The Israeli economy as reflected in the financial markets, she concluded, exhibits great fortitude and is marginally influenced by its security situation.

Flug pointed to the low scholastic achievements in math, literacy, and science, a factor that has been linked to poverty. Looking forward, she said, if nothing is done about it, this trend is expected to rise in correlation with a relative demographical increase in the Arab and ultra-Orthodox Jewish sectors. The challenge, Flug noted, is to ensure that families with two incomes are able to escape their low socioeconomic standing.

In her concluding remarks, she called for a policy that focuses on sustainable financial growth that integrates weaker

social sectors into the workforce while improving the quality, earning capacity, and productivity of Israel's human resources.

Science on Tap

On April 30, 55 bars were packed full with audience members, beers in hand, listening to scientists from the Weizmann Institute describe their research on everything from stem cells to quantum physics to renewable energy.

Are there parallel realities? Do dark energy and dark matter rule the Universe? How did life originate? Can we build a brain? Is nuclear fusion the solution to our energy problems? What do we mean by "personalized medicine?" Why do stars explode? These are just a few of the questions that the scientists discussed.

The stars of the Gesher Theater joined the act in several bars with short performances and songs that related to science. This was the fifth Science on Tap event in Tel Aviv. Over five years, Science on Tap has been a resounding success: It has been replicated both in Israel and around the world, and not just by science groups: Economists and law researchers and even Kabbalists have held "on Tap" events.



Science on Tap with Dr. Eran Elinav

Sixth sense

Aviad Maizels' innate instinct to usher insights from basic research to industry led his vision-sensory gaming product straight to Apple Inc.

Aviad Maizels, 38, one of Israel's leading high-tech entrepreneurs in the past decade and a Weizmann Institute of Science alumnus, likes to say that a big part of the Israeli high-tech future lies within the labs of leading academics who generate innovative ideas that can revolutionize our lives in many different ways. The founder of PrimeSense—a company specializing in visual data processing that was sold to Apple Inc. last year—would know, having received his MSc under the supervision of Prof. Adi Shamir at the Weizmann Institute.

PrimeSense, founded in late 2005, made headlines last year with its sale to Apple, and thanks to its innovative technology. The company developed a technology that can both see a three-dimensional scenery and analyze it using a mix of hardware and software, so that devices can interact with users.

Integrating insights from physics, computer vision, information theory, and computer science, the technology assesses a scene with near-infrared light, and uses various algorithms to “read” and extract the 3D data and generate depth, video, and audio information. Usable with multiple systems, it essentially allows machines to “sense” the world around them without active user input.

PrimeSense was purchased by Apple

Inc. in 2013 for an estimated \$350 million. Following the acquisition, most PrimeSense employees were absorbed into Apple, which rebranded the company's headquarters in Tel Aviv.

Maizels came to the Weizmann Institute while still in military service in 2002 to study part time in the Department of Computer Science and Applied Mathematics. He says it was the quality of the people at the Institute which appealed to him most. “When you look

**“Science generates real value and is a growth engine for the economy”
—Aviad Maizels**

for a position or a career, the most important thing is finding a good ‘teacher,’ who is really more than a teacher—a mentor,” he says.

He has especially fond memories of Prof. Shamir. “He always remembers his students, cares about them years after they’ve graduated, and is always interested to hear what you have to say”. Maizels’ master’s thesis on error correction was co-supervised by Prof. Simon Litsyn of Tel Aviv University. Both,

he says, are his role models because of their ability to “balance academia and industry”.

“Science generates real value and is a growth engine for the economy,” he says. “We should aspire to incorporate valuable discoveries and studies by Israeli scientists in the commercial market to maintain advantage in the world of business”.

After his graduation from Weizmann in 2005 and the completion of his army service, Maizels went to work in the Israeli high-tech industry. As an avid gamer, he was deeply engaged with the question: “Why is there so little innovation in the gaming genres? What would happen if computers could understand humans, as well as their environment?” The answer to these questions, Maizels says, could change how humans communicate with computers, and also how computers are put to use in our world today—in gaming and beyond.

This was the thinking process that led to the establishment of PrimeSense. Its name was derived from the conclusion that the most important ‘sensor’ for understanding the world is vision. Maizels and his co-founders believed that through a combination of 2D, 3D, and audio input, they could generate



Aviad Maizels, who received his MSc from the Weizmann Institute in 2005

machines that are able to ‘understand the world’—from gaming to smart homes, to autonomously watch over the elderly in order to call for help if the need arises, etc.

