

No. 17 • Spring 2020

The Weizmann

International magazine of science and people

The Brain Issue



Plus: Special section on Weizmann
coronavirus response



From the President

Dear friends,

We are in the midst of a global challenge that has forced everyone to adjust their lives and work routines, and the Weizmann Institute of Science is no exception. At the same time, as part of civil society, the Institute has a role to play in finding solutions. We see it as our duty to summon all of our resources and scientific expertise to contribute to the global battle against the novel coronavirus, for the benefit of humanity.

Our campus has swiftly become a hub of concentrated efforts in three critical directions: to help ramp up testing capacity, track outbreaks in the making, and advance promising research initiatives toward treatments and potential vaccines. Many of our scientists, each from his or her own unique angle, are stepping up to the plate to urgently search for solutions. We have assembled a task force comprised of researchers and administrators, including myself and the vice presidents, who are coordinating all of these efforts and working together to do our utmost to summon all possible resources to enable the science to move ahead.

In this issue of *Weizmann Magazine*, you can read about some of our initiatives related to the coronavirus. You'll also read about our major new flagship projects in neuroscience and artificial intelligence, which remain top priorities: the Institute for Brain and Neural Sciences, and the Artificial Intelligence Enterprise for Scientific Exploration.

This is my first greeting to you in the magazine as President, and I look forward to many more. Most importantly, I offer you and your families my best wishes for health and tranquility.

Sincerely,

Prof. Alon Chen
President, Weizmann Institute of Science

Visit us:
www.weizmann.ac.il/WeizmannCompass

Credits

A publication of the Department of Resource Development

Editorial Staff

Prof. Roee Ozeri, Vice President for Resource Development and Public Affairs | **Kelly Avidan**, Director, Department of Resource Development | **Tamar Morad**, Head, Donor Communications | **Heidi Shulman**, Publications and Video Production Coordinator, **Yarden Jaron**, Visual and Digital Production

Writing Staff

Sandy Cash | **Dinah Elashvili** | **Tali Galsky** | **Sharon Reinheimer** | **Anne Sperling** | **Edward Truitt**

Illustration

Tal Bavli-Ziv

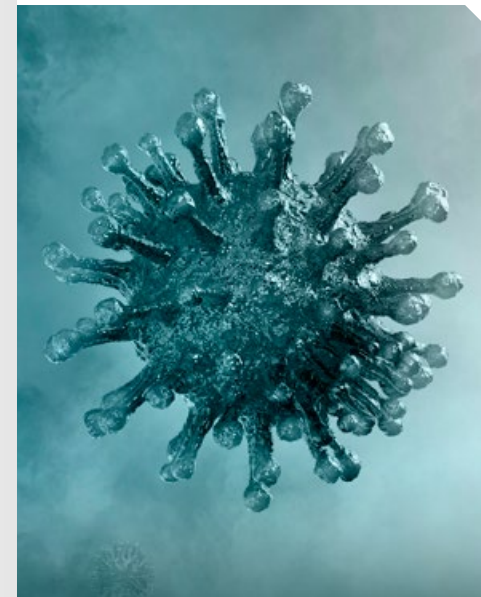
Graphic Design

Alexey Kletsel, Netgo Ltd.

Photography and renderings

Philipp Böni | **Itai Belson**, **Ohad Herches** of the Weizmann Institute Photo Lab | **Yael Ilan** | **Hadar Kaminsky** | **Ronald Korner** | **Weizmann Institute Photo Archives** | **Shutterstock** | **Paul J. Trummer**

Table of Contents



Briefs
2 Special section on coronavirus response

New Scientists

- 18 Finding Earth 2.0: Introducing Dr. Sagi Ben-Ami
- 20 Sleuthing for the fingerprint of water: Introducing Yael Kiro, groundwater detective

Science Features

- 46 Artificial intelligence: the future of smart. AI is reshaping our lives and revolutionizing science



Cover Story
22 A wise future for neuroscience: Weizmann's new flagship project

Special Section

- 32 The 2019 Annual General Meeting of the International Board

Weizmann World

- 50 Stories and updates from our worldwide committees

Education

- 56 Boots on the ground in Ofakim: Israel's first science pre-army prep program



Spotlight On
28 Rising Tide's quest to advance cancer research and care

Beyond the Bench

- 58 Brain-saving technology

Alumni

- 60 A healing solution after brain surgery

Art and Science

- 62 The artistry of math

In Memoriam

- 64 Dr. Yael Mutsafi, 1981-2019

Coronavirus Response

2-3

Special section: Weizmann coronavirus response

As we find ourselves—all of humanity—in the midst of a pandemic caused by the outbreak of SARS-CoV-2, the Weizmann Institute of Science is advancing major research efforts and other initiatives to address this challenge: more than 50 projects are now underway.

The new coronavirus is a global health threat that is unprecedented in any of our lifetimes. The Weizmann Institute, with its world-renown in immunology, structural biology, computational science and artificial intelligence, cellular sequencing, and drug discovery, is poised to make key breakthroughs at this critical time.

In this section, you may read a sampling of our efforts, focusing in three main directions: ramping up testing capacity, tracking outbreaks in the making, and advancing promising research initiatives toward treatments and potential vaccines.

Ramping up testing

- ▶ **The Nancy and Stephen Grand Center for Personalized Medicine** (G-INCPM) on campus

has been transformed into a center for the rapid production of diagnostic tests, in coordination with Israel's Ministry of Health. This move has enabled a multi-fold rise in the number of tests produced and **Prof. Robert Fluhr** is heading this effort. The G-INCPM is home to the country's most comprehensive and advanced infrastructure for genomic and proteomic analysis, making it a vital resource for Israel's scientific and medical community as they seek to create new coronavirus testing approaches.

Video: Coronavirus testing center at the Grand Center on campus

מכון ויצמן למדע

- ▶ In parallel, an effort by **Profs. Eran Elinav** and **Ido Amit** is underway to develop a new testing method based on a process that involves fewer stages compared to existing tests, vastly expands the number of samples that can be tested at a time, and offers a method that greatly reduces the biological risk to which the teams that perform the tests are exposed. The Weizmann scientists expect to have the capacity to test about 20,000 samples per day.

Video: It's a revolution: massive ramp-up in safer testing

A model to sustain economic activity

- ▶ As the state of the economy becomes an increasing source of concern, **Prof. Uri Alon** and his graduate students **Omer Karin** and **Yael Korem-Kohanim**, together with senior engineer **Boaz Dudovich** of Applied Materials, have developed an epidemiological model that shows how it is possible to enact a nationwide policy to effectively suppress the coronavirus and at the same time allow sustainable, albeit reduced, economic activity. The model is based on the mathematics of an intermittent lockdown: five days of lockdown and two days of work every week. In this way, the virus replication number—the number of people infected by each contagious carrier—drops below 1: the magic number that would lead to a decline in the epidemic.

A four-day work/ten-day lockdown strategy is even better, they suggest, allowing those infected at work to cease becoming infectious at home. Prof. Alon suggests that after several such cycles, the number of infected people will drop dramatically. The epidemic can be contained until sufficient testing, effective treatment, or a vaccine is developed, which would negate the need for a lockdown.

מכון ויצמן למדע

The Weizmann Coronavirus Response Fund

The Institute has established the **Weizmann Coronavirus Response Fund**, which will enable Institute leadership to urgently disseminate support to its scientists working on the front lines to find solutions, and to support unique science education initiatives to address the demand for online distance learning.

The Response Fund aims to raise approximately \$25 million for the urgent allocation of support. More than 50 projects across campus are underway. A sampling of our other efforts are described in this special section, including:

- ▶ Searches for the perfect drug or vaccine, such as the projects underway by **Prof. Sarel Fleishman**, **Dr. Ron Diskin**, and **Dr. Nir London**
- ▶ An effort spearhead by **Profs. Eran Segal** and **Benjamin Geiger** is tracking geographic clusters in which the coronavirus is prevalent and will likely spread.
- ▶ The Davidson Institute of Science Education at Weizmann launched a new website called **Stuck at Home?** which offers a suite of digital science activities at a time when students, teachers, and parents are in need of quality distance-learning content.

You can read more about the Weizmann Coronavirus Response Fund on the Institute website, or via the QR code below.

More on the Weizmann Coronavirus Response Fund

מכון ויצמן למדע

Mapping corona in stealth mode

Predict Corona fuses data on symptoms, geography to predict outbreaks in the making

Weizmann Institute scientists have developed a method for monitoring, identifying, and predicting geographical clusters in which the coronavirus is prevalent and will likely spread, by tracking symptoms throughout the Israeli public—both healthy and sick individuals. The method is at the core of the Predict Corona project, spearheaded by Institute's Prof. Eran Segal and Prof. Benjamin Geiger, together with the Hebrew University's Prof. Yuval Dor.

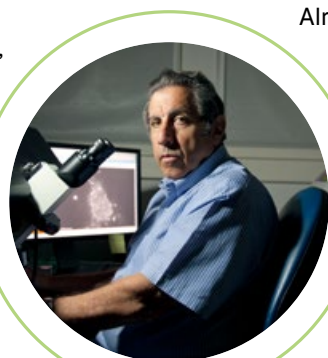
Predict Corona is being rolled out to the entire Israeli public in coordination with Israel's Ministry of Health and the country's HMOs, and is being adopted now by over 10 countries, including the U.S., Italy, and Spain.

"Viral spread occurs in clusters of infection," says Prof. Segal. "Therefore, early identification of clusters may facilitate various actions aimed at slowing down the spread of the virus."

The scientists describe their method in a fast-tracked publication in *Nature Medicine*.

AI in the service of public health

Predict Corona is a brief, one-minute voluntary survey that asks Israelis to share their geographical location (including street and neighborhood), and any symptoms associated with COVID-19—while protecting patient privacy—to assess infection patterns for SARS-CoV-2, the virus that causes COVID-19. The questionnaire tracks the development of virus-induced symptoms, and the analysis relies on Big Data algorithms and artificial intelligence.



Prof. Benny Geiger

Already, the scientists have detected a significant increase in symptoms reported by the public in areas where verified coronavirus patients are known to have been. The mapping may enable health authorities to concentrate anti-contagion efforts on areas in which an outbreak and spread of the virus is predicted—while allowing them to ease measures in areas where an outbreak is not expected.

The initiative relies on this daily questionnaire, which can be accessed in five languages (Hebrew, Arabic, English, Russian, and Amharic).



Prof. Eran Segal

Together with Prof. Ran Balicer of the Clalit Research Institute (affiliated with Clalit Health Services, Israel's largest HMO) and other researchers, the scientists called on other countries to implement the strategy. The interest was immediate, and countries including the U.S., Italy, Spain, India, Luxembourg, Malaysia, Germany, and Britain, are using the tool.

Prof. Segal and researchers from the U.S. are spearheading the formation of an international consortium that will share methods, insights, and summary data to build predictive tools and compare across all countries. Companies such as Intel, as well as academic researchers and members of the Israeli military, have reached out to offer their assistance and are already contributing to this effort.

A framework for identifying regional outbreak and spread of COVID-19 from one-minute population-wide surveys

Towards a drug against COVID-19

Co-led by Dr. Nir London, global consortium aims to drastically accelerate development of drug

An international initiative led by the Weizmann Institute's Dr. Nir London has brought together a range of key players in the drug development process—from academia in four countries, to biotech and contract research organizations, to specialized software companies—to accelerate the development of a drug against COVID-19.

Dr. London is collaborating with researchers at Oxford University, Memorial Sloan Kettering Cancer Center, University of British Columbia, a California biotech company PostEra, and Enamine, one of the largest chemical vendors in the world, to develop small molecules to target a key SARS-CoV-2 protein that can halt and counteract the virus.

The partners have developed the means to characterize the structure of the main protease of SARS-CoV-2—an essential enzyme that is responsible for a key step in the virus life cycle. The researchers have agreed to share all their data openly to avoid bureaucracy and intellectual property considerations. All data is available in real time to the entire research community, inspiring a true open-science global collaboration.

Their goal: to target this enzyme's activity effectively, which would be a key antiviral approach. By ramping up research production in a coordinated effort with contract research organizations (CROs) they are hoping the effort will lead to an effective anti-COVID-19 drug candidate in a matter of months.

Dr. London and his team in the Department of Organic Chemistry are experts on drugs that rely on the formation of covalent bonds, and their innovative electrophile-fragment screening platform has been used against various proteins. In the past two weeks, they have applied it to the viral protein (produced and shipped from the UK) and have identified promising



Dr. Nir London

initial hits that can potentially serve as starting points for a drug. The Oxford University team and the Diamond Light Source (the UK's national synchrotron light source science facility), were able, in turn, to determine crystal structures showing how these compounds bind in the protease's active site.

So far, they have identified 78 hits against the SARS-CoV-2 protease, 37 of which are covalent fragments originating from the London lab. Now, they must narrow down the possibilities, which requires the input of medicinal chemists and cheminformatics and design experts.

Crowdsourcing for science

To that end, the researchers are hosting an online crowdsourcing challenge to ask medicinal chemists and computer-aided drug design experts around the world to design better molecules based on the available fragments. Close to 2,000 designs have been submitted so far, and the challenge is ongoing. PostEra's AI-based computational models are used to prioritize chemical synthesis and drug-binding simulations created by software project called Folding@Home would be used to predict binding affinity. Together, these efforts will significantly accelerate the compound-design cycle.

Once such promising candidate drugs are identified, Enamine and CROs will be on called to synthesize and test every compound's safety.

Video: Dr. Nir London: The race for a cure

Learning from other lethal viruses

Insights on Ebola, arenaviruses pave way for Dr. Ron Diskin's next target: the coronavirus

In an effort to find solutions for the novel coronavirus, structural biologist Dr. Ron Diskin is expediting two parallel investigations to counter the disease based on his previous research on similar animal-borne contagions, and on the vaccine for Ebola, a virus that, like SARS CoV-2, is also believed to have originated in bats.

In the last six months, Dr. Diskin, of the Weizmann Institute's Department of Structural Biology, has made a series of crucial discoveries related to viruses that cross over from animals to humans. In fact, papers published by Dr. Diskin just weeks before the coronavirus outbreak, and another one in more recent weeks, may point to new ways to find a cure not only for the coronavirus—but a wide range of highly infectious and lethal viruses that cross over from animals (particularly rodents) to humans.

In January in *Nature Communications*, he described a molecular decoy he and his lab members engineered that leads a group of animal-borne viruses, called arenaviruses, to avert cell membranes—and thereby prevents infection. The lab is applying the same approach used to create this new molecule, which they call "Arenacept," to the coronavirus.

Dr. Diskin also recently published two other important studies, in *Nature Medicine* and *Cell Host & Microbe*, respectively, showing just how the vaccine against the Ebola virus activates the immune system to fight off the virus. In collaboration with partners in Cologne, Germany, the Diskin lab mapped out how the antibodies bind to the virus and destroy them—and discovered that smaller doses than what are currently administered are just as effective. The latter study identified the precise molecular target of these specific antibodies acquired by all vaccinated individuals and Ebola patients who had recovered from the disease, and described the mechanism by which a common immunological response against Ebola is elicited.

These discoveries are incredibly timely, and taken together with Dr. Diskin's other insights on the



Dr. Ron Diskin

mechanisms of lethal viruses, he plans to investigate the novel coronavirus—with his eyes set on a cure or vaccine. In the first avenue, he is conducting a comprehensive screening for identifying a decoy molecule that will have all the desired properties needed to construct an immunotherapeutic molecule (immuno-adhesin). In the second avenue, Dr. Diskin is collaborating with several groups to isolate antibodies from recovered coronavirus patients. They intend to elucidate three-dimensional structures to reveal how these antibodies bind to the SARS-CoV-2 virus, which could lead to a potential vaccine or antibody treatment for coronavirus.

מכון ויצמן למדע

Designing the perfect antibody

Prof. Sarel Fleishman is applying computer modeling tools to create a coronavirus-blocking solution

Prof. Sarel Fleishman and his team in the Department of Biomolecular Sciences are using a unique platform developed in their lab to address the coronavirus problem by designing and testing millions of "nanobodies"—small synthetic antibodies that could potentially slip through the coronavirus's formidable defenses. Once they home in on the most effective nanobodies, it may become possible to design a treatment capable of stopping the deadly virus.

A structural biologist and technology innovator, Prof. Fleishman has developed computer modeling tools that support the rapid and inexpensive design of customized proteins. Much of his work focuses on antibodies—proteins that defend the body against disease-causing invaders, like viruses and bacteria. Now, he is focused on a particular structural element in the coronavirus—the "spike protein" recently characterized by scientists at the University of Texas in Austin, which plays a key role in the infection process. His goal is to design a robust antibody that would bind to vulnerable points on the spike protein and stop infection in its tracks.

