

FOCUS

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WATERPROOF SUNSCREEN

Marine and freshwater cyanobacteria protect their photosynthesis system from overexposure



Marine and freshwater cyanobacteria protect themselves from over-excitation in strong light by activating the Orange Carotenoid Protein (OCP). The picture depicts three bacteria, one in full sunlight (top, reddish), one in shade (bottom, orange hue) and one in the middle. (Image courtesy of Itay Goldshmid, Macromolecular Research Laboratory).

While we are all familiar with photosynthesis from the plant world, not everyone knows that it is also essential for all living things in the animal kingdom. Even those organisms that do not photosynthesize, do consume its primary product: glucose.

Due to the importance of this process, organisms have developed mechanisms that protect them from overexposure to sunlight. Just as photographic film can be overexposed, natural photosynthetic systems are also liable to damage from overexposure, leading to the organism's death.

Prof. Noam Adir and PhD student Dvir Harris of the Schulich Faculty of Chemistry have now revealed one such defense mechanism. Their study, conducted in collaboration with Dr Diana Kirilovsky's laboratory at I2BC-CEA, France, was published in the prestigious scientific journal *PNAS* in March 2016.

The defense mechanism was deciphered in cyanobacteria (once known as "blue-green algae"). The main player in this mechanism is Orange Carotenoid Protein (OCP). OCP modifies its structure and color in response to intense light, blocking the flow of energy that reaches the center of the photosynthetic reaction.

"In this study we discovered how the OCP blocks the energy," explains Adir, who is the current dean. "In effect, the protein acts as a biological switch. In response to strong light, part of the protein penetrates into the phycobilisome (PBS) — the protein complex that functions as a light-harvesting antenna in the cyanobacteria — and changes the PBS structure, thereby diverting the flow of energy to the reaction centers. According to experiments done by the Kirilovsky lab, this defense mechanism blocks more than 90 percent of the sun's radiation. As soon as the radiation diminishes, the protein returns to its normal state and the flow of energy resumes."

NANO GHOST BUSTERS

Special delivery to combat cancer

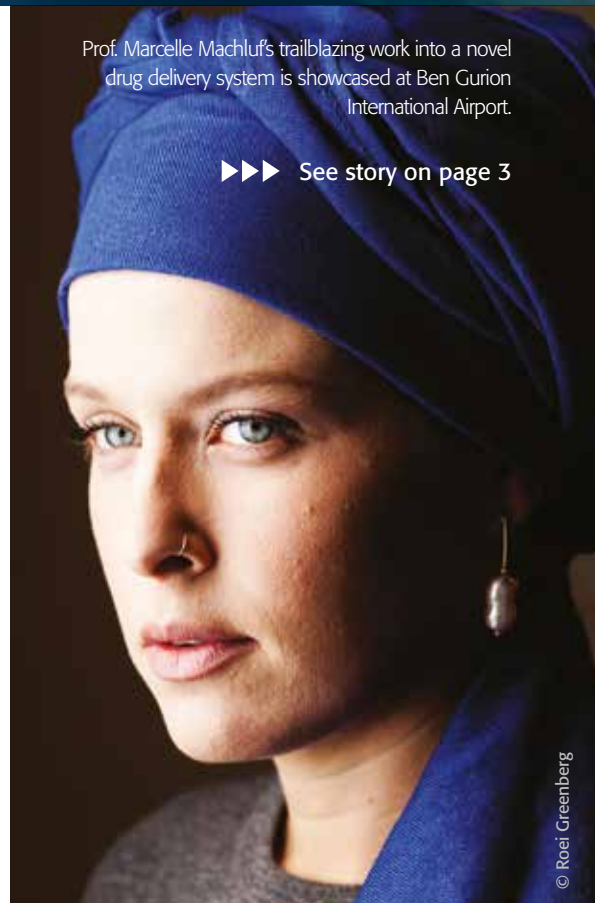
The ultimate goal in cancer therapy is a "magic bullet" that provides a versatile delivery platform for site-specific targeting of multiple compartments of the cancer tissue. Prof. Marcelle Machluf, of the Faculty of Biotechnology and Food Engineering, is leading the way with her novel drug delivery system, using the "nanoghost" as a vehicle to transport the therapeutic to the target cells in a nontoxic manner.

In the Laboratory for Cancer Drug Delivery and Cell Based Technologies, nanoghosts are produced from the cell membranes of naturally targeted mesenchymal stem cells.

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Prof. Marcelle Machluf's trailblazing work into a novel drug delivery system is showcased at Ben Gurion International Airport.