Maizels says PrimeSense succeeded thanks to a unique combination of insights and creativity of its members, the persistence of the team, and market conditions (a.k.a. luck). In consumer electronics, user interfaces are created amidst what Maizels calls ‘the interface crisis’: There will always come a point in time where the current interface becomes too complicated to use due to the number of operations it needs to support, and there will be always someone who will break the paradigm—two good examples are Nintendo’s Wii and Apple’s iPhone.

In the world of gaming, the user

interface of the mid-2000s displayed remote controls packed with many buttons and features, he explains. Nintendo made the first big break with its Wii remote control and Microsoft, in an attempt to regain its leading position, looked for something that would completely break the paradigm; PrimeSense’s technology was just what they had in mind. Thus, PrimeSense technology was integrated into Kinect, a visual and audio sensor developed by Microsoft. Kinect for Xbox 360 was launched on November 4, 2010, and quickly set a Guinness World Record for the fastest-selling gaming peripheral, selling eight million units in two months.

PrimeSense’s goal was to continue to lead the gaming “revolution” and expand it to many other markets such as

interactive TVs, home robots, elderly care, etc., before it was acquired by Apple. Maizels says, however, that the deal was a success. “When Apple makes a product, they make a *product*,” he says. “Its products are always precise and have the best finish in the market. It has a reputation for seeing things through. The moment PrimeSense technology will be incorporated into an Apple commercial product, the vision of PrimeSense will become something even bigger than what we first had in mind.”

Maizels says that the life of a start-up or any company for that matter is a “never-ending struggle,” from the first meeting of founders to the IPO stage or to the merger or acquisition stage. “You always have to be original, innovative, and relevant, or else you collapse.”

Dissect, explore, compute

At the School of Contemporary Science, the cutting-edge fields of bioinformatics and computational biology are just a touch-screen away

Biological research has resulted in vast quantities of data. Think the Human Genome Project, and the many cells, biological pathways, molecules, proteins and the myriad interactions among them that science has revealed. Sifting through the seemingly insurmountable sums of information is now a major challenge in biology research.

How do we get our heads around it all? Well, computers are doing the task, and now advancements in computer science—namely leaps in computational capacities and storage capabilities—have made the field of computational science essential for any serious scientific endeavor. The fact that computational biologist Prof. Michael Levitt won the Nobel Prize in 2013 in Chemistry is testament to the importance of this subject in scientific research. Yet high-school curricula in biology and physics rarely provide students with this now-essential computational component.

A unique program at the Davidson Institute of Science Education, the educational arm of the Weizmann Institute of Science, attempts to bring the computational revolution into the classroom. Moach (the Hebrew acronym for 'computational science', and the resulting word for 'brain' in Hebrew) is a three-year extra-curricular program

designed for excellent high-school science students. Moach, which runs once a week in the afternoons, offers two tracks—physics and biology—for 10th to 12th grade students. Participants go on to complete their matriculation in computational physics or biology.

The computational biology program, Moach Biology, is one of the only high-school programs of its kind in the world. While a growing number of schools and research institutions in the U.S. and Europe offer intensive programs, summer camps, and courses on the subject, Moach Biology gives students a computational biologist's "tools of the trade". In addition to learning about issues such as genetics and viruses, students learn how to write computer programs in Python, generate computer models, and extract information from large biological databases they themselves locate online.

Teachers—all of whom hold PhD degrees in life sciences—provide students with tasks and challenges to work on in pairs, according to their own pace and under constant guidance. Each year students present their final projects, which deal with everything from single proteins to advanced genetics and diseases such as cancer.

Dr. Einat Sprinzak developed the Moach Biology program and has been

teaching its first class since 2011. She says "the small classes, relaxed atmosphere, and interesting projects and experiments all contribute to a productive learning environment". The program, she adds, is beneficial to students both in terms of acquisition of knowledge and practical tools. "The applicable computational skills that our students receive will help them to get better jobs in the field of biotechnology in the future," she says.

"Both programming and biology are languages of their own, and their combination makes you think," says Dvir Gilad, a 12th grade participant. Says his partner, Rotem Huminer, "There's a reason why it's called Moach. In Moach they make you think. They challenge you non-stop".

Both Dvir and Rotem recently presented their final project—a study to find correlation between the presence of highly interacting proteins in certain tissues and their presence in similar, yet cancer-stricken, tissues—to their families and fellow students, during the graduation ceremony of the first class of Moach Biology. Earlier projects included the in-depth study of both human and cross-organism mitochondria, the energy-producing element in our cells, to better understand its role in the evolutionary life cycle.