Lessons from malaria

The potential impact of this design approach is illustrated by a recent breakthrough achieved in the Fleishman lab against another infectious killer: the parasite *Plasmodium falciparum*, which causes malaria. The lab invented a methodology to design computer-based models of proteins, including antibodies, that do not exist in nature, and which have superior properties. The tools—available online and used by labs around the world—encode how proteins fold and function and predict how specific mutations would impact protein characteristics on the atomic level.

Two years ago, an algorithm created by Dr. Adi Goldenzweig—then a PhD student in the Fleishman lab—resulted in the design of an anti-malarial vaccine. Not only did these synthetic proteins

provoke a protective immune response that short-circuited infection by the malaria parasite, they were also cost-effective to produce, and remained stable at extremely high temperatures—a significant advantage for impoverished populations living in tropical climates. Successfully tested in laboratory studies by Prof. Fleishman's colleagues in the UK, the new proteins are being scaled up for release as a commercial vaccine.

Antibodies that are perfectly primed to block coronavirus will not be easy to design, however. That's because the spike protein structures that drive infection are shielded by particularly complex structures known as glycans.

To get past this glycan shield, Prof. Fleishman will massively expand a computational protocol already validated on a small scale in his lab.

His team, comprising doctoral student Lucas Krauss, and Drs. Ravit Netzer and Adi Goldenzweig, are leveraging their suite of protein design tools to generate computer models of millions of designed antibodies in search of those most likely to bind successfully to one or more of the coronavirus's vulnerable sites, and winnow down the set using experimental high-throughput screening technology, thereby identifying the top antibody candidates.



Prof. Sarel Fleishman's method has been proven in the development of a potential malaria vaccine.

Video: Prof. Sarel Fleishman: Designing a coronavirus vaccine

מכון ויצמן למדע

Prof. Ruth Arnon: Lessons from influenza

What the quest for a universal flu vaccine can teach us

With infections, as with football, a best offense is often a good defense. But while that strategy works for many infectious diseases, it doesn't work with influenza; thanks to its readiness to mutate, the influenza virus effectively "shifts the goalposts" each year, requiring a new vaccination.

Renowned Weizmann Institute immunologist Prof. Ruth Arnon is spearheading a new defense—a universal influenza vaccine that is currently in Phase III of the clinical trial process—that focuses on the parts of the flu virus that stay the same from year to year, gluing the goalposts to the ground once and for all.

Prof. Arnon, who emphasized that she is not an expert on coronavirus, says she thinks a similar strategy might also be useful for countering coronaviruses, including the current SARS-CoV2 strain (which causes the COVID-19 disease).

That is, a possible pharmaceutical approach to creating a vaccine against COVID-19 involves targeting a particular viral protein, called SPIKE, which is an important offensive player in the virus's infection game. Another approach would be targeting a protein, or segments of the virus proteins, that are common across the most virulent types of coronavirus, including SARS-CoV-2, and MERS-CoV.

"If I were working in the coronavirus field," says Prof. Arnon, "this non-changing protein approach is where I would focus my efforts."

It's going to take time and patience. Even if a universal coronavirus vaccine were identified today, it is unlikely to be of use this year.

Time and patience

Part of the challenge is one that is common to all vaccine production processes. Vaccines must be tested in animals, but there are no good animal models of how the COVID-19 infection cycle works



Prof. Arnon is the past president of the Israel Academy of Sciences and Humanities, and co-developer of the blockbuster multiple sclerosis drug Copaxone. Her universal flu vaccine is in Phase III clinical trials.

in humans, which means preclinical trials will likely have to be carried out. Moreover, a vaccine must be tested in people for safety—a process that can take weeks to months. And then, once a vaccine is identified, it must be produced in sufficient mass quantities—and administered far and wide—in order for herd immunity to take effect. Herd immunity is a form of indirect protection that occurs when a large percentage of a population has become immune to an infection, thereby providing a measure of protection to individuals who are not vaccinated. In effect, the virus runs out of hosts.

Furthermore, vaccine trials tend to take longer than trials for, say, cancer drugs; the vaccines are administered to healthy people, and efficacy can only be determined through a painstaking "wait and see" approach, to find out whether the vaccines indeed fend off infection.

מכון ויצמן למדע

So, notes Prof. Arnon, it isn't enough to generate a vaccine—it has to be delivered to everyone at risk in order to be truly effective. For COVID-19, that's the whole world. By the time that happens, the current outbreak may have run its course.

It's also not clear whether, if a vaccine is developed for COVID-19, coronaviruses will have a seasonal fluctuation and die out like influenza, which is what happens to the flu, thanks to the herd immunity caused by the seasonal flu vaccine, as well as the arrival of warmer temperatures to which the virus is ill suited.

Coronaviruses are a common type of virus, and they come in a variety of strains. Most of these strains produce the mildest of cold symptoms in the infected individual. From time to time—and with frustrating unpredictability—a virulent variety appears, such as the SARS coronavirus (SARS-CoV) strain of 2003, MERS-CoV in 2012 (both of which petered out by summer) and most recently, SARS-CoV-2. If this latest one sticks around, or if it decides to keep reappearing like influenza, having a vaccine will be crucial.

While a universal coronavirus vaccine may not help us win the current outbreak, says Prof. Arnon, it would help us mount the best defense for the future.

Video: What is a vaccine?

מכון ויצמן למדע

Coronavirus by the numbers

A measured approach to understanding—and defeating—the COVID-19 pandemic

The SARS-CoV-2 pandemic is a harsh reminder that, whether the virus is spreading within a single human host or in a wave of infection spanning continents, many of the most critical answers we seek about this unprecedented crisis are expressed in numbers. Quantitative questions include: How long does it take a single infected person to infect a million others? How long does the coronavirus survive on surfaces? How effective is social distancing, and how many lives can this policy potentially save?

More than a decade ago, during his postdoc at Harvard Medical School, Prof. Ron Milo created an online, shareable resource for "bio-numbers"—values culled from the scientific literature that relate to biological processes as they occur on all scales, from the levels of atoms and molecules, to the levels of organisms and ecosystems. Over the years, Prof. Milo's initiative grew into a massive database called BioNumbers that allows scientists around the world to search bio-based data to find answers to their questions, and to identify interesting questions that had never occurred to them before.

Now, he and his colleagues are applying the same approach to the fight against the coronavirus. Those colleagues include Yinon Bar-On, a PhD student in the Milo lab in the Weizmann Institute's Department of Plant and Environmental Sciences, Prof. Rob Phillips from the California Institute of Technology, and Dr. Avi Flamholz of the University of California at Berkeley.

In a recent publication in *eLife*, the researchers used existing peer-reviewed literature to create something that could well be called "Corona-by-the-numbers"—a comprehensive collection of the key biological properties currently known about the coronavirus that can be measured in numerical terms. They will be curating these numbers, and updating them as new data emerge from laboratories, clinical centers, and public health authorities worldwide.

A range of scientific insights could potentially emerge from the use of this data. For example, the carefully curated values may spark new ideas about how the immune system could be stimulated to fight the virus. They may reveal how the coronavirus is similar to, or different from, other viruses against which preventative strategies already exist. Measurements of viral particle concentration could aid in the design of diagnostic kits for asymptomatic patients. And by offering measurements of factors that influence the speed at which the disease spreads, the data Prof. Milo and his colleagues compile may lead to new strategies for protecting populations worldwide.

"Knowledge of the numbers related to the coronavirus can give us a 'sixth sense' that allows us recognize what we can't see or feel—thereby serving as a basis for thoughtful, quantitative insights that may lead to important discoveries," Prof. Milo says.



Science Briefs

10-11



Science vs. neurodegeneration

Two Weizmann Institute labs have taken the lead in the battle against neurodegeneration, with discoveries that may eventually contribute to treatments—or even cures—for two separate conditions: Huntington's disease (HD) and Amyotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease.

Huntington's disease is a fatal genetic disorder caused by mutations in the huntingtin gene, leading to the progressive breakdown of nerve cells in the brain. Often striking in the prime of life and causing deterioration of both physical and cognitive abilities, HD currently has no cure.

Now, Prof. Rivka Dikstein of the Department of Biomolecular Sciences has identified two molecules that can block the activity of Spt5, a gene involved in HD onset. A regulator of gene transcription—an early stage in the process that leads to protein production—Spt5 is specifically required for transcribing the mutant huntingtin gene associated with HD progression.

A team led by Dr. Anat Bahat, a staff scientist in the Dikstein lab, screened a library of about 100,000 small molecules, and discovered two

molecules that bind to Spt5 and block the expression of the mutated protein. However, in cases where the huntingtin gene appears in its normal, non-mutated form, these molecules allow protein expression to occur. These findings represent an important step forward in the eventual development of a drug capable of "short circuiting" a molecular dynamic that drives Huntington's disease.

In a separate advance, Prof. Eran Hornstein of the Department of Molecular Genetics recently discovered a molecule involved in the onset of ALS. Prof. Hornstein and his colleagues led a large international collaboration that identified a microRNA gene that plays a crucial role in motor neurons. This microRNA gene is expressed at lower levels in ALS patients as compared to healthy individuals—something that makes it a powerful biomarker for early ALS diagnosis. The team also identified rare mutations in the gene that codes for this ALS-associated microRNA.

Prof. Hornstein's research could lead the way toward new strategies in which the microRNA he and his colleagues discovered would be used to mediate ALS symptoms, thereby transforming ALS from a death sentence into a chronic, manageable illness.

מכון ויצמן למדע

Homeschooling in the time of corona

The Davidson Institute offers distance-learning solutions

Schools everywhere have closed due to the spread of the novel coronavirus, and teachers are turning to remote learning to keep their students on track. If the online world wasn't already a central fixture of our lives, now the Internet has become a primary portal to the outside world for parents and kids cooped up at home—and in Israel, school lessons and assignments have shifted almost exclusively to the online space.

The Davidson Institute of Science Education at the Weizmann Institute, which operates dozens of curricular and extracurricular programs, is on the front lines of this effort with its robust Davidson website. It launched a new site called *Stuck at Home?*, which offers a suite of digital science activities for the entire family.

Stuck at Home? includes videos, articles, puzzles, science experiments that can be conducted at home, and other innovative science and math activities. The Davidson Institute has shared the link to this content via social networks, groups within the Ministry of Education and WhatsApp groups. The response has been overwhelming: On the first day after schools in Israel were closed, the Davidson Institute website was flooded with

users—about 250,000. Before the crisis, the site received about 20,000 visits per day. While most surfers are accessing the site from Israel, several thousand are from other countries as well, primarily the US. While *Stuck at Home?* is in Hebrew, Arabic, and English, and efforts are underway to translate it into Spanish.

Science on demand

The site offers a diverse range of science-related topics and it is also a portal to other Davidson content, such as its free and popular Science VOD page, which includes an extensive library of videos on demand. Davidson also launched a page with a suite of articles on the COVID-19 outbreak, as well as posts related to virology and epidemiology in general. The staff is also maintaining a daily report tracking the spread of the virus.

Visit the '*Stuck at Home?*' website.

מכון ויצמן למדע



📍 *Tipping the gender balance: women physicists at an international workshop on campus in November*

Where are the female physicists? It's not a theoretical question

Physics has historically been a male-dominated field, but a new initiative in the Weizmann Institute's Faculty of Physics is trying to understand why—and take proactive steps to shifting the gender balance.

In November, the faculty held a workshop that attracted physicists and gender diversity experts from around the world to analyze the problem and discuss success stories from other institutions and countries. The conference was co-led by Prof. Yossi Nir of the Department of Particle Physics and Astrophysics; Dr. Meytal Eran-Jona, a sociologist who recently became the Institute's first Director of Diversity at the Feinberg Graduate School; and Prof. Marika Taylor, a professor of theoretical physics at the University of Southampton in the UK. It was sponsored by the Schwartz/Reisman Institute for Theoretical Physics.

With a grant from Israel's Ministry of Science and Technology, Prof. Nir and Dr. Eran-Jona investigated the gender imbalance in the field of physics nationwide. They found that while 38 percent of high school students who study advanced physics are girls, that percentage continues to decline throughout the stages of higher education and career choice. Only 16 percent of undergraduate physics majors are female, and only six percent of physicists in tenured or tenure-track positions are women. Just 16 women hold tenure or tenure-track or positions in physics in Israel.

"The challenges are many, starting at the high school level when girls first encounter physics, and the roadblocks continue until the point of career choice," says Dr. Eran-Jona. One of the biggest "forks in the road," she says, is when women consider pursuing postdoctoral positions abroad—the unwritten prerequisite to attaining a position in Israeli academia. It's a decision that often requires uprooting a spouse and young children and surviving on a typically low postdoc salary in expensive international cities. This is a crossroads for women across the sciences, but is particularly acute in physics, "a male-dominated field where, unfortunately, women do not always feel at home," says Prof. Nir.

Since the November workshop, several initiatives have taken root, include: launching postdoctoral grants for people with childcare responsibilities; embracing an anti-harassment legal policy for prevention and enforcement of proper workplace behavior; and enhancing female visibility as speakers in conferences and seminars.

Dr. Eran-Jona has also been working with FGS and the Faculty of Physics to adjust the student recruitment process. Additional gains include the Faculty's exposure to and active participation in gender diversity efforts in physics worldwide, including a new affiliation with a European organization dedicated to this subject.

"Our uncle Mort Zuckerman would be kvelling over the impressive group here today, especially by the overwhelming number of women in the program," says Eric Gertler.

12-13

Zuckerman Symposium: Women in STEM

The third annual Zuckerman US-Israel Symposium, focused on the advancement of women in STEM subjects, took place in November on the Weizmann Institute campus. The symposium was part of the Mortimer B. Zuckerman STEM Leadership Program, which awards financial grants to American postdoctoral fellows doing research in Israel, provides vital resources to Israeli universities, facilitates the return of Israeli scholars to Israeli institutions, and helps support Israeli postdocs doing research in the US.

The Zuckerman STEM Program, established in 2016, has funded 125 scholars at 63 American universities and seven Israeli universities to date. In the 2019-2020 year, three out of its four faculty scholars are women, and women comprise 54% of this year's grantees.

"Our uncle Mort Zuckerman would be kvelling over the impressive group here today, especially by the overwhelming number of women in the program," says Eric Gertler, a trustee of the Zuckerman Institute. "We consider the Zuckerman STEM Leadership Program to be a ripple of hope and a center of energy, and we're confident that this great collaboration will have a lasting impact on the world."

James Gertler, another trustee of the Zuckerman Institute, says, "We look forward to more and more successes for the women in our STEM program and the United States-Israel academic exchange."

The event included talks and panels including women from academia,

industry and government. The speakers included Dina Ben-Yehuda, Dean of the Hadassah – Hebrew University School of Medicine; Dr. Irit Idan, Executive Vice President of Research Development at Rafael Advanced Defense Systems; and Marissa Gross Yarm, Head of International Student Affairs at the Israeli Council for Higher Education. Dr. Thomas Zurbuchen from the Science Mission Directorate of NASA also took part.

From the Weizmann Institute, participants included Prof. Ada Yonath, who won the Nobel Prize for Chemistry in 2009, and a former postdoctoral researcher in her lab, Dr. Moran Shalev-Benami of the Department of Structural Biology, a Zuckerman Scholar, who described her research on visualizing protein function.



📍 *Prof. Ada Yonath, the keynote speaker at the Zuckerman Symposium*



Prof. Ido Amit and Eran Elinav flanking Joao Monteiro and Ursula Weiss of Nature.

Next Gen Immunology Conference 2020

Hundreds of world-leading researchers in immunology convened February 2-5 at the Next Gen Immunology Conference at the Weizmann Institute—a gathering that has now become the “go-to” conference in the field for scientists, postdocs, and students. The conference is held every two years in partnership with the prestigious journal *Nature*.

Led by Profs. Eran Elinav and Ido Amit of the Department of Immunology, the conference highlighted discussions between scientists, clinicians, and the pharma industry; and new tools

like *in vivo* imaging, single-cell sequencing, and new genomics approaches that will advance the understanding of the microbiome, the nervous system, cancer, metabolism, and beyond. The conference included some 85 poster sessions.

The event was sponsored by the Moross Integrated Cancer Center, the Azrieli Institute for Systems Biology, the Nancy and Stephen Grand Israel National Center for Personalized Medicine, and industry partners including Merck and Teva Pharmaceuticals.

מכון ויצמן למדע

“Recognizing and supporting promising scientists early in their careers is essential to ensure that they maximize the impact of their future research,” says Len Blavatnik.

14–15

Weizmann scientists win all three Blavatnik Awards

Honors highlight research in cryptography, genetics, and protein assembly

The annual Blavatnik Awards for Young Scientists in Israel have gone to three Weizmann scientists—the first time that all three awards will be bestowed exclusively on Weizmann researchers. Dr. Igor Ulitsky, a biologist who is studying how a type of genetic material—long noncoding RNA—works to influence health and disease, received the award in the Life Sciences category. Dr. Emmanuel Levy, a biochemist investigating how proteins assemble and interact, won the Chemistry award. And computer scientist Prof. Guy Rothblum, who is advancing the study of cryptography, received the Physical Sciences & Engineering award.