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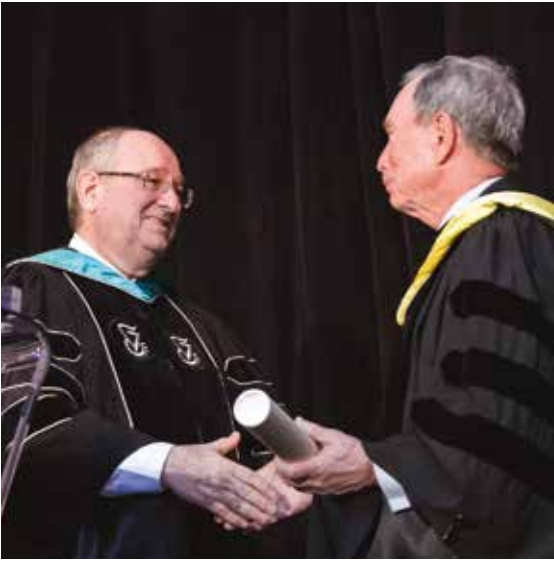
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FROM THE PRESIDENT



(l-r) President Peretz Lavie and Mayor Michael Bloomberg

It is always most gratifying to publicly acknowledge one's patrons, even when their support is not contingent upon such recognition. We were blessed with such an opportunity on March 16, 2016, when we awarded Michael R. Bloomberg, three-term New York City Mayor and philanthropist, with an Honorary Doctorate.

Mayor Bloomberg was honored for his 2011 vision in opening a channel of active collaboration between Technion and New York City, through the selection of the Cornell-Technion bid for the establishment of a new 'School for Genius' on Roosevelt Island.

To build a world-class research institute, you need a visionary leader who can look far into the future. Michael Bloomberg was that person for Technion. Because of his foresight, the Joan and Irwin Jacobs Technion-Cornell Institute today leverages a synergy between its parent institutions to create leaders in New York who will develop innovative technology and solutions to benefit humanity, establishing the City in a leading position for the 21st century and beyond.

Bloomberg reciprocated the compliment when he responded, "The Technion is an incarnation of that quintessential Israeli idea that nothing is impossible. It's an

idea that Israel and New York City share. It's what has made both centers of innovation and invention, and it is what has allowed both to respond to adversity with strength."

That strength is not recognized by Bloomberg alone. Going through our gateway to the world, Ben Gurion International Airport, en route to a convention in Seoul, South Korea, I was proud to witness Technion achievements and alumni innovations among the 60 "Israeli discoveries and developments that have changed the world" selected for display by the Ministry of Science, Technology, and Space. Indeed, we have been able to honor some of these alumni already, such as Rafi Mehoudar and Amit Goffer, and we are giving Dov Moran – inventor of the "disk-on-key" memory stick, an Honorary Doctorate this June during the Board of Governors meeting.

At the International Presidential Forum on Global Research Universities in Seoul, I gave the keynote lecture on "Technion's contribution to society and the economy in Israel." There, I related how Technion, in addition to striving for excellence, has always believed that education and literacy are the main tools to narrow the gaps in Israeli society. More than a century ago, when the Technion vision was merely the province of a few "crazy dreamers," it was already clear that the institution that they sought to establish in Israel would be open to all, regardless of religion, ethnicity, political opinion, or gender. This fundamental principle continues to guide us today, as we invest considerable resources to promoting the integration of minorities at Technion.

And addressing society in the rest of world, Technion is thrilled to have launched a new initiative together with RAVSAK: The Jewish Community Day School Network. In an ever-changing world, we need to find new and relevant ways to connect younger generations of the Jewish people with Israel. What better way to do so than a thought-provoking, fun competition that has a strong STEM education focus? To this end, we initiated the Technion Jewish Day School Challenge. The mission: to build a Passover-themed Rube Goldberg machine – a contraption that is deliberately over-engineered to perform a simple task.

More than 600 students from 41 Jewish day schools – located in Europe, North America, Australia, and Africa – participated in the Challenge. Across the globe, students followed a rigorous rubric, which called for the machines to ultimately reveal a Seder plate – inspired by Technion students' 2015 Rube Goldberg machine that told the Passover story in a most imaginative if convoluted way.

I congratulate all those who participated, and I hope to see them enrolled as Technion students in a few years' time.

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BOARD OF GOVERNORS MEETING 2016

FRIDAY JUNE 3 - WEDNESDAY JUNE 8

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- > Rita Emerson, USA
- > Robert Hanisee, USA
- > Zeev Holtzman, Israel
- > Eyal Kaplan, Israel
- > Stephen B. Klein, USA
- > Dr. Shlomo Markel, Israel
- > Julia and Joshua Ruch, USA

Honorary Doctors

- > Prof. The Hon. Dame Marie Bashir AD CVO, Australia
- > Prof. Jacques Lewiner, France
- > Dov Moran, Israel
- > Ed Satell, USA
- > Dr. David J. Skorton, USA
- > Prof. Edwin L. (Ned) Thomas, USA
- > Eyal Waldman, Israel

Ceremonies & Events

- > President's Reception
- > Harvey Prize
- > Honorary Doctorates
- > Honorary Fellowships
- > Dennis Ross shares insight on US-Israel ties - Modai Lecture
- > Adelis Brain Research Award
- > Technion Salutes the ATS at 75

Highlights

From Iron Dome to David's Sling - A VIP visit to RAFAEL. Meet the Technion alumni behind the best missile interceptors in the world

What's next for women in science?