Students in the School of Contemporary Science at the Davidson Institute of Science Education

Smart way to spend a day

The Clore Garden of Science's new Brain Exhibit educates visitors about the organ that makes us who we are

The Brain Exhibit at the Clore Garden of Science, which opened in July, lets visitors explore the wonders of animal and human brains. The development and design of the Brain Exhibit, the first of its kind in Israel, was done in-house by the Clore Garden and Davidson Institute of Science team, with each exhibit crafted from scratch.

The exhibit features a simulated MRI

machine that children can lie down on to learn how it works, and a giant nose that they can climb into. Visitors learn about the role of neurons and synapses, what they look like, and how information is transmitted in the brain. In the center of the garden is a giant "Brain Tent": an enormous inflatable model of the brain covering an area of 24 square meters in which visitors can explore the depths of

the center of thoughts and emotions and discover how the brain works. A second tent shows an image of what's happening outside, but flipped upside down, as a way to show how the brain perceives the images entering it from the eyes.

The exhibit includes creative workshops and a multi-sensory show of demonstrations and activities that teach about how the brain works.

The brains behind the Brain Exhibit

In coming up with the idea for the exhibit, the new head curator of the Clore Garden, Dr. Naama Charit-Yaari wanted something that would attract the crowds just as last year's Dinosaur Exhibit did, with great success.

Dr. Charit-Yaari is used to taking on challenges—and usually a few at once.

The mother of four, who also has three step-children, is an oceanographer and a member of the UN's nuclear test ban inspector team who flies private planes in her spare time.

With degrees from the Hebrew University of Jerusalem—her PhD was in physical oceanography—she did postdoctoral research at the Geological Survey of Israel, where she continues to conduct research today.

After completing her postdoc, Dr. Charit-Yaari worked

at the Soreq Nuclear Research Center for five years. During her years at Soreq, Naama became a nuclear inspector, team leader, and instructor representing the State of Israel as a member of the UN Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). Before joining the Clore Garden, Dr. Charit-Yaari was head scientist at MadaTech-The Israel National Museum of Science in Haifa.



Dr. Naama Charit-Yaari



Prof. Retsef Levi of MIT

Putting math to work for efficiency's sake

As U.S. hospitals grapple with how to keep down costs in the face of insufficient federal reimbursements, two prominent American hospitals have turned to operations research, analytics, and operations management for answers. Prof. Retsef Levi from MIT's Sloan School of Management—who just completed a year as a Feinberg Foundation Visiting Fellow at the Weizmann Institute's Department of Computer Science and Applied Mathematics—is spearheading major projects at Massachusetts General Hospital and Beth Israel Deaconess Medical Center in Boston that are changing their system design and streamlining everyday operations to improve patient care and make it more efficient.

Prof. Levi's work at these two Harvard University teaching hospitals addresses core system design challenges at those places and is potentially applicable to many other similar centers throughout the U.S. More broadly, his research addresses far-ranging real-life problems faced by companies, organizations, and societies concerning supply chains, resource allocation, and the interplay between optimization and learning. At the Weizmann Institute, he took part in collaborations involving operations research and computer science that aim to introduce new methods in operational efficiency with Prof. Robert Krauthgamer, postdoctoral fellow Dr. Michael Dinitz (now a faculty member at John Hopkins University), and Chen Attias, an MSc student in the Department of Computer Science and Applied Mathematics.

The surgical 'supply chain'

In the past eight years, Prof. Levi and his MIT colleagues conducted a system-level analysis at Mass General of surgical patient flow, and the hospital has implemented several of the study's recommendations. As a result, wait times for patients have been shortened, more beds have been freed up, and the foundation has been laid for better operating room utilization. About a third of surgeons changed their regular surgery day to improve patient flow and resource utilization through the week. The overall outcome of this collaboration

Prof. Levi's work is making hospitals for efficient—and more effective—and is applicable to a broad range of organizations and commercial entities

is a creative redesign of the hospital's surgical 'supply chain', which has saved the hospital over \$1 million annually, improved patients' access to care, and pertinently demonstrates that improving the quality of health care can actually go hand-in-hand with lowering costs.

Prof. Levi is now developing an improved approach for intensive care unit safety and risk management at the hospital. "I believe we are going to redefine the way in which safety and risks are being perceived in the

healthcare environment, moving from focusing on 'safety events', which require us to enumerate all the possible mishaps—a feat that can never be truly exhaustive—to the consideration of 'risky states'. Risky states are fundamental conditions of the environment, the system, and the people in that system that might increase the likelihood of harm to occur and the magnitude of the risks."