“Recognizing and supporting promising scientists early in their careers is essential to ensure that they maximize the impact of their future research,” says Len Blavatnik, Head of the Blavatnik Family Foundation that awards the prizes. “For the past several decades, Israel has been a powerhouse of scientific breakthroughs and technological innovation. The three young scientists recognized by these awards are outstanding examples of the enormous potential of Israeli scientific talent.”

The Blavatnik Foundation, which offers a series of prizes for outstanding scientists, launched its Israel awards in 2017 in collaboration with the Israel Academy of Sciences and the Humanities.



Dr. Igor Ulitsky



Prof. Guy Rothblum



Dr. Emmanuel Levy

Sweet news: AI advances diagnosis of gestational diabetes

A new algorithm developed by Weizmann Institute scientists can predict which pregnant women are at a high risk of gestational diabetes, a common condition in which women without diabetes develop high blood sugar levels. The study was authored by Prof. Eran Segal and reported in *Nature Medicine*.

Analyzing data on nearly 600,000 pregnancies available from Israel's largest health organization, Clalit Health Services, the study determined that, based on the predictions offered by the algorithm on these data, it may be possible to predict and prevent gestational diabetes.

"Our ultimate goal is to help the health system take measures to prevent diabetes from occurring in pregnancy," says senior author Prof. Segal, who has dual appointments in the Department of Computer Science and Applied Mathematics and the Department of Molecular Cell Biology. The study was done in collaboration with researchers at Rabin Medical Center in Petah Tikvah and Clalit.

Gestational diabetes is fraught with health risks for both mother and baby. Typically, the condition is diagnosed in the second trimester, by way of a glucose tolerance test in which the woman drinks a glucose solution and then undergoes a blood test to see how quickly the glucose is cleared from her blood.

Prof. Segal and his colleagues processed a dataset of more than 2,000 parameters for each pregnancy, including each woman's blood test results and medical history, and ran the data through an algorithm built to "connect the dots" between the medical data and the diagnosis. It revealed that nine of the parameters were sufficient to accurately identify the women who were at a high risk of developing gestational diabetes. The nine parameters include the woman's age, body mass index, family history of diabetes, and results of her glucose tests during any previous pregnancies.

These findings suggest that by having a woman answer just nine questions, it should be possible to tell in advance whether she is at a high risk of developing gestational diabetes. And if this information is available early on—in the early stages of pregnancy or even before the woman has conceived—it might be possible to reduce her risk of acquiring the condition by making lifestyle modifications such as exercise and diet.

Meanwhile, women identified by the questionnaire as being at a low risk for gestational diabetes may be spared the cost and inconvenience of the glucose testing.

The study is another step forward in advancing artificial intelligence techniques for health—demonstrating the usefulness of large human-based datasets, specifically electronic health records, for deriving personalized disease predictions that can lead to prevention and intervention.



"Our purpose was to generate enthusiasm for science among the young patients, and to allow them to step away from the difficulty of their illnesses and the hospital routine for a moment," says Prof. Schuldiner.

16-17

Bringing the lab to the hospital

Prof. Maya Schuldiner's group makes a visit to Kaplan Medical Center

Scientists from the Department of Molecular Genetics visited patients in the pediatrics unit at Kaplan Medical Center in Rehovot to teach a bit of science and conduct a few simple experiments. The visit was initiated by Michal Eisenberg, a PhD student in Prof. Maya Schuldiner's lab.

"Our purpose was to generate enthusiasm for science among the young patients, and to allow them to step away from the difficulty of their illnesses and the hospital routine for a moment," says Prof. Schuldiner. "We witness the kids' involvement and curiosity around science and it always moves us." She hopes the partnership with Kaplan will continue.

Prof. Amnon Zung, Head of Pediatrics at Kaplan, says that the partnership with Weizmann is welcome, and the experiments with Weizmann scientists offer a meaningful and stimulating experience for the patients. "We are happy to be the first hospital to have such



Prof. Maya Schuldiner' (at right) and her colleagues with pediatric patients at Kaplan Medical Center.

a partnership with the Weizmann Institute, and no doubt that the geographic proximity between our two institutions, focused on health and science in Rehovot, can lead to additional partnerships in the future."

In a particularly special moment, Prof. Zung met his daughter, MSc student Naama Zung, who was part of the Weizmann group, for a big hug and kiss.

New Scientists

18–19

Introducing Dr. Sagi Ben-Ami

Dr. Sagi Ben-Ami, an experimental astrophysicist, is developing advanced instruments and methods that will help detect “bio-signatures”—substances that provide scientific evidence of past or present life—on planets outside of our solar system.

A first clue may be that life as we know it requires oxygen to survive. Indeed, the existence of molecular oxygen, O_2 , is one of the strongest indicators of planetary life, and its detection would be a key step in finding a life-supporting biosphere similar that of the Earth. And though a new generation of extremely large telescopes (ELTs) will become a reality in the coming decade and greatly increase scientists' ability to find and characterize terrestrial planets, none of them will be able to detect oxygen.

So Dr. Ben-Ami set out to develop a spectrograph—an instrument used to measure properties of light—but whose ability to capture extremely high spectral resolutions will enable the detection of O_2 as well. Initially, this instrument will be used alongside today's telescopes, which, though not equipped to detect molecular oxygen, can help in the study of large-sized planet atmospheres. Later, when ELTs become available to the wider scientific community, his spectrograph archetype can be used in conjunction with one of these ground-based telescopes to detect O_2 .

Here comes the sun

Another major factor in a planet's capacity for bioactivity is the ultraviolet (UV) radiation field from its host star. Most of us think of UV radiation as something we need to shield ourselves from with sunscreen and hats. And while high levels of UV radiation can destroy emerging biomolecules, we wouldn't be here on Earth without it: UV radiation is an important factor in the development of prebiotic molecules—chemical or environmental precursors

of the origin of life—and may have been a key energy source in Earth's infancy. Until now, scientists have had limited tools for detecting the UV habitable zone, the area around a star that is optimal for the evolution of life based on its UV radiation.

Dr. Ben-Ami will be a part of the latest revolutionary project in space exploration: the Israel-U.S. spaceborne ULTRASAT mission, spearheaded by the Weizmann Institute's Prof. Eli Waxman. ULTRASAT represents a revolutionary step forward for the astrophysics community, because it is capable of detecting and measuring the UV emissions from transient explosions minutes after they occur—not the days or weeks captured by current telescopic systems. ULTRASAT is expected to generate a “discovery rate”—the rate at which celestial events are identified—that is 300 times greater than today's technologies, revolutionizing our understanding of a wide range of explosive transient events, like the explosions of stars and the disruption of stars by massive black holes.

A native of Tel Aviv, Dr. Sagi Ben-Ami earned his BA (2005) and MSc (2008) in physics from the Technion — Israel Institute of Technology and his PhD (2014) in physics from the Weizmann Institute of Science.

In 2014, he was awarded a NASA Einstein Fellowship and conducted his postdoctoral research at the Harvard-Smithsonian Center for Astrophysics. He returned to Israel with his wife, whom he met while at Harvard, and rejoined the Weizmann family in January 2020 in the Department of Particle Physics and Astrophysics.

FINDING EARTH 2.0

Sleuthing for the fingerprint of water

Introducing Dr. Yael Kiro, groundwater detective

Groundwater, seawater, ice, micro-droplets trapped in sediments, and evaporated minerals like Dead Sea salts can carry a chemical signature that can be unlocked and read with the sophisticated analytical tools being developed by scientists like Dr. Yael Kiro in the Department of Earth and Planetary Sciences.

Dr. Kiro is a geochemist who uses radioactive isotopes and chemical clues to read the environmental record preserved in groundwater, lake sediments, ice cores, and coastal aquifers.

As a PhD student at the Hebrew University of Jerusalem, Dr. Kiro focused her research on hydrology in the Dead

Reading rocks like a book

Geologists and geochemists like Dr. Kiro can read layers of sedimentary rock like a book that reveals hundreds of thousands of years of history. Using 1,500 feet of core samples from the bottom of the Dead Sea, Dr. Kiro co-led an international study that showed evidence of two “mega” droughts from this geological record: one that began approximately 120,000 years

ago, when average global temperatures rose about four degrees Fahrenheit, and another about 10,000 years ago, following the last ice age.

In a recent study, Dr. Kiro helped compare the trace chemicals in the tiny pockets of saline fluids found in core samples drilled in the deepest floor of the Dead Sea. This gives scientists new insights into the Dead Sea during the last interglacial and glacial periods and some clues about changes in rainfall patterns at that time which might be relevant for the changes in store to Israel in the near geological future.

The alarming rate of the Dead Sea’s shrinkage—about a meter per year—is a well-known and lamented phenomenon that is the result of water diversion projects, and industry pumping out the salty, profitable water for potash. It’s also the result

Sea, and went on to develop a new concept for using radioactive isotopes to estimate the age of groundwater systems and to track the circulation of water in aquifers deep underground.

Water is a precious commodity in the arid Middle East, and groundwater aquifers are a big part of Israel’s water equation. Dr. Kiro provides some of the tools needed to learn how much water is present in an aquifer, its salinity, and what kinds of minerals and pollutants are present. Being able to age and track samples of groundwater can provide data on how long an aquifer takes to circulate and recharge. This is vital information for politicians and planners as well as earth scientists.

מכון ויצמן למדע

About half of the world population lives in coastal regions and relies, in part, on groundwater from coastal aquifers. The interface between land and sea, and the interaction between groundwater and seawater, present a complex and interconnected system.

20–21

of declining rainfall. Israel has few reservoirs, and is now desalinating seawater for human consumption and agricultural use.

At the Weizmann Institute, Dr. Kiro has expanded her research to study the circulation of seawater and groundwater in aquifers beneath the coastline of Israel and the Mediterranean and is comparing that to other coasts around the world. One collaborative field project underway examines the coastal sediments and aquifers of the Delaware coast in the eastern United States, which present a very different profile than Israel’s.

University. Analyzing these samples will give a detailed picture of the area’s paleoclimate over tens of thousands of years.

She also worked with a team in Norway, looking for identifiable signatures to enable radium isotope fingerprinting of water unlocked by melting permafrost. Permafrost in circumpolar regions has recently undergone massive thawing, with severe environmental consequences, including the release of greenhouse

About half of the world population lives in coastal regions and relies, in part, on groundwater from coastal aquifers. The interface between land and sea, and the interaction between groundwater and seawater, present a complex and interconnected system. Understanding its dynamics is important for practical purposes such as water management, with many as-yet-unexplored questions for a geochemist.

The geologic record can also reveal past climate changes and provide information for environmental and climate models that are essential for future predictions.

Dr. Kiro spent much of the summer of 2019 along the Chilean coast in South America taking core samples from the ocean sediments with a team from Rutgers



Dr. Yael Kiro

gases and the possible amplification of global warming. The research team found an identifiable permafrost radioisotope fingerprint, and showed that it could be used to track the thawing of these long-trapped bodies of water.

Dr. Kiro received a long string of awards and recognitions as a student and in her postdoctoral years, including a three-month internship with the U.S. Geological Survey funded by the United States–Israel Binational Science Foundation (BSF) in 2009. She did her postdoctoral fellowship at the Lamont-Doherty Earth Observatory of Columbia University, and spent time there as an associate research scientist before joining the faculty of the Weizmann Institute in 2019.

מכון ויצמן למדע



A wise future for neuroscience

Weizmann's flagship initiative will make us smarter than ever about the human brain

Neuroscience is at a critical juncture, with breakthroughs coming at a rapid pace. In the last decade alone, new imaging techniques and tools that allow scientists to see, stimulate, and record brain activity have opened the door to previously unfeasible studies. An explosion of knowledge in genomics has spurred explorations of psychiatric and other brain disorders. Links between the brain and the immune system have led to new ways to think about diseases like Alzheimer's, and the brain has been shown to be far more malleable than we ever thought possible.

Yet many fundamental mysteries remain unsolved. How do consciousness and cognition emerge from the brain's complex neural networks? How does the brain respond to everyday experience, and to emotional stress and physical trauma? Why does brain function decline with age, and what are the circumstances underlying mental illness or neurodegeneration?

Paradoxically, these technological advances and bold questions come on the fleeing heels of big pharmaceutical companies, who have found the risk/reward ratio in

Cover Story

22–23

neuroscience to be too high bear, and the success rate of neurological medicines too low. Achieving the scientific momentum necessary to address the urgent need for solutions demands collaborative, multidisciplinary partnerships that combine

excellence in neurobiology with insights from chemistry, physics, linguistics, computer science, and engineering, among other fields.

To take advantage of recent developments and catapult

neuroscience research to a new level, the Weizmann Institute of Science is launching a \$200 million flagship project, the Institute for Brain and Neural Sciences. It will take shape through the construction of a state-of-the-art building that will serve as a hub for more than 40 internationally renowned groups actively investigating topics of relevance to brain research and neuroscience—including from physicists and computer scientists working beyond the archetypical borders of the life sciences. The building will also house a range of innovative technologies that will allow scientists to explore the brain in entirely new ways.

The Institute for Brain and Neural Sciences will comprise eight integrated research centers and an additional center for new technology development.

It is expected to generate a synergy that leverages the Weizmann Institute's permeable boundaries between departments, and its small size and informal culture that enable free-flowing interactions and collaborations. And, of course, its great science.

Snapshot of success

The results speak for themselves. The December 2019 issue of *Nature Neuroscience*—the highest-impact journal in the field—featured a record three articles from one institution, and that institution was the Weizmann Institute. In that issue, Prof. Alon Chen identified four distinct temperaments among mice—comparable to personality characteristics in humans—and linked them to specific genetic profiles, a major step towards enabling scientists to more deeply study mental health and illness in people. Prof. Rony Paz revealed how emotional learning and memory are represented in the brain by showing that temporal sequences across neurons in the amygdala serve as a coding mechanism. Prof. Ofer Yizhar used cutting-edge optogenetics to track the dynamics of how the brain encodes social sensory cues, with relevance to autism spectrum disorder.



מכון ויצמן למדע

מכון ויצמן למדע



Last October, Prof. Rafael Malach and Prof. Michal Irani caught the interest of the cognitive and systems neuroscience communities with a brain imaging study that revealed the importance of facial geometry in how we perceive human faces. Earlier in the year, Prof. Malach uncovered a neuronal mechanism central to human free recall—rapid ripples of activity across the brain's hippocampus. The study appeared in *Science*.

The accomplishments go on. Prof. Michal Schwartz pioneered the theory of 'protective autoimmunity,' which attributes a revolutionary role to the immune system in supporting cognitive function, mental stability, stem cell renewal and repair, and in combating neurodegenerative diseases such as Alzheimer's. Meanwhile, Prof. Nachum Ulanovsky and Dr. Yaniv Ziv made key findings on navigational 'place cells' in the brain that have important implications for understanding Alzheimer's disease and dementia. The initial discovery of these cells garnered the 2014 Nobel Prize in Physiology or Medicine.

Prof. Shimon Ullman, a 2015 Israel Prize laureate, is working to narrow the gap between the visual recognition abilities of humans and the artificial intelligence systems they build. And Prof. Noam Sobel used the Weizmann Institute's powerful 7-Tesla magnetic resonance imaging system to show that olfaction is possible even in the absence of an olfactory bulb.

Accelerating multidisciplinary research

The Institute for Brain and Neural Sciences will accelerate multidisciplinary research by gathering the diverse neuroscience knowledge, expertise, and infrastructure at the Weizmann Institute into a greater, collaborative, and integrated whole—creating a unique environment of physical proximity that promotes robust synergistic energy and catalyzes discovery for the benefit of humanity.

Scientists at the Weizmann Institute of Science has contributed to over 500 articles of relevance to neuroscience in the last five years alone, and several of those papers have already been cited hundreds of times. From base pairs to bedside, from the emerging field of artificial intelligence, to technological advances in disease modeling and illuminating the neural landscape, neuroscience stands at a precipice. With the establishment of the Institute for Brain and Neural Sciences, Weizmann is ready to soar.

מכון ויצמן למדע

Centers of Investigation

The Development of Neural Networks

The adult brain is a complex network of roughly 100 trillion connections among billions of neurons. Proper functioning of this network demands an efficient wiring of circuits, optimized yet flexible enough to handle the uncertainties of daily living.

Q How does the brain, with all of its complex neural networks, develop? What happens when the process goes awry?

A Scientists will aim to reveal how the diversity of specific types of neurons emerge during development, how neurons migrate to their correct locations, and how neurons' extensions are guided over long distances to find their targets. Topics will include understanding the formation of neural connections (synapses), remodeling of synapses and circuits, development of sex differences in neural networks, the role of neural support cells, as well as neuronal metabolism.