Innovating innovation - Technion giants speak

Next generation start-up nation: BizTec Entrepreneurship Challenge's best and brightest

FOCUS

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NOTICE OF NONDISCRIMINATORY POLICY AS TO STUDENTS

The Technion admits students of any religion, gender, race, color, national and ethnic origin to all the rights, privileges, programs, and activities generally accorded or made available to students at the school. It does not discriminate on the basis of religion, gender, race, color, national and ethnic origin in administration of its educational policies, admissions policies, scholarship and loan programs, and athletic and other school-administered programs.

NANO GHOST BUSTERS

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Nanoghosts can be loaded with different drugs or genes and retain the selective targeting capabilities of their source cells while leading to tumor growth inhibition. This innovative technology dramatically increases the therapy's efficacy and prevents the side effects associated with existing chemotherapy. Recently, the nanoghost therapy has been proven also as a gene delivery platform to combat cancer.

The clinical application of gene therapy for cancer is still very limited. The prevalent method, which inserts genes into target cells using viruses, may arouse a harsh immune response and still cannot reach the clinical setting.

An article published in February 2016 in *Nano Letters* heralds a breakthrough in the accurate delivery of genes to the target without the use of viruses. Here, Machluf's team report on nanoghosts, loaded with genetic material, that are injected directly into the bloodstream through which they navigate to the tumor. The tumor cells begin to produce an anti-cancer protein only once they reach the target – bypassing healthy tissue en route. The anti-cancer protein affects not only the target cells, but also the



adjacent cancer cells and the essential blood vessels that support the tumor.

Furthermore, since these vehicles do not generate any immune response, there is no requirement to harvest the mesenchymal stem cells from the individual patient.

Animal models have yielded very encouraging data: the mechanism works, doubling life expectancy after the development of prostate cancer, leading to a delay of over 75 percent in the

development of prostate cancer, and of over 50 percent in the case of non-small cell lung carcinoma.

In a new research project, Machluf teams up with Assoc. Prof. Eva Hernando-Monge at NYU Langone Medical Center to investigate the possibility of suppressing melanoma – skin cancer that has spread or metastasized to the brain, and is often incurable – using a novel drug delivery system to the brain.

According to Machluf, "In this study we are checking the possibility of loading nanoghosts with anticancer drugs or molecules that inhibit the expression of protein necessary



Ben Gurion International Airport: Exhibition of scientific discoveries that changed the world, dominated by achievements by Technion researchers and alumni.

© Kobi Gideon/GPO

Gateway to the World

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Check in at Ben Gurion International Airport, check your baggage, and then – on your way to the departure lounge – check out the exhibition wall, staged by the Ministry of Science, Technology, and Space, that presents 60 Israeli scientific discoveries that have changed the world.

Technion researchers and alumni take pride of place among the select developments that affect the lives of billions. Showcased research achievements include the discovery of the ubiquitin system by Nobel Laureates Avram Hershko and Aaron Ciechanover; the discovery of quasiperiodic crystals by Nobel Laureate Dan Shechtman;

the discovery of the rasagiline molecule by Profs. Moussa Youdim and John Finberg, marketed for the last decade as Azilect® for the treatment of Parkinson's disease; SniffPhone mobile technology developed by Prof. Hossam Haick for diagnosing disease based on a breath sample; new technology for targeted delivery of anti-cancer drugs in the body, developed in the laboratory of Prof. Marcelle Machluf; and a robot for spinal surgery developed by Prof. Moshe Shoham. Technion's involvement at the world's largest scientific experiment at the particle accelerator at CERN is also acknowledged.

Technion alumni successes with world impact include the "disk-on-key" flash memory drive by Dov Moran; drip irrigation technology that revolutionized agriculture, developed by Raphael Mehoudar; "camera-in-a-pill" for diagnosing and monitoring diseases in the digestive system innovated by Dr Gabriel Iddan; ReWalk exoskeleton enabling paraplegics to walk invented by Dr Amit Goffer; alumnus Prof. Arieh Warshel's Nobel Prize in Chemistry for the development of multiscale models for complex chemical systems; and Iron Dome antimissile defense system developed largely by Technion graduates.