Prof. Levi and his team at MIT are creating statistical and learning models that will indicate which states really give rise to increased risks, and will later use these to formulate practical measures. "I believe this is a more fundamental approach to tackling a system-level problem because rather than taking care of individual events, you are changing the quality of the system and therefore its properties in a way that mitigates all harm rather than one specific harm," he says.

Prof. Levi has also worked on developing new models and algorithms to address core challenges of the U.S. Air Force in the areas of logistics and supply chain management. In Israel, he has been working with multiple industrial and governmental organizations, including developing a new distribution model for the Yedioth Media Group (publisher of *Yedioth Abronoth* newspaper), which was implemented successfully. That project was awarded the Daniel H. Wagner Prize for Excellence in Operations Research Practice.

His highly applicative field of research makes him an unlikely visiting scientist on the Weizmann Institute campus. But

his deep interest in the theoretical questions that arise from modeling complex problems provides common ground with Prof. Krauthgamer and others. Their joint effort, together with a postdoctoral fellow, brings together two timely topics in operations research and computer science: investigating process and supply-chain design flexibility, where the goal is to design supply chains that can quickly adapt a set of products to variable demands. Their project leverages modern techniques from the areas of network flows, graph expanders, and efficient algorithms and optimization, to develop new theories and practical methods to design robust supply chains.

Born and raised in Kfar Saba, Prof. Levi

took an unusual route into academia, reflecting a family tradition of creativity and achievement; his brother Reshef is a well-known comedian and filmmaker and another brother, Yannets, is the author of a popular children's book series. Like many of his Weizmann Institute counterparts, Prof. Levi's path has always been directed by a deeply rooted curiosity and wish to expand intellectually. "I was an intelligence officer in the army for almost 12 years. Only around the age of 29, without so much as an academic degree, I started my studies, not guided by a clear plan but rather by what stimulated my interest," he says. He focused on mathematics at Israel's Tel Aviv University, earning a Bachelor's degree,

summa cum laude, in 2001, and then a PhD in Operations Research from Cornell University in 2005.

At the Weizmann Institute, Prof. Levi was joined by his wife Anat—a professional medical translator and interpreter at Boston hospitals—and their six children. He says he tremendously enjoyed working and living at the Institute. "The Institute was very generous to provide world-class logistical support to allow the smoothest transition of my family to Israel," he says. "The intellectual environment is very stimulating and teaching and interacting with the students was a delight. I really hope to maintain long-term relations with individuals and the Institute."



Prof. Retsef Levi of MIT was a visiting professor at the Weizmann Institute in 2013-2014

Thank You

We are grateful to the individuals and foundations that support the work of the scientists mentioned in this issue of Weizmann Magazine.

Dr. Ido Amit

M.D. Moross Institute for Cancer Research
J & R Center for Scientific Research
Jeanne and Joseph Nissim Foundation for Life Sciences Research
The Abramson Family Center for Young Scientists
The Wolfson Family Charitable Trust
Abisch Frenkel Foundation for the Promotion of Life Sciences
Leona M. and Harry B. Helmsley Charitable Trust
Sam Revusky, Canada
The Florence Blau, Morris Blau & Rose Peterson Fund
Estate of Ernst and Anni Deutsch
Estate of Irwin Mandel
Estate of David Levinson
Dr. Amit is the incumbent of the Alan and Laraine Fischer Career Development Chair

Dr. Ran Budnik

Yeda-Sela Center for Basic Research
The Larson Charitable Foundation

Prof. Hadassa Degani

Prof. Degani is the incumbent of the Fred and Andrea Fallek Professorial Chair in Breast Cancer Research

Prof. Eytan Domany

The Leir Charitable Foundations
Mordechai Segal, Israel
Louis and Fannie Tolz Collaborative Research Project
Prof. Domany is the incumbent of the Henry J. Leir Professorial Chair

Prof. Zelig Eshhar

Leona M. and Harry B. Helmsley Charitable Trust
Comisaroff Family Trust
Joel and Mady Dukler Fund for Cancer Research