This research will lead to a better understanding of the pathology underlying a variety of diseases and disorders from epilepsy and fragile X syndrome, to a range of mental illnesses.

Perception and Action

Humans have an insatiable appetite for sensory input—whether conscious or unconscious. Sensory perception provides the immediate ingestion of information, driving our behaviors as we seek out the new.

Q How do we sense, and how does the brain combine input from different sensory modalities to form a coherent picture?

A Weizmann scientists are exploring a variety of forms of sensory processing to clarify how sensory input translates into action. They are also working to unveil the process of motor action—from the decision to take an action in higher brain areas, to the execution of a movement via commands transmitted to the spinal cord, followed by muscle activation.

This research will improve our understanding of sensory disorders and motor diseases, and contribute to efforts to develop sensory substitution techniques, alleviate chronic pain, and develop artificial sensing technologies, such as robotic arms and brain-machine interfaces.

Mental and Emotional Health

More than 7 percent of global life expectancy years lost to illness, disability, or premature death are caused by mental illnesses, including depression, anxiety, schizophrenia, and bipolar disorder, among other debilitating conditions.

Q What prompts mental illness, what promotes resilience, and how can we manipulate these processes?

A Scientists in this center will employ integrated molecular, biochemical, genetic, and behavioral methods in state-of-the-art preclinical models to investigate neural pathways. Others will use

מכון ויצמן למדע



psychophysics techniques and brain imaging technology in humans and electrophysiology in animal models to unveil emotion-related networks at the level of individual brain cells and understand how these networks malfunction in mental illness.

Insights expected to emerge from this center will bolster mental resilience, prevent mental illness, and inform the design of new targets for brain-based treatment when illness does occur.



Prof. Rony Paz, Head of the Department of Neurobiology

Learning, Memory, and Cognition

The hallmark of human evolution is sophisticated cognitive function.

Q How do our brain make us who we are—and how can we ‘fix’ the brain when this activity falters?

A Scientists will seek answers to these questions and their relevance to cognitive impairments, dementia, amnesia, learning disabilities, and mental illness.

The human brain makes complex computations that far outstrip the capacity of any modern machine. The process of working memory, the impact of attention, and the consolidation and storage of some

memories while others are suppressed or erased are all part of this complexity. Add to that optimal decision-making (encompassed in the emerging field of neuroeconomics). Additionally, addressing these issues and more requires an integrated study of brain activity that combines insights from neuroscience, and computer scientists will also pave the way towards advanced machine learning and ‘smart’ technologies that are at the heart of artificial intelligence.

The Aging Brain

As science and medical technology continue to expand the human lifespan, societies and individuals must face the inevitable consequences: the physical and mental deterioration of healthy aging, not to mention the increasing prevalence of age-related neurodegenerative diseases.

Q How does the brain transform in the aging process? Can this process be halted or reversed?

A Through extensive collaboration across fields and disciplines, Weizmann scientists will advance our understanding of what drives the aging process and the physiological results of brain aging—in health and disease—and are expected to yield potential

treatments for aging-related disorders. This center will work in collaboration with the Sagol Institute for Longevity Research, which investigates brain and body biology related to aging and longevity.

Neurodegeneration

Alzheimer’s disease, Parkinson’s disease, amyotrophic lateral sclerosis, multiple sclerosis, and Huntington’s disease are all characterized by inexorable loss of cognition and memory, changes in behavior, and an inability to control bodily functions. Research to prevent and repair neurodegeneration is a priority for science and for medicine.

Q What are the causes and trajectories of neurodegenerative diseases? How can they be prevented and cured?

A Finding solutions to the challenges of neurodegeneration will lie at the heart of research conducted in this center, which will serve as a

platform for the discovery of basic mechanisms of brain integrity, their failure in neurodegeneration and the potential means of amelioration. Research will leverage the developmental, sensorimotor, memory, and aging advances of its sister centers, and return key insights into the molecular, cellular, genetic, and systems-level mechanisms fundamental to how the nervous system functions.

Injury and Regeneration

Unlike the expansive growth and adaptation of neurons in early development, central nervous system neurons undergo little or no regeneration following injuries, such as those to the spinal cord, that occur during adulthood. This failure of resilience has been attributed to a combination of inhibitory extrinsic factors—such as traumatic injury—as well as the loss of intrinsic growth ability.

Q What happens to the nervous system when it is injured? How can we repair damage to the brain and spinal cord?

A Scientists will work to understand the role of these intrinsic and extrinsic factors, which may shed light on how to convince damaged neurons to regenerate. Research will address such fundamental questions as the response to injury and the growth potential of damaged neural tissue. Researchers will also draw insights from organisms such as fish and amphibians, who regenerate neurons with far greater efficiency than mammals do.

Theoretical and Computational Neuroscience

Theoretical and computational neuroscientists ask questions about the principles that underlie the design of neural circuits, neural coding, and information processing in the brain—and the resulting impact on behavior. Their research aims to reveal how neural circuits form, how they function,

and how they learn, and how they might be corrected when damaged—or even improved.

Q What is the ‘language’—the neural code—used by the hundreds of billions of neurons in the brain? How does this language enable the brain to perform the sophisticated computations that make us human?

A Researchers in this center will employ mathematical tools taken from statistical physics, dynamic systems, machine learning, and information theory to create new models and theories of brain function, and engage in intense collaborations with experimental laboratories. The resulting computational tools for analyzing ‘Big Data’ will open up new experimental frontiers, while theoretical models for understanding the design and function of neural circuits will inform both pathology and drug design. Ultimately, it will reveal the ways in which ‘bugs’ in the neural code underlie neurological disease.

Development of Innovative Technologies

Weizmann scientists have an extensive history of developing groundbreaking technologies that have been implemented throughout the international neuroscience community. **This center will leverage that expertise as a hub for the development of new technologies and techniques that are necessary to accelerate the pace of discovery across all the centers in the Institute for Brain and Neural Sciences.**

The creation of such technologies require close collaboration among biologists, physicists, chemists, engineers, and computer scientists. These experts will work together to identify specific problems, brainstorm solutions, and then design and build these solutions.

Steering a sea change for cancer patients

Rising Tide Foundation's quest to advance cancer research and care



L to R: Rising Tide Foundation CEO Wendelin Zellmayer and Founder Shawn Stephenson

When Shawn Stephenson's grandmother, Mary Brown Stephenson, died of cancer in 1982, it was a devastating turn of events for his family—both because of her loss, of course, and also because she was denied existing treatment that could have saved her life, according to Mr. Stephenson. Her own doctors in Arizona turned down her requests to be treated by a Boston physician who, the family was convinced, would have treated and possibly cured her particular form of lung cancer.

מכון ויצמן למדע

Spotlight On

28–29

Then in his teens, Mr. Stephenson was deeply affected by her death, and the entire family turned their collective efforts to helping patients with cancer access the solutions they need and want. The Stephensons went on to establish treatment centers and funding mechanisms for clinical trials across the United States. Intent on canvassing the globe for promising research and care solutions for patients, Shawn Stephenson went on to launch Rising Tide Foundation, which funds cancer research with translational promise—studies whose outcomes are likely to result in treatments for patients.

Five years ago, Rising Tide made a visionary gift to the Weizmann Institute that has funded a large range of initiatives related to cancer research: from competitive grants to start-up packages for young cancer investigators, to scholarships and fellowships for students and postdoctoral researchers. The funding has helped advance Weizmann investigations into new diagnostic methods, more personalized drugs, novel immunotherapies, and more. The partnership is now entering a second stage of generous funding, over a four-year timeline.

"It is a partnership that fits like hand in glove—a mutual interest in advancing research with an eye for improving patient outcomes," says Mr. Stephenson. "From the beginning, Weizmann has been committed to its focus in understanding how cancer works and how it might be cured or better treated, and with our focus on improving outcomes for the patient and saving lives, this has become a remarkable relationship."

Moreover, he says, the partnership could serve as a successful role model for others interested in funding basic research with a goal toward translational research—a bench-to-bedside pipeline in which discoveries can be translated into drugs and treatments. "In stage two, we hope others will join us on this journey to broaden and deepen this incredible research," he says.

מכון ויצמן למדע



Shawn Stephenson: inspired to tackle cancer since his teens

Three decades of care and discovery

After Mary Brown Stephenson's passing, the family established a chain of privately funded, for-profit treatment centers called Cancer Treatment Centers of America, in 1988. Several years later, they started Gateway for Cancer Research, a nonprofit that funds clinical trials in cancer. Both entities, with their respective agendas of care and clinical research, are focused on the same goal: to offer patients more and better options for treatment and cures.

Then, in 2006, with an eye toward identifying research investigations outside the US, Shawn Stephenson co-founded Rising Tide, with headquarters in Schaffhausen, Switzerland. In addition to Weizmann, it has funded

the American Society of Clinical Oncology, through an innovative program that funds mentoring partnerships between veteran and young scientists in the US and Europe. It also supports the Leukemia & Lymphoma Society, a US-based nonprofit; the Anticancer Fund, a Belgian nonprofit, which supports clinical trials for cancer therapies with a special focus on rare cancers and orphan drugs to treat them; and pediatric cancer research at Cambridge University and Stanford University.

The multiplier effect

The relationship with the Weizmann Institute began in 2014 with a visionary multi-million dollar gift to support cancer research. Wendelin Zellmayer, Rising Tide's CEO, says the foundation's board chose a series of research avenues at Weizmann that held major promise for eventually translating into therapies that would reach the bedside in a

relatively short span of time. A half-decade later, these investigations—which have been supported by Rising Tide and other donors—have indeed broken new ground in areas of major promise.

Accelerated and expanded with this funding, these investigations have also since attracted grants from the European Research Council and the Israel Science Foundation. "Weizmann's great scientists are doing excellent basic research, which is leading to real application that will help patients," says Zellmayer. "We see how our funds have created a multiplier effect, such that not only has the research been expedited, but also the projects we have supported have led to external grants from major funding agencies, and from other donors."

Inspired by success, Rising Tide determined earlier this year to enter a new stage of funding for Weizmann science. The focus of the next round will be support for studies in cancer prevention

Cancer in focus

A sampling of groundbreaking Weizmann projects supported by Rising Tide

Testing tumor sensitivity to drugs: Dr. Ravid Straussman and Dr. Nancy Gavert from his team in the Department of Molecular Cell Biology developed a method to grow in the lab freshly removed sections of human tumors and test their sensitivity to a large panel of drugs, called ex-vivo organ culture (EVOC). The EVOC method allows for a rapid determination of a tumor's susceptibility to various drugs over a course of up to seven days. This method offers a major advantage over existing drug-testing methods because it tests the sensitivity of tumor cells to drugs within its so-called microenvironment—the non-cancerous cells that surround and support the cancer cells—which offers a more accurate model of how the tumor would respond to treatment in the patient's body.



Dr. Ravid Straussman

Dr. Straussman and his lab established Curesponse, a start-up company based on the EVOC technology, which is now in multi-center clinical trials for various cancers.

The urea cycle as a guidepost for cancer treatment: Dr. Ayelet Erez, of the Department of Biological Regulation, is a clinical and research geneticist who specializes in inherited metabolic pediatric syndromes for understanding metabolic irregularities in complex disorders such as cancer to find better ways to diagnose as well as improve response to therapy. She and her lab members found that the urea cycle—a metabolic pathway that converts physiological waste so it can be excreted as urine—is disrupted in various cancers to enable

"We want to empower patients by being able to offer them more options... This is why we invest in translational cancer research," says Sharon Stephenson.

30–31

and detection and towards improving patient outcomes. The foundation is also keen on boosting the "multiplier effect" referred to by Mr. Zellmayer, by inspiring other philanthropists and agencies to support the same projects—and thereby help move them forward at an even more rapid pace. While the first funding stage was successful, the next stage "could have an even greater impact," says Zellmayer.

Mr. Stephenson's reasoning for supporting translational cancer research always goes back to

the patient, and what he calls "the 'Mother Standard of Care' (a trademarked phrase) that is the hallmark of their operations in the US and Europe. "We want to be able to offer cancer patients everything we'd want to be able to offer our own mothers if they were sick... We want to empower patients by being able to offer them more options—to enlarge the number of choices they have. This is why we invest in translational cancer research. We are very pleased with our relationship with Weizmann and we are looking forward to intensifying it."

recycling of these metabolites. More specifically, they determined that urea cycle enzymes and related changes in metabolites can potentially serve as biomarkers for early detection of cancer, and may be used to determine whether individual patients will respond well to cancer immunotherapy.

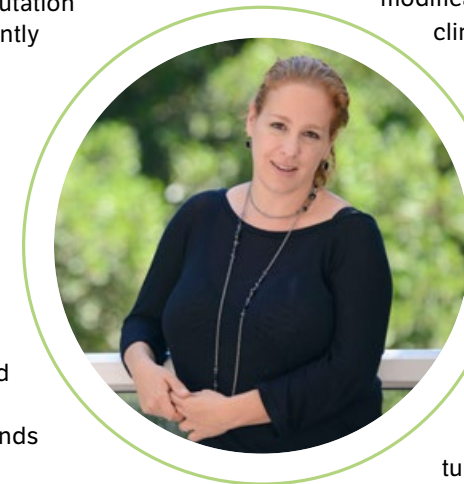
Drugs targeting a cancer-causing genetic mutation: Dr. Nir London's lab in the Department of Organic Chemistry designs cancer drugs that target specific mutations in tumor cells in a personalized manner. One focus is a specific mutation in the p53 gene—the most frequently mutated gene in cancer—called R273C, which leads to the development of tumors.

Dr. London's group identified the first-ever molecules that can strongly and specifically bind to p53 harboring this mutation, and are working to translate this binding to cause regression of the tumor. Such compounds could serve as drug candidates in the future, for the hundreds of thousands of patients with this mutation.

Proteins that drive and inhibit cancer: Dr. Yifat Merbl in the Department of

Immunology focuses on the regulation of proteins in cancer and immunity. Maintaining protein homeostasis involves an extensive protein network of more than 1,000 proteins that are responsible for sensing and responding to cellular stress, to allow proper function. Her lab investigates both how proteins are regulated and modified—so-called post-translational modifications—and how they are degraded in health and disease. The lab has developed novel technologies to profile the protein modification and degradation landscape in clinical samples.

Among other findings, Dr. Merbl has found a particular modifying protein called FAT10 that regulates the infiltration of tumors into the immune system's T cells; inhibiting this protein could potentially refine immunotherapy techniques. She is investigating this and other "control mechanisms" that proteins undergo in the cell, which may affect tumor progression and the response to therapy.



Dr. Yifat Merbl

Prof. Michael and Sara Sela celebrated at opening event



Video: A tribute to Prof. Michael Sela

L to R: Prof. Michael Sela, Sara Sela, Prof. Daniel Zajfman cutting the ribbon at the new Michael Sela Auditorium

מכון ויצמן למדע

The Opening Event of the 71st Annual General Meeting of the International Board in November 2019 marked the opening of the Michael Sela Auditorium and celebrated Prof. Michael and Sara Sela, pillars of the Weizmann community. It also marked the start of the last Board event in Prof. Daniel Zajfman's 13-year term as President. More than 500 people were in attendance.

Prof. Sela's scientific advancements in immunology have led to breakthrough drugs including Copaxone for the treatment of multiple sclerosis, and a series of cancer drugs. He is also past President of the Weizmann Institute. They gave a visionary gift to renovate the former Michael and Anna Wix Auditorium, with the generous consent of the Wix family of the UK. The new state-of-the-art Michael Sela Auditorium will be a hub for scientific meetings, Board meetings, and cultural events on campus.

"I owe much more to the Institute than anything I did for the Institute. I owe my life to the Institute," said Prof. Sela. "I thank Daniel Zajfman for everything he has done for the Institute," he added, and

he deeply thanked Sara for her work on the auditorium refurbishment.

The Board events were compressed by missile fire from Gaza, which shut down the Institute for a full day. Nevertheless, a long series of donors were honored for their contributions and friendship, and Prof. Zajfman's leadership, and that of his leadership team, was highlighted throughout the week of events. Incoming President Prof. Alon Chen, who began his term on December 1, gave an inaugural speech at the Open Session of the Board, in which he discussed his vision for the future.

The event included a performance by the Young Israel Philharmonic Orchestra.

André Deloro Prize to Prof. Eli Zeldov



The André Deloro Prize for Scientific Research was awarded to Prof. Eli Zeldov of the Department of Condensed Matter Physics at a session of the International Board on November 13.

Rebecca Boukhris, who presented the award, is a Trustee of the Adelis Foundation, founded by the late philanthropist André Deloro. The prize is awarded annually to an outstanding scientist whose research holds particular promise for deepening the understanding of science.