GNAM STYLE

Yale University's Global Network for Advanced Management (GNAM) international student delegation

Global Network Weeks give MBA students and faculty within Yale's global network the opportunity to pursue intensive study at another network school, leveraging the expertise of that school.

This year's Technion GNAM Week, in March 2016, focused on "Start-up Nation" with an emphasis on the entrepreneurial culture and ecosystem in Israel. Technion's Davidson Faculty

of Industrial Engineering and Management (IEM) hosted 40 affiliated business students from Brazil, China, India, Israel, Mexico, and Japan, as well as Yale (USA).

Prof. Miriam Erez (pictured), an Israel Prize laureate, described the Knowledge Center for Innovation, which she founded. She discussed creativity, innovation, and disruptive ideas, as well as the effect of the national culture on creativity and innovation. From day one, the culturally diverse students worked on a team project of developing new start-ups, which they presented at the end of the week.

Participants also visited incubators and start-ups both in Haifa and in Tel Aviv, and had a chance to meet faculty members, entrepreneurs, and a venture capitalist.



"IEM constitutes a diverse group of researchers living the notion of 'intrapreneurship' at Technion," said Prof. Avishai Mandelbaum, dean.

"The drugs will be able to cross the blood-brain barrier, detect the brain tumor, and attack it directly."

for tumor cell growth and injecting them into the bloodstream. The drugs will be able to cross the blood-brain barrier, detect the brain tumor, and attack it directly. We need to complete the preclinical trials and examine the impact of this technology on humans."

This latest study is one of the first two joint projects in the Langone-

Technion oncology research program, supported by noted philanthropists and NYU Langone Trustees Laura and Isaac Perlmutter.

"Our studies should provide important information on nanoghosts' general value as drug and gene carriers or gene silencing molecules to the brain, and create potential for new treatment approaches against brain tumors and metastases," says Machluf. "The difficulty of delivering agents to the brain represents a major impediment to improving outcomes in patients suffering from brain tumors. Our state-of-the-art nanovehicle promises safer, simpler, and more clinically relevant treatments than existing vehicles, which are comprised of polymers or synthetic vesicles which largely lack the ability to enter the brain and to target evolving and changing pathologies."

Machluf is an affiliated member of the Technion Integrated Cancer Center in the Rappaport Faculty of Medicine. In 2015, she was appointed Deputy Executive Vice President for Research for the Pre-Clinical Research Authority at Technion.

JULUDAN PRIZE AT 30 FOR BIOMEDICAL APPLICATIONS

The Juludan Prize was established in 1984 by three survivors of WWII and the Holocaust, living in the UK. While Julius Tigner, Ludwig Kleiner and Daniel Falkner are now all deceased, Technion celebrated their legacy and generosity for the 30th time, in March 2016.

The Juludan Prize recognizes outstanding scientific research achievements that show promise of having valuable scientific-technological applications and are channeled to enhance man's welfare and prolong the human life span.

Executive Vice President for Research Prof. Wayne Kaplan said, "While Technion was chosen to administer the prize, it is open to researchers from all Israeli universities. Its recipients over the past 30 years are a wonderful example of the great talent and quality of research that Israel has to offer. Another interesting point is the diversity in the fields of research represented. This last point is significant as it represents the true nature of transformative scientific research.

When looking for great discoveries and inventions that influence humanity, one should look for the researchers that work well together in a multidisciplinary environment."

Prof. Marcelle Machluf, of the Faculty of Biotechnology and Food Engineering, was acknowledged for her breakthrough work in a novel drug delivery system and Prof. Alon Wolf, of the Faculty of Mechanical Engineering, was recognized for his research into improvement to gait following total knee replacement surgery.

Michael Kaye, a family member representing the founders, said how much he admires the brains and effort that go into research. He commented that the awardees' strength, bravery, and readiness to gamble parts of their lives to pursuing their research, when the outcome is yet uncertain, are "a perfect memorial to those three gentlemen."

Back to the Future – Could Bicycles be Part of the Answer for Sustainable Cities?

By Gail Lichtman



Could a 19th century invention – the bicycle – be the answer to creating sustainable cities in the 21st century?

According to University of Oregon Prof. Marc Schlossberg – Professor of Planning, Public Policy and Management, co-founder and co-director of the Sustainable Cities

Initiative (SCI), and an executive committee member of the National Institute for Transportation and Communities – the answer is a resounding, “Yes.”

“A sustainable city has to be a livable city,” explains Schlossberg, who recently spent six months at Technion as a Fulbright Senior Scholar. “It has to be an interesting city where different kinds of people should be able to get around easily and interact with others in shared space. It also needs to be a city with a lot of green space.”