Dr. Eran Elinav

Abisch Frenkel Foundation for the Promotion of Life Sciences
The Benozio Endowment Fund for the Advancement of Science
The Gurwin Family Fund for Scientific Research
Leona M. and Harry B. Helmsley Charitable Trust
Adelis Foundation
Yael and Rami Ungar, Israel
Crown Endowment Fund for Immunological Research
John L. and Vera Schwartz, Pacific Palisades, CA
Rising Tide Foundation
Alan Markovitz, Canada
Cynthia Adelson, Canada
Estate of Jack Gitlitz
Estate of Lydia Hershkovich
European Research Council
CNRS - Centre National de la Recherche Scientifique
Estate of Samuel and Alwyn J. Weber
Mr. and Mrs. Donald L. Schwarz, Sherman Oaks, CA
Dr. Elinav is the incumbent of the Rina Gudinski Career Development Chair

Dr. Avishay Gal-Yam

Helen and Martin Kimmel Award for Innovative Investigation
Nella and Leon Benozio Center for Astrophysics
Peter and Patricia Gruber Awards
Robert Krauthgamer
The Citi Foundation

Prof. David Mirelman

Erica A. Drake and Robert Drake, Scarsdale, NY
Joel and Mady Dukler Fund for Cancer Research
Estate of Fannie Sherr

Prof. Moshe Oren

M.D. Moross Institute for Cancer Research
Dr. Miriam and Sheldon G. Adelson Medical Research Foundation
Robert Bosch Foundation
Estate of Harold Z. Novak
European Research Council
Prof. Oren is the incumbent of the Andre Lwoff Professorial Chair in Molecular Biology

Dr. Roe Ozeri

Crown Photonics Center
Yeda-Sela Center for Basic Research
Wolfson Family Charitable Trust
Martin Kushner Schnur, Mexico
Friends of the Weizmann Institute of Science in Memory of Richard Kronstein
Zumbi Stiftung

Prof. Yair Reisner

Belle S. and Irving E. Meller Center for the Biology of Aging which he heads
Leona M. and Harry B. Helmsley Charitable Trust
Steven and Beverly Rubenstein Charitable Foundation
Roberto and Renata Ruhman, Brazil
Prof. Reisner is the incumbent of the Henry H. Drake Professorial Chair of Immunology

Dr. Michal Rivlin

The Benozio Endowment Fund for the Advancement of Science
Revson Award towards the National Postdoctoral Award Program for Advancing Women in Science
The Peter and Patricia Gruber Awards
Dr. and Mrs. Alan Leshner, Potomac, MD
Mr. and Mrs. Gary Leff, Calabasas, CA
Mr. and Mrs. Roe Oron, Israel

Prof. Eran Segal

The Kahn Family Research Center for Systems Biology of the Human Cell Carolito Stiftung
Cecil & Hilda Lewis Charitable Trust
European Research Council
Mr. and Mrs. Donald L. Schwarz, Sherman Oaks, CA

Prof. Michael Sela

Joel and Mady Dukler Fund for Cancer Research
Victor Pastor Fund for Cellular Disease Research
Comisaroff Family Trust
Paul Sparr Foundation
Prof. Sela is the incumbent of the W. Garfield Weston Professorial Chair of Immunology

Dr. Yoav Soen

Leona M. and Harry B. Helmsley Charitable Trust
Dr. Soen is the incumbent of the Daniel E. Koshland Sr. Career Development Chair

Prof. Amos Tanay

Helen and Martin Kimmel Award for Innovative Investigation
Pascal and Ilana Mantoux, Israel/France
The Wolfson Family Charitable Trust
The Rachel and Shaul Peles Fund for Hormone Research
Moise and Carol-Ann Emquies, Santa Monica, CA
Estate of Evelyn Wellner

Prof. Reshef Tenne

Helen and Martin Kimmel Center for Nanoscale Science which he heads
Irving and Azelle Waltcher Endowed Research Fund in honor of Prof. Moshe Levy
European Research Council
Prof. Tenne is the incumbent of the Drake Family Professorial Chair in Nanotechnology

Prof. Shimon Ullman

European Research Council
Prof. Ullman is the incumbent of the Ruth & Samy Cohn Professorial Chair of Computer Sciences

Prof. David Wallach

Leona M. and Harry B. Helmsley Charitable Trust
Merck Serono
Prof. Wallach is the incumbent of the Joseph and Bessie Feinberg Professorial Chair

Prof. Yosef Yarden

Dr. Miriam and Sheldon G. Adelson Medical Research Foundation
The Maurice and Vivienne Wohl Biology Endowment
Louis and Fannie Tolz Collaborative Research Project
European Research Council
Marvin Tanner Laboratory for Research on Cancer
Prof. Yarden is the incumbent of the Harold and Zelda Goldenberg Professorial Chair in Molecular Cell Biology