L to R: Prof. Daniel Zajfman, Rebecca Boukhris, and Prof. Eli Zeldov

Honoring excellence

Weizmann Institute bestowed eight honorary degrees in 2019

The Weizmann Institute of Science bestowed honorary doctorates on eight distinguished individuals whose contributions to society have had a tangible and celebrated impact. The degrees of PhD *honoris causa* were conferred at a festive ceremony on November 12 during the 71st Annual General Meeting of the International Board.



Back row, L to R: Prof. Raphael Mechoulam, Prof. Daniel Zajfman, Prof. Martha C. Nussbaum, Shimshon Harel, Prof. Jehuda Reinharz, Larry Blumberg.

Front row, L to R: Rebecca Boukhris, Alex Levac, Mario Fleck, Prof. Jonathan Dorfan, Mr. Robert J. Drake, Prof. Daniella Goldfarb. Seated: Rabbi Adin Steinsaltz

The Weizmann Institute's 2019 PhD laureates:

President Reuven (Ruvi) Rivlin, 10th President of the State of Israel. President Rivlin has devoted his life to connecting people around the world to the beauty and sanctity of Jerusalem. His rich career in public service includes seven terms in the Knesset, Israel's Parliament, two terms as Knesset Speaker, and two terms as Minister of Communication. President Rivlin has come to symbolize deep and respectful communication, something that has earned him the love and respect of the Israeli people.

Mrs. Rebecca Boukhris, Trustee of the Adelis Foundation. An accomplished international banker, Mrs. Boukhris has successfully advanced the mission of the Foundation's founder, the late André Deloro: to support the State of Israel and the Jewish people. Supporting social and educational initiatives, the Adelis Foundation also provides critical funding for the Weizmann Institute's programs in physics, chemistry, and the study of disease.

מכון ויצמן למדע

Prof. Jonathan Dorfan, a particle physicist and the former President of Okinawa Institute of Science and Technology Graduate University in Japan. Prof. Dorfan led the design and construction of the B-factory accelerator complex and coordinated other projects at SLAC—the Stanford Linear Accelerator Center that enabled experiments leading to the 2008 Nobel Prize. A member of the Weizmann Institute's International Board, and longtime co-chair of its Scientific and Academic Advisory Committee, Prof. Dorfan's career achievements and institutional impact have made him a treasured leader of the world scientific community.

Mr. Mario Fleck, South American business leader and philanthropist who founded the Brazilian Friends of the Weizmann Institute of Science and serves as its President. Under Fleck's charismatic leadership, the Brazilian Friends became a community dedicated to supporting cancer research—a goal significantly advanced with the inauguration of the Weizmann-Brazil Tumor Bank, an on-campus facility providing critical resources for scientists seeking to advance studies related to cancer prevention, diagnosis, treatment, and cure.

Mr. Alex Levac, a photojournalist, is a 2005 Israel Prize laureate. Mr. Levac elevates the human condition by framing everyday scenes with humor and compassion. The self-declared "paparazzi of the anonymous," he has created riveting images that document the joys and struggles of people around the world, and give a lasting visual expression to one of history's most astounding accomplishments: the re-establishment of the Jewish people as a free nation in their ancient homeland.

Prof. Raphael Mechoulam, pioneering research scientist who discovered THC—the psychoactive ingredient of the cannabis plant—and the neural circuits that process THC in the brain. A Weizmann scientist who earned his PhD at the Institute, Prof. Mechoulam's high-impact findings were of foundational significance for today's growing medical cannabis industry, and continue to drive important advances in the field of drug design.

Prof. Martha C. Nussbaum is a philosopher at the University of Chicago whose research encompasses law, divinity, classics, ethics, and cognitive neuroscience. Prof. Nussbaum is one of the founders of the Capabilities Approach—an acclaimed theoretical model designed to point out what people need to have in order to live a good and successful life. By championing the place of emotion in the establishment and understanding of human values, her work helps us understand divisions in society, and offers new strategies for overcoming them.

Rabbi Adin Steinsaltz is the first person since the medieval sage Rashi to have completed a full translation of and commentary on the Babylonian Talmud, and of the Bible, into modern Hebrew, as well as English, French, Russian, and Spanish. Internationally regarded as one of the greatest rabbis of this century and of the last, Rabbi Steinsaltz—whose academic background includes university training in mathematics, physics, and chemistry—is an educator who founded schools, and, through his own teaching, continues to promote spiritual advancement for every human being through the removal of obstacles to Jewish learning.

TVML Foundation lauded for Weizmann-MIT Collaboration Fund

The Weizmann Institute celebrated a visionary gift by Marcos and Vivian Lederman of Brazil to establish the TVML Foundation MIT-Weizmann Collaboration Fund, which supports joint research projects in computer sciences. The first beneficiary of the fund is Prof. Guy Rothblum of the Department of Computer Science and Applied Mathematics, who is working with MIT colleagues on advancing encryption for improved data privacy.



מכון ויצמן למדע

Leading with science

President Reuven Rivlin accepts honorary PhD

The Weizmann Institute of Science bestowed an honorary doctorate on Israeli President Reuven Rivlin, one of eight individuals to receive the PhD honoris causa in a festive ceremony on November 12, during the 71st Annual General Meeting of the International Board. An excerpt from President Rivlin's keynote speech is below.



President Reuven (Ruvi) Rivlin at conferment ceremony of honorary doctorates

מכון ויצמן למדע

“*In the third of April 1934, a festive ceremony took place to inaugurate the Sieff Research Institute.*

In honor of the celebration, (as they reported it in the newspaper at the time), the British flag and the Hebrew flag flew above the building.

Just imagine!

Fourteen years before the establishment of the State of Israel, at the time of the British Mandate, the leaders of the Jewish settlement—which at the time numbered about 300,000 men, women and children—succeeded in founding an institute for scientific research, the third in line after the Technion in Haifa, and the Hebrew University of Jerusalem. Among those who attended the ceremony was Professor Richard Martin Willstätter.

In 1915, this Jewish-German chemist was awarded the Nobel Prize for Chemistry. In 1924, he retired from his work at the academy in Munich because of the anti-Semitism of some members of the faculty. In 1938, he escaped from the Nazi threat to Switzerland, where he died in 1942.

But for one moment in time, between retiring due to anti-Semitism and his escape to Switzerland, at the height of the darkness that had overcome Europe, he stood here and very precisely defined the mission of the new Institute. And I quote: “In my vision, I see above the gates of the Institute, neither in bronze nor in writing, yet nevertheless clearly, these three inscriptions: ‘Work for the development of science! Work for the prosperity of the Land of Israel! Work for the benefit of humanity!’”

This is what he wrote.

Dr. Chaim Weizmann, the scientist, the statesman, and the President, pushed for the establishment of the Sieff Institute because he believed that “Torah shall go forth from Zion” with science, with research, with

מכון ויצמן למדע

invention, with creativity, with innovation and with enterprise. Eight-five years later, one can say with confidence that the Weizmann Institute has realized not only Chaim Weizmann's vision, but also the vision of Professor Willstätter.

And not just the Weizmann Institute.

Our little ‘start-up nation’ is acclaimed in many parts of the world; our academia is considered to be a beacon of knowledge, both theoretical and practical. Our entrepreneurial thinking, our scientific inventions, the technology that is developed here—all of these have become a focal point for pilgrimage.

I meet many leaders from all over the world who want to learn from us and collaborate with us for the development of science, for the benefit of all mankind. And this is a significant part of the prosperity of Israel—of the Land of Israel and the State of Israel.

Distinguished guests—science, as we are taught in school, is something that is very accurate, linear, clear, understandable, distinct. Sequential. Cause and effect. But whoever is accepted into the world of science for his or her higher education—whether it is in biology or chemistry, physics or mathematics, biochemistry, or even computer science—is aware of the fact that science is not just a linear process.

The most complex discoveries, the most surprising, the most amazing, have resulted from a breaking down an accepted concept, from breaking through the standard thought process, which we think of as being a measured pace, step by step.

Video: President Reuven Rivlin on Weizmann and Israeli science

The leaders of the Jewish community in the Land of Israel established educational institutions for the children of the settlement long before there was a country here. They did so with the same attention and concern with which they invested in the livelihood of the inhabitants and the pioneers of the Aliya.

They invested in building the infrastructure of higher education, culture and research, with the same concern they had when establishing communities, developing dairy farms, and planting agricultural crops. They understood that basic needs are also dependent on fulfilling spiritual needs. They realized that a nation is not built along one linear line, but in parallel.

And it is precisely here the Weizmann Institute which for many years has been known as—and rightly so—“The MIT of the Middle East,” that I want to remind us all that the economic future, as well as the social strength and security, of the State of Israel, lies in its capacity to realize its scientific and technological potential. That investment in higher education, in science and research, is an essential component of building the national home in Israel, the construction of which is not yet complete.

And meanwhile, the State of Israel must promote and nurture the humanities, which are—and which Professor Nussbaum, who

wrote a book about it, will testify—a necessary and irreplaceable piece of the infrastructure for every culture, for every country, for the social strength and vitality of every society.

The spiritual treasures of the Jewish people—and Rabbi Steinsaltz will undoubtedly explain this better than I—are the wind beneath our wings. It is thanks to them that we have been able to maintain an unbroken dynasty of generations. Without them we would not have survived for thousands of years as a people without a home. Without them, we would not have been able to establish a state, and turn it into the prosperous country that it is.

“If there is no flour, there is no Torah. And if there is no Torah there is no flour.”

Without literature, the Bible, and history, no matter how many study units of mathematics and science are taught in schools, this will not be the worthy society that our Zionist fathers and mothers dreamed of establishing.

This will not be the worthy society that we want to bequeath to our children.

I thank you for the honor you have bestowed on me, both for the title itself, and for receiving this alongside such wonderful men and women.

God bless you all. ”



Honoring Dita and Yehuda Bronicki

At the 71st Annual General Meeting of the International Board, the Weizmann Institute of Science celebrated the friendship and generosity of Dita and Yehuda Bronicki of Israel who gave given to a large range of scientific and educational projects at the Institute, including the Davidson Institute of Science Education, the research of Prof. Nahum Ulanovsky in the Department of Neurobiology, as well as nanoscience, energy research, and experimental physics.

L to R: Prof. Daniel Zajfman, Dita Bronicki and Yehuda Bronicki

מכון ויצמן למדע

Laying the cornerstone of the David Lopatie Institute of Comparative Medicine

A cornerstone-laying ceremony took place on the site of the future David Lopatie Institute of Comparative Medicine during the Annual General Meeting of the International Board, in the presence of Mr. David Lopatie. The event took place on November 13.

Mr. Lopatie, of Johannesburg, South Africa, has given generously to establish several buildings on campus, namely the David Lopatie International Conference Centre and the David Lopatie Hall for Graduate Studies, housing the Feinberg Graduate School.

The new Lopatie Institute of Comparative Medicine will advance the study of disease through the use of animal models and advanced technologies.

Comparative animal studies allow scientists to control temperature, humidity, light, diet, and other factors that might affect the outcome of the experiments. These rigorous controls provide greater certainty about experimental results. Moreover, the natural course of a disease in humans may take dozens of years. In contrast, a model organism can quickly develop a disease or some of its symptoms. Researchers can thereby learn about the disease much faster.

As such the David Lopatie Institute for Comparative Medicine will serve life scientists throughout the Weizmann Institute.

“You are truly my extended family,” Mr. Lopatie said to the guests at the ceremony. He thanked the Weizmann construction team and his own colleagues and friends from South Africa. He deeply thanked Prof. Daniel and Joëlle Zajfman.



Mr. David Lopatie at the ceremony



L to R: Prof. Daniel Zajfman, Mr. David Lopatie and Prof. Alon Chen

מכון ויצמן למדע



L to R: Dame Vivien Duffield and Dr. Rita Schmidt

A festive luncheon to celebrate the Clore Garden and Clore Prize

The annual Clore Luncheon was held on November 11. This year, the event honored Dame Vivien Duffield and the Clore Israel Foundation for their support for the renewal and expansion of the Clore Garden of Science. Dame Vivien Duffield also conferred the Sir Charles Clore Prize on a new, outstanding scientist, Dr. Rita Schmidt from the Department of Neurobiology, an expert in brain imaging whose work has implications for a range of avenues of neuroscience research.

Dana Weiss, Chief Political Analyst of Israel's Channel 12 News, gave the keynote address, discussing the deadlock in the formation of the Knesset and key issues in Israeli politics and society.

מכון ויצמן למדע

Opening the doors of the Moross Integrated Cancer Center

The Moross Integrated Cancer Center was inaugurated in its new home, the Ullmann Building for Life Sciences, in the presence of philanthropic supporters of its key research pillars. The event took place on November 13.



The ribbon-cutting ceremony for the Moross Integrated Cancer Center

Mandy Moross was honored the previous day for his establishment of the flagship project, and the following donors were honored at the November 13 ceremony:

Eric Stupp representing the Swiss Society for the Weizmann Institute of Science, founders of the Swiss Society Institute for Cancer Prevention Research.

Bob and Renée Drake, founders of the EKARD Institute for Cancer Diagnosis Research.

Julian Dwek and members of the Dwek family, founders of the Dwek Institute for Cancer Therapy Research.

Michael de Picciotto, founder of the de Picciotto Cancer Cell Observatory in Memory of Wolfgang and Ruth Lesser.

Mario Fleck, President of the Brazilian Friends of the Weizmann Institute, founders of the Weizmann-Brazil Tumor Bank.

David Teplow, National Chair of the American Committee, representing the Kleinman Cancer Cell-Sorting Facility.

The Moross Integrated Cancer Center works to unravel the complexity of cancer by harnessing the power of basic research to facilitate translation into the clinical arena in the quest for cancer prevention, early diagnosis, and ultimately, a cure.

מכון ויצמן למדע

Partners in science

Milvia Perinot, Ilana and Pascal Mantoux, Eden and Steve Romick

A series of dedications honored supporters for major new gifts in the areas of imaging and genomics, stem cell science, and immunology.

I could support cancer research in this important way. I was just as delighted to be able to add to the gift earlier this year, so that the Kreter Institute can make even greater progress in imaging and cancer," she said.

Ilana and I get a more intimate feeling about science." Ilana spoke eloquently about how non-Jewish Israelis play an integral role in the future of science in Israel, citing Yaqub as an example. "We are proud of the honor that he brings to Israel and to the Weizmann Institute," she said.



L to R: Prof. Daniel Zajfman, Steve Romick, and Prof. Ido Amit.



Milvia Perinot

Milvia Perinot of Switzerland and Israel was celebrated for her new gift to support the expansion of the Henry Chanoch Kreter Institute for Biomedical Imaging and Genomics, headed by Prof. Michal Neeman. "When the Henry Chanoch Kreter Institute for Biomedical Imaging and Genomics was established in 2012, I was delighted that

Ilana and Pascal Mantoux were honored for a new visionary gift to support the research of Prof. Yaqub Hanna of the Department of Molecular Genetics. "While we have supported other areas within Weizmann, our support of Yaqub has become a long-term partnership... it has allowed us to develop a personal relationship which we have sustained to this day. We are honored and proud of our friendship with Yaqub," said Pascal. "Every time we visit Yaqub's lab,



L to R: Ilana and Pascal Mantoux, Prof. Yaqub Hanna

Eden and Steven Romick of California were celebrated for supporting the professorial chair Prof. Ido Amit from the Department of Immunology. "My wife and I are so happy to support Ido and his world-leading work in immunology," Steve said.

מכון ויצמן למדע

Sherman Institute inaugurated

An evening event marking the establishment of the Dr. Barry Sherman Institute for Medicinal Chemistry celebrated the visionary gift of the Sherman family of Toronto to advance research on drug discovery. The new Sherman Institute is headed by Prof. Sarel Fleishman of the Department of Biomolecular Sciences.



L to R: Prof. Daniel Zajfman, Alexandra Sherman Krawczyk, Jeff Cohen, Susan Stern

The new Sherman Institute funds multi-disciplinary collaborations and holds monthly seminars that attract researchers from all over the world.

The event took place at Kibbutz Ga'ash on November 11. Among the speakers were Weizmann President Prof. Daniel Zajfman; Prof. Fleishman; and the daughter of the late Barry and Honey Sherman, Alexandra Sherman Krawczyk.

Video: The Dr. Barry Sherman Institute for Medicinal Chemistry

מכון ויצמן למדע

Video: Core Facilities tour



The strength of core facilities

The Core Strength Luncheon was an opportunity to celebrate donors who gave to core facilities at the Weizmann Institute.

Those honored were:

- ▶ Dr. Mark Alexander, for establishing the Norman E. Alexander Family M Foundation Wing in the André Deloro Building for Advanced and Intelligent Materials.
- ▶ Laurent and Nathalie Amar and Canadian friends for their support for the Quantum Foundry in the Center for Advanced and Intelligent Materials.
- ▶ Kenneth Cooper, representing the M. Judith Ruth Foundation, for establishing the M. Judith Ruth Institute for Preclinical Brain Research.