“My focus is on transportation,” he continues. “For me, a very important part of transportation in the sustainable city involves the minimization, if not elimination, of CO2 emissions through the use of walking, cycling, and/or mass transit.”

Schlossberg’s teaching and research at UO focuses on sustainable transportation and the redesign of cities for walking and cycling. “My work is applied – not hyper-theoretical. I am interested in working with communities,

policymakers, and academics to rethink how to make new ideas and approaches work.”

In Oregon, SCI developed a pedagogic model to connect communities and universities on a larger scale than normally conceived. “This model takes advantage of existing students and courses and connects them with a city to work on city-identified projects – be it housing, transportation, parks, economic development, et cetera. Every year, we work in a different city. Since 2009, we have worked in five Oregon cities and trained 25 other universities, including Technion, to adopt this model.”

While in Israel, Schlossberg engaged in the same hands-on approach. In addition to guest lecturing in courses at Technion and elsewhere, he took part in organizing a conference, with Technion Prof. Karel Martens, on “Rethinking Israeli Streets,” co-sponsored by the Israel Ministry of Transport and Road Safety, Technion, Tel Aviv University, and the United States-Israel Educational Foundation, which sponsors the Fulbright Israel program. Noting that cities over the last 70 years, both in Israel and other countries, have been built to accommodate cars and not people, Schlossberg put forth the idea of bicycles, which he says are not only eco-friendly and cost effective but also a space-saving mode of transportation.

In the six years since his previous visit to Israel, Schlossberg was struck by the incredible increase in the number of cyclists in Tel Aviv and by the city’s bike rental system.

“The biggest issue preventing more wide-spread use of bikes is non-existent infrastructure,” Schlossberg explains. “There is not one city in Israel where the cyclist is not in competition with the car. You will never get a lot of people to use bikes without better infrastructure. More people would bike if safer infrastructure were available.”

“What is needed are physical barriers between bike lanes and car lanes, which then makes cycling as comfortable on busy city streets as it is on separated trails along the beach. Cities that want to be serious about bicycle transportation must design in this way.”

“More people would bike if safer infrastructure were available.”

“I focus on redesign. If students get training in redesigning cities for bikes, then they will be able to implement it when they become tomorrow’s urban designers.”

Schlossberg also got involved with Technion’s Social Hub for Community and Housing, within the Faculty of Architecture and Town Planning. Two years ago, the Social Hub launched the Urban Laboratory, a multidisciplinary model that gives practical meaning to academic and professional knowledge while at the same time helping cities to solve their problems. Its current project is in Acre (Akko), an ancient mixed Arab/Jewish city that is a UNESCO World Heritage Site.

“The project in Akko is looking at the disparity of living conditions in order to create a multicultural, sustainable city,” says Schlossberg. “The Laboratory is a great applied program and a wonderful opportunity for the community to get access to young minds and fresh thinking.”

INTER-STATE EXPRESS

U.S. Secretary for Transportation Anthony Foxx and a distinguished delegation from the Department of Transportation visited Technion in November 2015, for a brief and informal meeting with a group of professors and students about innovation and research in the field of transportation.

Foxx interacted with faculty, researchers and scholars involved in an array of transport-related issues.



(l-r) Technion President Prof. Peretz Lavie, U.S. Secretary for Transportation Anthony Foxx, Dean of the Faculty of Civil and Environmental Engineering Prof. Oded Rabinovitch, and visiting Fulbright Senior Scholar Prof. Marc Schlossberg



The Smart City: Designed for People

By Gail Lichtman

Are our cities fated to have more traffic congestion, noise, pollution, and parking problems in the future?

Not necessarily, according to Prof. Karel Martens who joined Technion's Faculty of Architecture and Town Planning this academic year, where he holds the Leona Chanin Career Development Chair.

"For years, we have lived with the doctrine that building roads is good for the economy," explains Martens. "As a result, we have designed cities for cars. This is a fundamentally wrong starting point. We need to design cities to serve people. In

the smart city of the future, people will be the focus and all will be able to get around easily, using fewer resources, thus enabling cleaner air and a more pleasant city."

For Martens, transportation, planning, and justice are interlinked. "People need to get around," he notes. "The easier it is to travel, the more convenient our lives and the more we can accomplish. If we cannot get around easily, life becomes more complicated and it can mean that we can't do things we need to do. Poor transportation limits options, sometimes to the extent that it excludes people from full participation in society. So transportation accessibility is an important dimension of justice. And transportation planning is fundamentally about justice."