Closing Gala celebrates Beck family and Weizmann Institute management



The Closing Gala of the International Board was an opportunity to pay tribute to the Beck family of Toronto, longtime supporters of the Institute; celebrate the Institute's 70th anniversary; and bid a fond farewell to Weizmann management after a 13-year term.

מכון ויצמן למדע

The gift from the Beck family represents a major testamentary gift from the late Tom and Mary Beck. Their children—Cathy, Liddy, and Anthony Beck—and their families were in attendance.

Tom and Mary Beck were enthusiastic and devoted lay leaders in Canada, helping establish Weizmann Canada in the late 1960s, 70s and 80s by hosting events and leading by example—giving generously to the Institute over many years, and then passing the torch to the next generation. Cathy Beck went on to actively lead the Canadian committee, serving as chair for six years, from 2010 to 2016, and is still deeply involved today. She is a member of the Institute's Executive Board. Under her leadership, the community of Canadian friends of the Institute enlarged exponentially, and philanthropic support in parallel, mirroring—and even surpassing—the surge of activity during her father's leadership a generation before.

Tom Beck passed away in 2016, and Mary in 2018. The testamentary gift was open-ended, allowing the Institute to determine the most appropriate beneficiary area. Together with Weizmann leadership and in a nod to the family's historic devotion to alternative energy research, the Beck siblings chose to allocate it to the Center for Advanced and Intelligent Materials (C-AIM), and, within it, the Tom and Mary Beck Institute for Materials for Energy and Sustainability.

C-AIM is a major flagship project that will nurture research on new materials, with an eye towards applications in alternative energy, space, aeronautics, and medicine, including new materials for storing and using energy.

The Center is being named in honor of Tom and Mary Beck and it is a fitting legacy for a family whose name is virtually synonymous with energy research at Weizmann, whose footprint is felt across campus, and which has been foundational in what is today a flourishing Canadian circle of friends.

Farewell to Institute management

The Closing Gala offered an opportunity to thank and bid farewell to President Prof. Daniel Zajfman and his leadership team, including Prof. Michal Neeman,



Cathy Beck

Vice President; Prof. Israel Bar-Joseph, Vice President for Resource Development and Public Affairs; Prof. Mudi Sheves, Vice President for Technology Transfer; and Shuli Geri, Vice President for Finance and Administration.

Prof. Zajfman talked about the many individuals he has worked with over the course of his last 13 years in office, and he received several standing ovations from the audience.

Incoming President Prof. Alon Chen (who began his term on December 1) gave an overview of his research on the neurobiology of stress.



All-star team, L to R: Executive Board Chair Shimshon Harel, Prof. Daniel Zajfman, Prof. Michal Neeman, Shuli Geri, Prof. Israel Bar-Joseph, Prof. Mudi Sheves, Prof. Jehuda Reinharz

מכון ויצמן למדע



Artificial intelligence: the future of smart

AI is reshaping our lives—and revolutionizing science

In every branch of science, investigators are buckling under the weight of too much of a good thing: information. From particle physics to genetics, and from cell biology to environmental chemistry, new technologies are generating massive data sets, making the interpretation of experimental findings a significant challenge. Luckily, the emerging discipline of artificial intelligence is generating mathematical “thought partners” that can sift through this mountain of data, and reveal discoveries that would almost certainly be overlooked by the human mind working alone.

What is artificial intelligence, anyway?

Artificial intelligence, or AI, is the simulation of human intelligence processes by machines. When Marvin Minsky, the founder of MIT’s AI laboratory, advised Stanley Kubrick on the film 2001: A Space Odyssey—which featured an intelligent computer, HAL 9000—artificial intelligence was still the stuff of science fiction. But bit by bit (and byte by byte), research advances have propelled AI into the mainstream. From IBM’s supercomputer Deep Blue, which faced off against human chess champion Garry Kasparov in the late 90s, to the robotic vehicles NASA landed on Mars in 2004, to today’s voice-activated “personal assistants” such as Apple’s Siri, Google Assistant, or Amazon’s Alexa, society has entered into an evolving human-machine partnership for which the terms of the contract are still being written.

Today’s “Big Data” revolution makes basic science related to artificial intelligence a matter of critical importance. A new \$100 million flagship project at the Weizmann Institute, the Artificial Intelligence Enterprise for Scientific Discovery, will develop AI tools and ensure their integration into a range of scientific areas, while providing the massive computing power necessary to store, process, and analyze the data that will lead to the next big discoveries.

AI is a broad concept used to describe the solution, by a computer, of tasks for which human

מכון ויצמן למדע

Science Feature

46–47

intelligence was previously considered a prerequisite. In the simplest cases, intelligent-like behavior can be achieved by simple a well-defined computer programs. But more challenging tasks require AI systems to gather complex data, reveal patterns, and make independent decisions.

Much like the human brain, successful AI systems comprise sensors, experiences, and the ability to process remembered data to make decisions. In AI, sensors are used to gather complex data, for instance, visual images, or, in biomedical applications, genetic and molecular data. Next, the system must be exposed to large data sets—for example, in facial recognition, or cancer prediction—for which a solution is already known. Finally, AI must be powered by an algorithm—programming code that enables the computer to discover patterns and make decisions based on the sensors and past experiences. Given these components, and if the tasks for which the AI system is designed have been defined correctly, it will do something quite astonishing: it will learn.

Ever-more powerful computers are expected to expand AI capabilities. New algorithmic approaches, such as “deep neural network” techniques inspired by the human brain, will join with emerging multi-sensor systems capable of accumulating data sets of unprecedented size. These developments point toward an exciting future, in which AI will push past the limits of the imagination, and realize its potential as a “thought partner” for its human creators.



Prof. Ilan Koren



Prof. Amos Tanay

AI at Weizmann

Home to some of the world’s most prominent experts in computer science and neurobiology, Weizmann Institute researchers are developing AI-based methods for everything from drug discovery and personalized medicine, to climate modeling and environmental protection. The application of AI to fields historically considered non-computational—such as archaeology and education—is demonstrating the power of such systems to “flag” significant patterns that, because of their enormous complexity, would be overlooked by even the most brilliant human scientist.

Among the many Weizmann investigators who use AI, three of them—Prof. Amos Tanay, Prof. Ilan Koren, and Prof. Eilam Gross—demonstrate how emerging AI tools are helping the scientific community achieve world-changing discoveries.

AI and health

What could we learn if we had detailed health data, relating to an entire population over decades, at our fingertips? This is what Prof. Amos Tanay—who holds appointments in both the Department of Biological Regulation and the Department of Computer Science and Mathematics—aims to find out.

The advent of Electronic Health Records as a replacement for traditional, handwritten medical charts has helped standardize how patient data is recorded, making it easier to share and use clinically important information. Prof. Tanay is taking this to the next level, by developing software for data

מכון ויצמן למדע



access and manipulation that makes it possible to “scan” population-wide data.

He is the director of a unique collaboration between the Weizmann Institute of Science and Clalit Health Systems, Israel’s largest HMO. The Weizmann/Clalit project (and its Bench-to-Bedside Program, directed by Prof. Gabi Barbash, a physician and former Director General of Israel’s Ministry of Health), makes available for scientific research more than 20 years of data, comprising computerized records of lab tests, treatments, and results for over four million Israeli citizens. This data repository, based on anonymized patient records, is being analyzed using AI machine learning protocols, as well as insights from the emerging research field of data science.

The ability of AI to recognize patterns within huge data sets has helped Prof. Tanay and his colleagues identify previously unrecognized factors that play a role in human health. For example, in collaboration with Dr. Liran Shlush of the Department of Immunology, Prof. Tanay established an AI-based strategy for the early diagnosis of Acute Myeloid Leukemia (AML). Based on the Clalit medical records, deep sequencing of the genes recurrently mutated in AML, and machine learning, the scientists identified a distinct gene mutation profile that accurately predicted which patients would live to a healthy old age, without developing the disease—a model that could potentially be used to identify pre-AML risk many years prior to disease onset.

In another recent AI achievement, Prof. Eran Segal—who holds appointments in both the Department of Molecular Cell Biology and the Department of Computer Science and Mathematics—designed an algorithm that can predict the risk of gestational diabetes even before pregnancy. This advance—based on machine learning algorithms that revealed clinically significant patterns in the Clalit data—may one day allow doctors to prevent gestational diabetes in specific patients, by prescribing lifestyle interventions for reducing high blood sugar.

If Prof. Tanay has his way, the next AI-based health discoveries may emerge from closer collaboration between scientists and physicians. The Tanay team is now putting the finishing touches on a new interface that would allow doctors—with no training in AI or machine learning—to query the Clalit database, test out their hypotheses, and provide better, more personalized care for their patients.

AI and climate research

A new AI-based strategy based on the work of three researchers, including Prof. Ilan Koren of the Department of Earth and Planetary Sciences—is using machine learning to achieve an unprecedented understanding of how cloud formation mediates the Earth’s energy balance and water cycle, and influences climate.

Every climate model must take clouds into account, but such data is usually gathered by satellites that capture low-resolution images that miss many small clouds, and reveal only cloud systems’ most basic properties. Prof. Koren, on the other hand, is developing a completely different approach to cloud analysis that, with the help of AI, will generate a wealth of new climate data.

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

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

With the help of machine learning, Prof. Koren and his colleagues will be able to identify very complex interactions, with a special emphasis on the smaller cloud structures that temper climate and can also be very sensitive to climate change. The new system is expected to improve the accuracy of current climate models.

AI and the nature of the universe

Machine learning methods are designed to explore and independently analyze large data sets. And if you’re looking for large data sets, then particle physics—a discipline in which scientists examine

Will tomorrow’s AI systems ask their own questions, and experience a “Eureka moment” in their circuits when they discover the answer? Only time will tell.

48–49

the behavior of subatomic particles at very high energies—is a great place to start.

Weizmann Institute scientists are prominent leaders in ATLAS, a detector that is part of CERN’s Large Hadron Collider (LHC)—the world’s most powerful particle accelerator. At the LHC, thousands of magnets speed up sub-atomic particles so they collide at close to the speed of light. Over a billion such collisions occur in the ATLAS detector every second, generating vast quantities of data analyzed at 130 computing centers around the globe.

Complex data produced by particle physics experiments strains the data storage capacity of the world’s strongest computers. AI can help, by generating real-time results from detected events. AI architectures might also be trained to identify and save events that don’t match expectations—rather than rejecting them—something that might alert scientists to phenomena that hold the key to the next major breakthrough.

Prof. Eilam Gross is a member of the Department of Particle Physics and Astrophysics who has devoted much of his scientific career to the ATLAS project. Prof. Gross was the overall team coordinator for the international group of scientists responsible for the LHC’s most celebrated accomplishment—the discovery of the Higgs boson. He is now hard at work on a new challenge: helping to design algorithms that will improve monitoring and data analysis in the coming upgrade of the ATLAS experiment. These algorithms are based on deep learning—a machine learning method based on artificial neural networks—and will enable faster



Prof. Yaron Lipman

and more efficient data analysis. This will make it possible to characterize rare sub-atomic events that have been neglected because of the enormous density—even by ATLAS standards!—of the data involved.

A world-renowned expert on the meeting point between AI and particle physics, Prof. Gross moved the field forward through a collaboration with Prof. Yaron Lipman from the Department of Computer Science and Applied Mathematics. Together, the scientists developed a novel method using geometric deep learning to improve detector performance by “tagging” particles of interest.

In another project, Prof. Gross used a type of machine learning called convolutional neural networks to predict how much of a certain type of energy would be “deposited” in components of the ATLAS detector. This advance makes it easier to separate inconsequential background noise from significant experimental findings. He is also using machine learning protocols to identify malfunctions in the detector itself.

Rapid AI progress has Prof. Gross and his colleagues dreaming of what could become possible in the near future. Rather than using machine learning to find patterns in high-density data in order to answer existing questions, tomorrow’s AI platforms may be able to ask their own questions independently, and even run the experiments.

And if tomorrow’s AI systems ask their own questions, will they experience a “Eureka moment” in their circuits when they discover the answer? Only time will tell.



Prof. Eilam Gross

Latin America makes a strong showing at International Board

At the International Board, the Latin American Committee enjoyed its largest delegation in Weizmann history, with about 100 guests. The Committee hosted an exclusive event for Latin American friends and in honor of the President of the Brazilian Association of Friends, Mario Fleck, who received a Doctor of Philosophy *honoris causa*.

Separately, the Argentinian Association of Friends organized its first nationwide Physics Challenge called "Think Outside the Box". Teams of high school students from five schools created safes with mechanisms based on principles of physics. The winning group was from the Technical Middle School of the University of Buenos Aires in Villa Lugano.

In Mexico, a group of young women created the Vera Weizmann group, aiming to promote the advancement of women in science at the Weizmann Institute. Prof. Rony Paz, Head of the Department of Neurobiology, and Dr. Itay Tirosh from the Department of Molecular Cell Biology visited Mexico in September and December, respectively, where they gave scientific lectures and participated in a series of events. In December, the Mexican Association of Friends held an event to celebrate four Mexican scientists who have been supporting Weizmann Institute research: Dr. Ana Flisser Steinbruch, Dr. Raquel Gerson Cwilich, Dr. Alberto Huberman Wajzman, and Dr. David Kershenobich Stalnikowitz.



📍 *Mario Fleck at the International Board*

Weizmann World



📍 *Ellen Merlo presents David Teplow with the American Committee's official gavel. (L-R) Dave Doneson, Ellen Merlo, David Teplow, and Dr. Gladys Monroy.*

US: American Committee leadership passes the gavel

The American Committee held its Leadership Retreat and Annual Meeting in New York City in the fall. The opening event, dubbed the "Transformative Power of Philanthropy," featured a panel discussion with Prof. Avidgor Scherz of Weizmann's Department of Plant and Environmental Sciences and Dr. Jonathan Coleman of Memorial Sloan Kettering Cancer Center in New York. American Committee CEO Dave Doneson moderated the discussion, and thanked the Thompson Family Foundation for their monumental support of this partnership since 2011.

"The story of the Thompson Family Foundation, Memorial Sloan Kettering, and the Weizmann Institute is part of a continuum of transformational philanthropy that has been the American Committee's inspiration for the past 75 years," Mr. Doneson said.

Attendees also watched a compelling video in which President's Circle Chairman Lester Crown shared his thoughts on science and philanthropy. The evening drew to a close with a tribute to Ellen Merlo, who concluded her term as National Chair, a position she has held since 2013. Mr. Doneson thanked Ms. Merlo for her years of service, commitment, and friendship.

The next day, lay leaders participated in a communications skills workshop tailored toward helping each participant tell their personal Weizmann story. The successful retreat concluded with the Annual Meeting of the Board of Directors during which Ms. Merlo passed the American Committee's official gavel to new National Chair David Teplow of Boston, and Dr. Gladys Monroy of the Bay Area was elected President.



📍 *Dr. Roberta Bondar moderating a panel discussion with National Postdoctoral Award recipients, L to R: Dr. Elena Meirzadeh, Dr. Shira Weingarten-Gabbay and Dr. Naama Aviram.*

Canada: ‘Wonderful Women’ in focus at Celebrating Philanthropy event

Weizmann Canada hosted more than 200 individuals for its Celebrating Philanthropy: Wonderful Women event in Toronto on September 25.

To highlight the importance of women in science, Dr. Roberta Bondar, Canada’s first female astronaut and first neurologist in space, gave a keynote address on the challenges she faced as she pursued her dreams, and the importance of encouraging and supporting women to pursue the sciences.

This led to a lively panel discussion moderated by Dr. Bondar with panelists Dr. Naama Aviram, a postdoctoral fellow in the Marraffini Laboratory of Bacteriology at Rockefeller University; Dr. Elena Meirzadeh, a postdoctoral fellow in the Department of Chemistry at Columbia University; and Dr. Shira Weingarten-Gabbay, a fellow in the Sabeti Lab, part of the FAS Center



📍 *Weizmann Canada’s Women and Science committee members, L to R: Estelle Richmond, Linda Reitapple, Michele Atlin, Francie Klein, Alana Kotler, Jennifer Tugg, Susan Rose, Reggie Greenberg and Nancy Pencer.*

for Systems Biology at Harvard University. The participants shared stories about their journeys and the opportunities afforded to them through the support of the Israel National Postdoctoral Award Program for Advancing Women in Science.

The evening’s program also included highlights of new research from the Weizmann Institute and featured the Weizmann Canada’s Women and Science committee, highlighting its efforts to raise funds for the Advancing Women in Science Program.

מכון ויצמן למדע



📍 *L to R: Zohar Menshes, Bob Drake, Prof. Alon Chen, H.S.H. Prince Hans-Adam II, Prof. Daniel Zajfman, and Rita Kieber-Beck.*

Europe: A royal welcome in Liechtenstein

H.S.H. Prince Hans-Adam II of Liechtenstein hosted Weizmann Institute scientists and leadership at his royal castle in January, including President Prof. Alon Chen; the former President, Prof. Daniel Zajfman; Bob Drake, Chairman of the European Committee; and Zohar Menshes, Executive Vice President of the European Committee. Prof. Chen offered a broad overview on major fundraising and scientific priorities.

Next, the delegation from the Liechtenstein Society of Friends met with H.E. Dr. Mauro Pedrazzini, Minister for Social Affairs in the Government of the Principality of Liechtenstein, who holds a PhD in physics. The group then traveled to Clinicum Alpinum, a psychiatric hospital in Gaflei, Liechtenstein. Its founder, Dr. Marc Risch, a specialist in psychiatry and psychotherapy, hosted the delegation. Prof. Chen gave a talk on the neuroscience of stress and its influence on disease. The event was followed by a festive dinner with spectacular views of the Alps.

The visit and event was led by Rita Kieber-Beck, Chair of the Liechtenstein Society, and Werner Bachmann, the Vice Chair.

מכון ויצמן למדע

Israel: Investing in education

The Science Club of the Israel Association of Friends honored Prof. Daniel Zajfman for his 13 years as President, at an event at the Hilton on December 16. event involved a panel focused on the future of education in Israel. The panel included Prof. Zajfman; Dita Bronicki; the renowned Israeli author Meir Shalev; and professional basketball executive David Blatt.

The conversation revolved around the best ways to educate future generations of students, teachers, and science enthusiasts, by providing them the right tools, resources, and equal opportunities. Mr. Shalev emphasized the importance of



📍 *L to R: David Blatt, Prof. Zajfman, Dita Bronicki, Meir Shalev*

“hands-on” learning, and spoke about the roles of teachers in his books. Ms. Bronicki spoke about the importance of investing in education, and Prof. Zajfman, discussed the Davidson Institute and its role in advancing science literacy and education. Mr. Blatt discussed excellence and dedication as paramount in sports and education.

The event was sponsored by the private banking unit of Credit Suisse.

Australia: Weizmann-Garvan symposium and synergy

The Garvan-Weizmann Centre for Cellular Genomics was celebrated at the Annual General Meeting of the International Board on November 13 in the presence of many Australian friends and scientists. Jillian Segal, a major donor to the partnership who, with her husband John Roth, has been instrumental in garnering support throughout Australia, spoke eloquently at the dedication event at the Sela Auditorium.

"It's a pleasure and a privilege to be a donor to this project," said Segal. "I'm thrilled to see the power of collaboration, and to see the synergies

between Garvan and Weizmann scientists, particularly in the area of single-cell genomics." She also acknowledged the work of the Israeli and Australian Chambers of Commerce for helping lay the groundwork for the collaboration.

Prof. Chris Goodnow of the Garvan Institute of Medical Research, also spoke, describing the origins of the program. "Scientific partnerships and collaborations," he said, "lead to three key worthy outcomes: breakthrough science; shaping minds to think differently about problems in human health; and the creation of 'ambassadors for science' who can speak about achievements of individual countries and institutions."

Earlier, on November 11, the inaugural Weizmann-Garvan Research Symposium brought together scientists from both institutions working on joint projects in immunology and autoimmune disease, the microbiome, type 2 diabetes, and more. The symposium was led by the Weizmann Institute's Prof. Ido Amit of the Department of Immunology and the Garvan Institute's Prof. Chris Goodnow. Other participating scientists included Profs. Amos Tanay, Eran Elinav, Ziv Shulman, and Idit Shachar from the Weizmann Institute; and A. Profs. Joseph Powell and Cindy Ma, and Drs. Joanne Reed, Warren Kaplan and Dorit Samocha-Bonet of the Garvan Institute.

 Jillian Segal and Prof. Daniel Zajfman

UK: From research to reality



 L to R: Dr. Roi Avraham, Weizmann UK Executive Director Sheridan Gould, Dr. Moshe Biton, Prof. Karina Yaniv, Prof. Alan Dangour, and Weizmann UK Chair Arabella Duffield

Three scientists from the Weizmann Institute's Department of Biological Regulation traveled to London for Weizmann UK's annual Ambassadors' Lecture, *From Research to Reality*, on November 25 at the Wellcome Collection, London. More than 100 guests attended the evening to hear the latest research on various aspects of immunology.

Dr. Roi Avraham explained how he aims to understand more about the dynamics of infection in the human body, and to design new ways for fighting infection at its earliest stages, especially in the face of widespread antibiotic resistance.

Dr. Moshe Biton offered a peek into his promising research on the dynamics of the human gut to study how the diverse range of cells found in the digestive system may hold the key to a range of diseases affecting the whole body.

Lastly, Prof. Karina Yaniv gave the audience pause for thought to consider that we all started life as a single cell and explored how advances in our understanding of blood vessels and the lymphatic

system will provide important insights into organ regeneration.

Weizmann UK Chair Dr. Arabella Duffield gave the opening remarks at the event and the panel was moderated by Prof. Alan Dangour from the London School of Hygiene & Tropical Medicine and a Trustee of Weizmann UK who said: "These three scientists have really given us an amazing glimpse into the incredible research taking place at the Weizmann Institute of Science."

The three Weizmann researchers were also in the UK to take part in a joint Manchester-Weizmann Symposium at the University of Manchester on *New Frontiers in Cell Biology and Immunology*.

A dinner was also hosted in Manchester by Weizmann friend Lord Alliance to tie in with the symposium. The evening celebrated Get Connected, the unique partnership of scientific collaboration between the Weizmann Institute and the University of Manchester.

Boots on the ground in Ofakim

Israel's first science pre-army prep program

When teenagers hang out together at two in the morning, quantum mechanics is not typically their chosen topic of conversation. But in the Davidson Institute's new pre-military preparatory program, discussing science is one of the favorite pastimes of its young cadets.

Founded by Davidson Institute of Science Education CEO Dr. Liat Ben David, program coordinator Eli Amedi, and former Weizmann President Prof. Daniel Zajfman, this pre-military training unit—or *mechina*—is not just another gap-year program offered to high school graduates in Israel before they enlist

Twenty kilometers west of Beersheva, Ofakim was selected as the first site of what is hoped will be a series of similar science-oriented *mechinot* [multiple such programs]. A development town established in the barren desert in 1955 where the government placed immigrants from Morocco and Tunisia, Ofakim suffered from high rates of unemployment and poverty for decades, until renewal efforts over the last two decades began to change the face of the city.

"This town is situated in the center of the country where quality science education is still lacking," Amedi says. "So it was the perfect location to launch this new *mechina* program."

Selected for their passion for science, the program's first 19 recruits moved into a small villa in the heart of Ofakim. Their daily schedule is filled with classes designed to enrich them physically, mentally, and spiritually: from philosophy, history, and science, to physical training, army preparation—and even yoga and mindfulness.

Once a week, the cadets visit the Weizmann Institute to meet with researchers and hear lectures. They analyze scientific articles, develop research skills, and

Education

56–57

discuss the business and ethics of science. They conduct research on topics of particular interest and give presentations to their housemates.

The cadets also devote 12 hours per week to volunteer at local elementary, middle, and high schools, teaching science and mathematics classes to more than 200 Ofakim students. Using hands-on lessons specially designed by the Davidson Institute, the volunteers teach classes during school hours, as well as run after-school enrichment programs.

On the frontlines of science education

"Working with the younger children is my favorite thing," one cadet says. "Seeing them go from being nervous about working with unfamiliar tools to then seeing the excitement in their eyes when they build something like an electrical circuit with their own hands is really rewarding. Some of them have told me they wish our sessions were the science classes they were taught every day."

"I find working with the high school kids the most rewarding," another cadet chimes in. "I can feel how I'm helping them prepare for their final exams. Bumping up their matriculation exam scores by 10, 15 points would be a big change that could really affect their lives."

The volunteer sessions do not only benefit the schoolchildren. In addition to the math and science the cadets learn, they pick up a myriad of valuable life skills. Particularly, they learn how to convey information in an engaging and inspiring way to a roomful of active children.

The *mechina* participants—who are not much older than the high school students they teach—have to walk a delicate line between teacher and friend, making the material fun while still presenting themselves as authority figures. All the while, they must ensure the students' safety as they handle potentially dangerous materials, such as chemicals and soldering irons. With lessons that range from 45-minute classroom sessions to four-hour "science day" demonstrations at a community center, the *mechina* volunteers have to figure out how to hold the attention of different-sized audiences, as well.

But these challenges have turned out to be one of the program's greatest strengths. What struck Prof. Zajfman when he visited the Ofakim schools was how much the students needed role models their own age.

"They are inspired, not by older seasoned scientists who already boast many achievements," Prof. Zajfman says, "but by other relatable teenagers who have been given the opportunity to dream and learn simply because they came from cities with a more developed educational system."

The pilot year of the Ofakim *mechina* program proved successful, and more than 80 candidates have applied for its second year, planned to launch in summer 2020 with 30 new recruits.

"One of the major goals of the *mechina*, as I see it," remarks Dr. Ben-David, "is to influence society in Israel's disadvantaged communities through its emphasis on critical thinking and knowledge-based decision making. The cadets, who become young scientific leaders in the community, are instrumental in this effort. This program is a game-changer, and we are looking forward to establishing more science-oriented *mechinot* in the future."



Talking science: cadets in the pre-army program in Ofakim

in the Israel Defense Forces. Besides courses on Judaism, Zionism, philosophy, and Israeli society that are standard in every pre-military program, a substantial part of the Davidson *mechina* curriculum is devoted to science, mathematics, and technology.

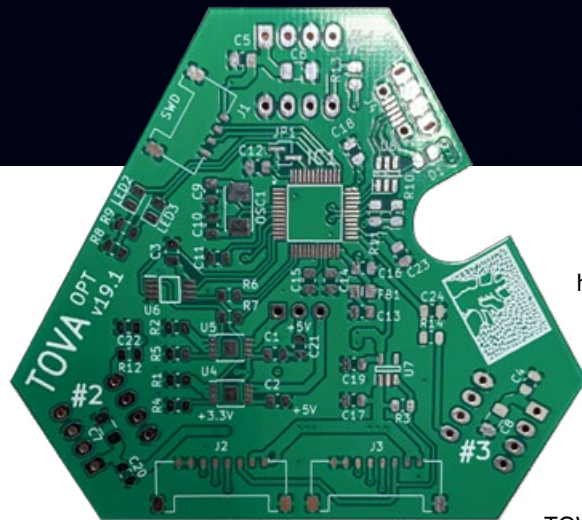
"We wanted to create a program that stood out in the sea of gap-year programs that already exist in Israel—one that would allow youth to use science to strengthen their connection to their country," Amedi says.

After two years of planning, the vision was realized, and Davidson's new *mechina* program launched last summer in the southern town of Ofakim.



Brain-saving technology

New device combines algorithms, infrared light, and imaging to monitor bleeding in the brain



The TOVA chip

Imagine a physician peering into a patient's head—from miles away—and diagnosing impending brain damage from an expanding blood clot, by simply glancing at a mobile device. That ability is close at hand, thanks to a collaboration between Prof. Alon Harmelin, Vice President for Administration and Finance; Dr. Slava Kalchenko, a senior staff scientist and Head of the In Vivo Optical Imaging Unit in the Department of Veterinary Resources at the Institute; and Dr. Paul Wright, a neurologist with Nuvance Health hospital network in New York State and Connecticut.

Prof. Harmelin and Dr. Kalchenko have developed an imaging system—called transcranial optical vascular assessment, or TOVA for short—that captures an image and data on the presence and growth of a subdural hematoma, a common type of bleeding within the skull on the outermost surface of the brain that frequently occurs after head injuries. TOVA comes in the form of a lightweight, wearable

headgear connected wirelessly to a mobile device (such as a tablet or smart phone) for continuous, real-time monitoring via the cloud, along with a centralized monitoring system.

TOVA will be readily portable and designed for continuous use. Patients will receive the wearable headgear when they are discharged from a hospital or

urgent care center, rather than undergo extended hospitalization and exposure to the ionizing radiation received from CT scan monitoring (the current method for diagnosing hematoma and other brain injuries). In this way, TOVA would offer an immediate reduction in the costs for prolonged hospitalizations while providing superior monitoring in one's own home.

According to Prof. Harmelin, who developed the technology when he was head of the Department of Veterinary Resources, "TOVA will be a game-changer for how we treat head injuries."

Beyond the Bench

Casting a new light, using AI

The technological secret behind TOVA is a combination of infrared light and radiofrequency signals, coupled with sophisticated algorithms. It is based on a key scientific phenomenon where blood has measurably different light-absorption properties as it travels through different tissues in the cranium.

The idea behind using the light-absorption properties of blood to image the brain is more than 40 years old. However, the means for harnessing such properties in a way that is both sufficiently accurate and safe (radiation free) has been considered impossible—until now.

"The computational requirements for building the algorithms are quite complex," says Dr. Kalchenko. "But thanks to the revolution in artificial intelligence-based 'machine learning' in the past 10 years, this is now possible."

Prof. Harmelin and Dr. Kalchenko created an algorithm that can encode the blood/light 'signature' of a hematoma in various tissues, and can distinguish it from healthy brain tissue. That is, they built the algorithm using an AI 'machine-learning' technique involving a series of datasets that simulate different signatures, and then 'taught' these simulations to a computer program that could then distinguish the presence and size of a hematoma in live animal models.

And now, in collaboration with Dr. Paul Wright, Prof. Harmelin and Dr. Kalchenko are advancing the applicability and availability of this wearable headgear to the medical community.

This development comes at an important time. Thanks to medical advances that promote longevity, more and more people are living longer lives; an unintended consequence, however, is that more and more of them are on blood thinners due to cardiac disease.

"The elderly are more prone to falls, and if they fall while on blood thinners, there's a high risk of having a traumatic brain bleed," says Dr. Wright. "Even if the blood is drained away, there's always a chance of a recurrence, which can go undetected until the next CT scan. Because TOVA offers real-time monitoring, the chances of significant brain injury are reduced."

TOVA is able to scan to a depth of 3 cm into the brain, a relatively short distance. In this way, the technology fits a particular diagnostic niche, complementary to CT and MRI.



L to R: Dr. Slava Kalchenko and Prof. Alon Harmelin

The goal is to make TOVA available in ambulances, doctor's offices, and nursing homes. Even integration into motorcycle helmets and military headgear, for on-scene triage, may be possible.

The development of TOVA technology received support from business development experts at Yeda, the Weizmann Institute's technology transfer arm, and its Innovation Development, Enhancement, and Acceleration (IDEA) program. IDEA is a new initiative to help Weizmann scientists bridge the gap between academia and industry. With Yeda's help, TOVA will soon be on hand—and on head—wherever the patient is.



Alumni

60–61



A healing solution after brain surgery

Dr. Amir Bahar (inset) and the fabric of the ArtiFascia patch

Dr. Amir Bahar's Nurami Medical makes post-op recovery faster, safer

Brain surgery is a frightening prospect under any circumstances, but successfully getting through the procedure is only half the battle. Even if the operation itself goes smoothly, the dangers of infection and cerebral leakage post-surgery are high.

מכון ויצמן למדע

One former neurobiology student from the Weizmann Institute has invented a patch for covering the exposed brain that is no Band-Aid solution—hastening healing in a purportedly more hygienic and effective manner than the current animal-based sealant used in brain surgeries today.

Dr. Amir Bahar, who received his PhD from the Weizmann Institute of Science in the labs of Prof. Yadin Dudai and Prof. Ehud Ahissar in the Department of Neurobiology, teamed up with Nora Nseir, a biomedical engineer with a degree from the Technion, to form their company, Nurami Medical. There they developed ArtiFascia—a surgical patch that utilizes nanofiber technology to patch the exposed brain and provide a temporary substitute for the removed dura mater—the thick membrane between the skull and the brain that acts as a protective barrier. Because of its thinness and elasticity, ArtiFascia mimics the dura more closely than alternative bandages, allowing for easier application for the surgeon and quicker healing for the patient.

The standard procedure after neurosurgery is to apply an animal-based collagen bandage to the surgical site and spray it with sealant. This process, however, is imprecise and time-consuming, and increases the risk of bacterial infections and cerebral spinal fluid leakage. By being self-sealing, ArtiFascia simplifies the bandaging process and reduces the chances of foreign materials finding their way into the wound. Additionally, because it is composed of biodegradable nanofibers and is many times thinner than the animal-collagen product, ArtiFascia does not require removal from the brain, a procedure that increases the chances of contamination. Instead,



ArtiFascia: beyond Band-Aids for the brain

the patch provides a necessary scaffold for dura regeneration which, once a new membrane is formed, dissolves within about six months.