According to Martens, there are two main transportation issues today. The first is that transportation needs to be much more environmentally sustainable to improve the quality of life in cities. The second issue – which has received much less attention in public debates – is that transportation systems have to serve all. "Right now, these systems are

designed mainly for people who drive cars. Transportation planners often forget those who do not or cannot drive. In many places, there are often no good alternative modes of transportation for non-drivers," he relates. Over the past decades, Israel has set out policies that are fundamentally incompatible. Transportation investment priorities still highly favor road building, in spite of the extension of the railway network. "A transportation system based on cars functions well under conditions of low densities and dispersed destinations. But Israel has exactly the opposite: high urban densities and a high concentration of employment in the country's core."

"Nor does building more roads create a pleasant urban environment," Martens says. "Take a look at Tel Aviv on any given day. It is gridlocked, noisy, and polluted. And the situation will only get worse, because of the road building that is happening on the outskirts of the city, making the car more attractive for residents living in the suburbs. People vote with their feet. When governments build more roads, we end up with more cars and more congestion, leading to calls for even more road building. This is a vicious cycle."

"Government has to change its priorities and policy. It has to realize that it is responsible for providing a transportation infrastructure that serves all people. The car can never serve everybody."

"Public transportation should be given priority. Every main street should have bus lanes, providing a comfortable solution for people without cars and an attractive alternative for households with cars. This high quality public transport system should be supported

by pleasant urban environments that are attractive for cycling and walking."

From 2000 to 2002, Martens was a Lady Davis Post-Doctoral Research Fellow at Technion's Faculty of Architecture and Town Planning. He returns to Technion with substantial international experience in transportation planning and policy. He has published extensively on the nexus between transportation and justice and most recently a book titled *Transport Justice: Designing Fair Transportation Systems*.

Martens says, "My role as a professor is to challenge deeply held assumptions about the design of transportation systems and cities if they are at odds with empirical evidence and with the duties of government. My role is to present alternatives that are in line with that evidence and match the responsibilities of governments. The insights I develop in this way, I pass on to the next generation of transportation professionals, architects, and civil engineers in my teaching. My ambition is to show them how to make our cities and neighborhoods suitable for people and how we can design transportation systems that can serve all citizens."

So how does a Dutch transportation expert end up in Israel? "I came here for love," Martens confesses. "While I was doing my PhD at Radboud University in the Netherlands, I met a lovely Israeli student also doing her doctorate."

Seventeen years and three children later, the Martens family is settling into life here. "Israel is a really nice place to live – if you ignore the transportation and parking problems," he notes with a smile.

"In the smart city of the future, people will be the focus and all will be able to get around easily, using fewer resources."



Boris Johnson, then Mayor of London, test-riding INU at the Google campus when he visited Israel in November 2015.

By Amanda Jaffe-Katz

Promising to be the future of personal green transport for urban commuters, Green Ride is currently working on the fourth prototype of its flagship scooter, INU. Meaning "dog" in Japanese, this faithful companion will be at its owner's side indoors and out, folding up automatically at a single voice command in less than four seconds to be wheeled like a carry-on suitcase on public transportation, in an elevator, or along marble-floored corridors.

Founded in late 2011 by Technion mechanical engineering alumnus Ori Dadoosh and a handful of other engineers, Green Ride has expanded to include some 25 employees –nearly all Technion graduates. They tackle the hardware, software, systems integration, and the predominantly mechanical issues of their novel scooter, with the goal to perfect a portable, durable, and stylish electric personal urban transport solution.

Easy Rider

Alumni start-up offers ultimate commute solution to inner city congestion/parking

The product is sleek. "We want to change the whole user experience," explains Dadoosh, who serves as CEO and CTO. "Our vision is to make INU a must-have lifestyle product, and do for urban commuters what Nespresso did for home coffee machines and the first iPhone did for mobile communications."

INU's main feature is its portability. Another important attribute is its integrated smart communications that can be accessed from the handlebar. The two-wheeler is powered by a lithium-ion battery integrated in the front wheel that can be fully charged in under three hours.

"For me – for all of us here at Green Ride – Technion provided us with the tools more than with the knowledge itself. When you leave Technion, you can confront anything at all – it doesn't matter if it relates specifically to engineering. The army was tough," says Dadoosh, who served in one of Israel's most elite commando units, "but Technion more so!"

Dadoosh says his motivation for becoming an entrepreneur, following some five years employed in high-tech and defense industries, was three-fold. He wanted to integrate an innovative product with science and technology, creating a viable business. With his specialized Technion background in robotics, he knew he could bring this expertise and "become a game changer."

INU was first unveiled in January 2015 at the prestigious Las Vegas Consumer Electronics Show (CES), generating overriding press excitement world-over and wannabe consumers' pre-orders.

Then, in September 2015, the third prototype was shown at Frankfurt Motor Show, resulting in more media coverage as well as stimulating European retailers' interest.

Green Ride hopes to get its first available models on the road, literally, by the end of 2016 or Q1 2017.