Dr. Bahar said his path from scientist to entrepreneur started with an incidental conversation with a neurosurgeon at a time when he was eager to initiate a project of his own, and was investigating potential unmet medical needs.

“I learned that doctors don’t have time to think about areas of work that could be improved,” he says. “They simply work with the tools they have. It isn’t until a biomedical engineer sits down and really talks with them that they discover the areas where medical technology is lacking. I learned that cerebral leakage was a major problem that often requires another surgery just to fix.”

With a patent in both the United States and China, Nurami Medical’s surgical patch has a promising future. The first human clinical trials began in 2017 with success. Six patients in the Czech Republic underwent surgery, and all were fully healed at their six-month follow up after using the ArtiFascia patch. A larger clinical study with 90 patients is currently underway.

Not only could this invention vastly improve a neurosurgical patient’s outcome, but the technology behind it has the potential to be applied to many surgical procedures throughout the body.





Art and Science

62–63

The artistry of math

Folding together creativity and calculation, the flexagon is a new hit

Most discoveries are driven by a search for answers to specific questions, but in some cases exploration simply starts with a playful use of material.

The story of the flexagon—a flat paper model that has been inspiring and challenging mathematicians and physicists for years—began with an extra piece of paper. When the British mathematician Arthur Stone, who in 1939 was a student at Princeton University, found that he could not fit American paper into his English binder, he decided to cut them to size. While sitting in class, he started folding these excess strips of paper into different shapes—and one of them caught his eye.

Stone showed this shape, which later got the name “trihexaflexagon,” to the theoretical physicist Richard Feynman, as well as two mathematicians, Bryant Tuckerman and John Tukey. Together, they formed the Princeton Flexagon Committee and dove into the world of flexagons, making calculations and developing models. The Feynman diagram, which has become a fundamental tool in particle physics, was one of them.

Hands-on, minds-on

Today, some 80 years later, flexagons are still stimulating the hands and minds of people

around the globe, and connecting fans who share new models and new insights with each other. Enthusiasts manipulate their paper—flexing, not folding—using special movements such as the “pinch flex,” the “reverse-pass through flex,” and the “V flex.” By being both a hands-on and minds-on activity, creating flexagons appeals to adults and children alike, bringing diverse and unlikely groups of people together through their shared affinity for flexagons.

This enthusiasm is why the Davidson Institute of Science Education dedicated the first Neil Shore Recreational Math Workshop to the topic of flexagons. The first workshop, held last summer, provided a unique opportunity for some 40 individuals to come together to think, play and learn about flexagons, including researchers, origami artists, educators, and gifted junior-high and high school students to meet, study, and create.

American lecturers Ann Schwartz and Scott Sherman, and Dr. Yossi Elran of the Davidson Institute, led the four-day workshop.

“Flexagons have their own inner logic that is fun to discover, and there is an element of surprise and challenge to it,” says Schwartz, a copywriter in the book-publishing world.

About 15 years ago, while attempting to recreate a shape she had made before, Schwartz ended up making a hexagon divided into 12 pie slices. Since then, she has continued creating and exploring new flexagons with great passion, and is considered internationally as a leader in the field.

The fun of flexing

Sherman, a programmer and flexagon expert, brought a different perspective to the seminar as someone who speaks the language of math—i.e., typology and group theory. In fact, when he finds a surprising way to fold a flexagon, he writes a program to explore it and predict all of the possibilities that may arise.

“I try to prove how many different ways there are to rearrange the different phases as you flex through them,” he explains. But still, the programming is not the main thing: “The Flexagon is a little bit like a fidget spinner that you can physically explore. The programs I write just help me learn more about it.”

The event organizers say they plan to publish books, videos, and templates related to flexagons. Specifically, they would like to create educational activities that harness the fun of flexing for students and teachers in Israel.

In a first, this special math workshop was supported by the United States Embassy in Israel. Ellen Schnitser, the Public Affairs Specialist at the US Embassy, says, “This exciting math initiative will increase the involvement of disparate groups of students—Israeli-Jewish and Israeli-Arab, boys and girls—in [science literacy] subjects, and will have a great multiplier effect.”



In Memoriam

Thank you to our supporters

64-65

Yael Mutsafi, 1981-2019

Dr. Yael Mutsafi, who completed both her PhD and postdoctoral studies at the Weizmann Institute, tragically passed away from breast cancer on December 4, 2019, at the young age of 38. She left behind a husband and two young children.

Yael was described by her loved ones as a rare woman whose extraordinary intelligence was matched only by her boundless compassion.

"She had an amazing, almost frightening memory," recalls her PhD thesis advisor, Prof. Avi Minsky of the Department of Structural Biology. "She would quote studies she had read years before, and even remember the page number of the source—I couldn't believe it. Not only did Yael have an extraordinary mind—she was extremely empathetic and cared very much about people."

She grew up in Arad, in Israel's Negev desert, and was fascinated by science from an early age. After receiving her bachelor's degree in biology at the Tel Aviv University in 2005, she joined Prof. Minsky's lab as an MSc student. It was not long before Prof. Minsky recognized her talent and suggested she switch to the direct MSc/PhD track. During that time, she studied the life cycle of the giant mimivirus to better understand how viruses penetrate and multiply in living cells. After completing her PhD, Yael pursued her first postdoctoral fellowship in Prof. Deborah Fass's laboratory in the Department of Structural Biology where she used fluorescence and electron microscopy methods to study how the physical support system around cells, known



as the extracellular matrix, assemble.

"Everything Yael did, she did intensely and deeply," Prof. Fass remembers fondly. "She would dissect every seminar, every paper, every scientist we knew. She had an opinion about absolutely everything, expressed firmly but with grace and delicacy. I pull up her voice in my memory all the time because I loved so much to hear it."

Following her postdoctoral studies in Prof. Fass's lab, Yael won a Revson Fellowship in 2015 from the Israel National Postdoctoral Award Program for Advancing Women in Science managed by the Weizmann Institute, and moved with her family to Bethesda,

Maryland, where both she and her husband worked as postdoctoral fellows at the National Institutes of Health (NIH). Shortly after she joined the NIH, she was diagnosed with an aggressive form of breast cancer. After multiple treatments, she went through a brief remission period, but the cancer returned.

"When everyone recalls memories of her, they always talk about how intelligent and kind she was," her husband, Daniel, says. "To me, her unique perspective on everyday things—a painting, a book, a person—her seeing something that no one else noticed and sharing these insights with me made life with her so interesting. Our children and I miss the privilege of her love, her softness, her tolerance and acceptance, and her support and power."

She is survived by Daniel and their two children, Nadav and Shai, as well as her siblings, Michal, Noa, and Omer, and her parents, Yossi and Yaffa.

מכון ויצמן למדע

Uri Alon

- ▶ The Braginsky Center for the Interface between Science and the Humanities
- ▶ The Kahn Family Research Center for Systems Biology of the Human Cell
- ▶ Estate of Olga Klein - Astrachan
- ▶ The Jeanne and Joseph Nissim Center for Life Sciences Research
- ▶ Rising Tide Foundation
- ▶ Sagol Institute for Longevity Research
- ▶ Zuckerman STEM Leadership Program
- ▶ European Research Council
- ▶ Prof. Uri Alon is the incumbent of the Abisch-Frenkel Professorial Chair

Ido Amit

- ▶ Adelis Foundation
- ▶ Kekst Family Institute for Medical Genetics
- ▶ Helen and Martin Kimmel Award for Innovative Investigation
- ▶ Lowy Foundation
- ▶ Estate of Arthur Rath
- ▶ Rising Tide Foundation
- ▶ The Bill & Patricia Ritchie Foundation Limited
- ▶ Anita James Rosen Foundation
- ▶ Steven B. Rubenstein Research Fund for Leukemia and Other Blood Disorders
- ▶ Sagol Institute for Longevity Research
- ▶ Estate of Simon Saretzky
- ▶ Richard & Jacqui Scheinberg

מכון ויצמן למדע

- ▶ Thompson Family Foundation Alzheimer's Research Fund
- ▶ Wolfson Family Charitable Trust
- ▶ Prof. Amit is the incumbent of the Eden and Steven Romick Professorial Chair.

Ruth Arnon

- ▶ Irwin Green Alzheimer's Research Fund
- ▶ Estate of Ethel Lena Levy

Sagi Ben-Ami

- ▶ Peter and Patricia Gruber Awards
- ▶ Willner Family Leadership Institute for the Weizmann Institute of Science

Rivka Dikstein

- ▶ Estate of Albert Engleman
- ▶ Estate of David Levinson
- ▶ Moross Integrated Cancer Center
- ▶ Rising Tide Foundation
- ▶ Dr. Barry Sherman Institute for Medicinal Chemistry
- ▶ Prof. Dikstein is the incumbent of the Ruth and Leonard Simon Professorial Chair of Cancer Research.

Ron Diskin

- ▶ Estate of Emile Mimran
- ▶ Moross Integrated Cancer Center
- ▶ Jeanne and Joseph Nissim Center for Life Sciences Research
- ▶ Dr. Barry Sherman Institute for Medicinal Chemistry

Eran Elinav

- ▶ Adelis Foundation
- ▶ Estate of Bernard Bishin for the WIS-Clalit Program
- ▶ Leona M. and Harry B. Helmsley Charitable Trust
- ▶ The Morris Kahn Institute for Human Immunology
- ▶ Else Kroener Fresenius Foundation
- ▶ Howard and Nancy Marks Charitable Fund
- ▶ Pearl Welinsky Merlo Scientific Progress Research Fund
- ▶ Daniel Morris Trust
- ▶ Park Avenue Charitable Fund
- ▶ Lawrence and Sandra Post Family Foundation
- ▶ Donald and Susan Schwarz
- ▶ Yael and Rami Ungar
- ▶ The Hanna and Dr. Ludwik Wallach Cancer Research Fund
- ▶ European Research Council
- ▶ Prof. Elinav is the incumbent of the Sir Marc and Lady Tania Feldmann Professorial Chair.

Sarel-Jacob Fleishman

- ▶ Head of the Dr. Barry Sherman Institute for Medicinal Chemistry
- ▶ Henri Gutwirth Fund for Research
- ▶ Stanley and Ellen Magidson
- ▶ Dianne and Irving Kipnes Foundation, Carolyn Hewitt and Anne Christopoulos, in Memory of Sam Switzer
- ▶ Edmond de Rothschild Foundations

- ▶ Schwartz/Reisman Collaborative Science Program
- ▶ Susan and Michael Stern
- ▶ Darlene Switzer-Foster and Bill Foster
- ▶ Sam (Ousher) Switzer & Children
- ▶ Yeda-Sela Center for Basic Research
- ▶ European Research Council

Benjamin Geiger

- ▶ The de Picciotto Cancer Cell Observatory in memory of Wolfgang and Ruth Lesser
- ▶ David and Molly Bloom, Canada
- ▶ European Research Council

Eilam Gross

- ▶ Nella and Leon Benozio Center for High Energy Physics

Eran Hornstein

- ▶ Nella and Leon Benozio Center for Neurological Diseases
- ▶ Edward and Janie Moravitz
- ▶ Prof. Hornstein is the incumbent of the Mondry Family Professorial Chair.

Yael Kiro

- ▶ DeWoskin/Roskin Foundation
- ▶ Paul and Tina Gardner
- ▶ Ilse Katz Institute for Material Sciences and Magnetic Resonance Research
- ▶ Raymond Lapon Fund
- ▶ Isidore C. & Penny W. Myers Foundation

Ilan Koren

- ▶ de Botton Center for Marine Science
- ▶ Scott Eric Jordan

- ▶ Dr. Scholl Foundation Center for Water and Climate Research
- ▶ Sussman Family Center for the Study of Environmental Sciences
- ▶ Bernard & Norton Wolf Family Foundation

Emmanuel Levy

- ▶ Richard Bar Laboratory
- ▶ Blavatnik Award
- ▶ Anne-Marie Boucher and Mitch Garber
- ▶ Merle S. Cahn Foundation
- ▶ Estate of Albert Delighter
- ▶ Estate of Fannie Sherr
- ▶ Zuckerman STEM Leadership Program
- ▶ European Research Council
- ▶ Dr. Levy is the incumbent of the Recanati Career Development Chair of Cancer Research

Nir London

- ▶ Joel and Mady Dukler Fund for Cancer Research
- ▶ The Helen and Martin Kimmel Center for Molecular Design
- ▶ Estate of Emile Mimran
- ▶ Moross Integrated Cancer Center
- ▶ Dr. Barry Sherman Institute for Medicinal Chemistry
- ▶ The Honey and Dr. Barry Sherman Lab
- ▶ Nelson P. Sirotsky
- ▶ Virgin JustGiving
- ▶ Dr. London is the incumbent of the Alan and Laraine Fischer Career Development Chair

Ron Milo

- ▶ Head of the Mary and Tom Beck-Canadian Center for Alternative Energy Research
- ▶ Dr. and Mrs. Brian Altman
- ▶ Larson Charitable Foundation New Scientist Fund

- ▶ Dana and Yossie Hollander
- ▶ Ullmann Family Foundation
- ▶ Zuckerman STEM Leadership Program
- ▶ European Research Council
- ▶ Prof. Milo is the incumbent of the Charles and Louise Gartner Professorial Chair.

Yosef Nir

- ▶ Amos de-Shalit Professorial Chair of Theoretical Physics
- ▶ Estate of Jacquelin Eckhaus
- ▶ Estate of Renne F. Lustig
- ▶ Estate of Marvin Reinstein

Rony Paz

- ▶ Nella and Leon Benozio Center for Neurosciences
- ▶ Estate of Toby Bieber
- ▶ Mr. and Mrs. Gary Clayman
- ▶ Rosanne Cohen
- ▶ Carl and Micaela Einhorn-Dominic Brain Research Institute
- ▶ Philip Garoon
- ▶ Murray H. & Meyer Grodetsky Center for Research of Higher Brain Functions
- ▶ Irving B. Harris Fund for New Directions in Brain Research
- ▶ Leff Family
- ▶ Harold L. and Faye B. Liss Foundation
- ▶ Andrea C. and Lawrence I. Marcus Fund for Emotional/Psychological Disorders
- ▶ Gladys Monroy and Larry Marks Center for Brain Disorders
- ▶ Oster Family Foundation
- ▶ M. Judith Ruth Center for Trauma and Anxiety Research
- ▶ Bernard & Norton Wolf Family Foundation
- ▶ Prof. Paz is the incumbent of the Manya Igel Chair of Neurobiology.

Guy Rothblum

- ▶ Benozio Endowment Fund for the Advancement of Science
- ▶ Blavatnik Award
- ▶ Estate of Albert A. Feldman
- ▶ TVML Foundation MIT-Weizmann Collaboration Fund
- ▶ European Research Council

Eran Segal

- ▶ Adelis Foundation
- ▶ Judith Benattar
- ▶ Crown Human Genome Center
- ▶ Else Kroener Fresenius Foundation
- ▶ Larson Charitable Foundation New Scientist Fund
- ▶ Aliza Moussaieff
- ▶ Fannie Sherr Fund
- ▶ Estate of Zvia Zeroni
- ▶ European Research Council

Amos Tanay

- ▶ Barry and Janet Lang
- ▶ Ilana and Pascal Mantoux Institute for Bioinformatics

- ▶ Edmond de Rothschild Foundations
- ▶ Steven B. Rubenstein Research Fund for Leukemia and Other Blood Disorders
- ▶ Estate of Alice Schwarz-Gardos
- ▶ Wolfson Family Charitable Trust

Igor Ulitsky

- ▶ Nella and Leon Benozio Center for Neurological Diseases
- ▶ Blavatnik Award
- ▶ Minna-James Heineman Stiftung
- ▶ Leff Family
- ▶ Sagol Institute for Longevity Research
- ▶ Estate of Fannie Sherr
- ▶ Willner Family Center for Vascular Biology
- ▶ European Research Council
- ▶ Dr. Ulitsky is the incumbent of the Sygnet Career Development Chair for Bioinformatics.

Shimon Ullman

- ▶ Carolito Stiftung
- ▶ Ethel & Harry Reckson Foundation
- ▶ Prof. Ullman is the incumbent of the Ruth & Samy Cohn Professorial Chair of Computer Sciences.

Flexigon Workshop

- ▶ Mr. Neil Shore
- ▶ U.S. Embassy in Jerusalem

Ofakim Mechina

- ▶ Perlman Family IDF Preparatory Science Education Fund
- ▶ The Gerald Schwartz and Heather Reisman Foundation

coronavirus

/kuh-roh-nuh-vahy-ruh s/

noun, plural co-ro-na-vi-rus-es

any of various RNA-containing spherical viruses of the family Coronaviridae, including several that cause acute respiratory illnesses.