Watch this space.

"We want to change the whole user experience."



New faculty member
Prof. Karel Martens

Meyer Excellence Program in Electrical Engineering

By Roberta Neiger

It's not easy to single out and attract the most talented from a pool of students already chosen for their excellence. But that's the *raison d'être* of the Meyer EMET Excellence Program, sponsored by Vincent Meyer and the Meyer Foundation: to identify and recruit the most gifted electrical engineering students, who will go on to perform research, and become worldwide leaders of technology and academia.

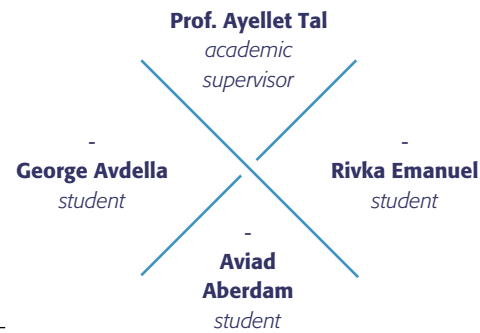
To draw top students to a career in research, the EMET program offers the best research-oriented education, including a broad mathematical, scientific, and technological background, as well as interaction with faculty and graduate students. It also provides Fellows with a generous stipend, freeing them from having to find employment and allowing them to concentrate on their studies.

Prof. Ariel Orda, dean of the Viterbi Faculty of Electrical Engineering (EE), explains that the EMET program

"I am completely satisfied... there is no better place to learn subjects of science and technology."

provides the department with a crucial tool for cultivating research excellence among outstanding students. He expects EMET alumni to play a leading role in shaping Israel's future in academia and in the high-tech industry. In particular, they are projected to become a vital component of future generations of the EE faculty. "This amazing program has been made possible through the generosity of the Meyer Foundation. We are indebted to Vincent Meyer for his remarkable vision and outstanding commitment," says Orda.

"We are looking for students who not only excel in their studies, but are also very curious, creative, and independent."



"The more I study electrical engineering, the more I love it. It's an endless frontier."

"It's so important to meet others who can present options for the future."

Prof. Ayellet Tal, the program's academic supervisor, explains, "We are looking for students who not only excel in their studies, but are also very curious, creative, and independent. These are the students with the greatest potential to become researchers and technological leaders. In this program, we expose them to the various research areas of the department and let them take their first steps in research."

While EE has an impressive number of undergrads, the most gifted are often grabbed by industry at an early stage. This may prevent them from pursuing higher degrees and become leading researchers in the academia or in industry. The EMET program has turned out 27 alumni, of whom 21 continued to graduate studies – 18 within Technion. Six are already PhD candidates: five at Technion and one at Stanford.

Technion has been nicknamed MIT-east and Israel called Silicon Valley II, for good reason. The Israeli high-tech industry's developments, as well as its technological and commercial achievements, are attributed largely to Technion graduates. Within this impressive scenario, EE ranks among the world's top 10 electrical and computer engineering departments, and is the major source of engineers who steer Israeli technology in electronics, computers, and communications.



Students of the Meyer EMET Excellence Program at the entrance to the Andre and Bella Meyer Advanced Technology Center

Three third-year EMET students tell their stories

George Avdella (l) says he must have science and technology in his genes. His mother, who studied math and ultimately became a high school math teacher, worked with him regularly to sharpen his skills in that area. His father, who frequently spoke of his work, was an engineer. George's younger brother, whom he terms "the truly smart one," is also a Technion student. But, guided by the words, "I can and I will," Avdella developed a 'can do' attitude completely on his own.

An Israeli Arab from Jaffa, Avdella now lives in Technion dorms, and says he cannot imagine studying anywhere else. "I am completely satisfied," he says. "The professors and students here are great; there is no better place to learn subjects of science and technology."

Freeing him from financial pressures, the EMET program allows Avdella to give full attention to his studies. Beyond the monetary support, he says, "The program gives me immense motivation."

This 22-year-old student does not know yet which aspect of electrical engineering he will pursue. He plays with the idea of creating a start-up company. The bottom line, he says, is "to develop something new, and to give back to Technion and the EMET Program by succeeding."

Aviad Aberdam (r) wasn't interested in being an excellent student from an early age. Today, though, he sees things differently. "I, like everyone else, now want to push to the extreme of my abilities. This is shared by many people," says Aberdam modestly, though few share his sky-high grades.

While Aberdam is "very happy to have chosen EE," he does not yet know which specific path he will take. "Many things in this field interest me, on the logical and scientific sides." At this point, Aviad is drawn to communications, signal processing and learning systems.

As an EMET student, he is exposed to different alternatives in the field. At monthly meetings, program participants gather to hear professors and grad students describe their work. Says Aberdam, "It's so important to meet others who can present options for the future."

Aberdam, who grew up in Haifa, is an observant Jew. At 27, and the father of two small children, one wonders how he maintains academic excellence and parenting. "It's comfortable being a student and a father," he says, surprised at such a notion. "My hours are flexible and I get to spend a lot of time with the kids. This is the perfect combination."

Rivka Emanuel (center), 24, originally from Chicago, says: "If I do something I'm passionate about, I want to give my all and do the best I can do. The EMET program lets me put 100 percent into my studies."

"Electrical engineering is a very wide field, and the EMET program opened me to many research options. I can go into chip development, signal processing, electro-optics, machine learning, or other areas," she continues. "The only problem is I'm interested in them all. What I know for sure, is that I want to be an electrical engineer and be part of the rapid innovation in this field as it continues to transform our lives."

From a Haredi (ultra-Orthodox Jewish) family, Emanuel discovered at age 14 that she could not blindly accept things on faith alone. "At this point I knew I would not be religious and that my goal was to understand the world from a scientific and engineering point of view." Taking the bold step of returning to Israel, which she had visited, Emanuel arrived at Technion, a decision she terms one of the best in her life. "The more I study EE, the more I love it," she says. "It's an endless frontier."

Too Much Information!

Unique Undergraduate Program in Data Science and Engineering

By Amanda Jaffe-Katz

Historically, the Davidson Faculty of Industrial Engineering and Management (IEM) was the first of its kind in Israel, and most likely worldwide. So, it is no surprise that IEM is again pioneering the way: Providing multidisciplinary training to engineers for the burgeoning field of Big Data, or Data Science and Engineering (DSE) as IEM prefers to call it.

With the accelerated quantity of data being created, improved communications capabilities, and the increased amount of information being stored, the DSE program, conceived and developed at IEM, reflects the shifting ground rules in the world in general, and in the world of computing in particular: Data, information, and knowledge have become an essential part of organizational operations and business strategy. Accordingly, the demand for data scientists is consistently growing, salaries of data scientists are high, and those in the profession are regularly head-hunted.

For many years, IEM has successfully educated graduate students in the field of Data Science, winning numerous awards for their research. Recently, IEM has developed DSE as an undergraduate degree Excellence Program within the faculty. Accreditation from the Council for Higher Education, to recognize the DSE BSc degree track, is anticipated. Such a novel undergraduate program will not only train professionals to work in industry, but will also prepare students for Technion-wide graduate work in Big Data.

Top students are recruited to the DSE program. From day one, they study high-level math, statistics, and programming. Four key areas to data science are addressed: Data Gathering, Management and Storage, Analytics, and finally Visualization and Dissemination of the knowledge created. The multidisciplinary nature of the IEM faculty – with expertise in high-level statistics, operations research, computation and economics, artificial intelligence, cognitive science, and more – enables a broad choice of relevant elective courses.

Most of the required courses already exist, but they are now offered with an added twist of using Big Data sets – ready and available within IEM, allowing students practical access to real data. “Previously, obtaining data was problematic,” says Prof. Avishai Mandelbaum, IEM dean and a central figure in the DSE program; “nowadays, getting data to academia from industry remains somewhat of a challenge, but the focus shifts to what to do with the data once you have it.”

“Getting data to academia from industry remains somewhat of a challenge, but the focus shifts to what to do with the data once you have it.”

“Sometimes, the data we seek to analyze are noisy and often fast changing. Our challenge is to extract added value from the data, and to enable a timely response,” continues Mandelbaum, who holds the Benjamin and Florence Free chair in Operations Research, Statistics, and Service Engineering. Prime examples of data sources are transportation systems and RTLS (Real-Time Location Systems) data. The latter are abundant nowadays, and can be found over a wide variety of locations, from shopping malls through storage systems to hospitals.



Dr Gila Molcho, coordinator of the Data Science and Engineering program, explains the novel track to potential students on open day.

The local industry is already on board, offering scholarships and arranging internships before the elite students even finish their Technion training. This provides undergrad students with a unique opportunity for early hands-on industrial experience.

In addition to Mandelbaum, two faculty members with expertise in data science related areas, Profs. Oren Kurland and Avigdor Gal, serve as the academic co-directors the program.

Tech Talks



Arik Senderovich of the Davidson Faculty of Industrial Engineering and Management, giving his winning talk on “Mining Location Data for the Health Economy.” Senderovich is supervised by Profs. Avishai Mandelbaum and Avigdor Gal.

Inspired by TED talks (short, powerful talks presenting new ideas), the Jacobs Graduate School initiated Tech Talks in February 2016, in the presence of guests of honor Dr Irwin and Joan Jacobs. Four graduate students, representing different faculties, spoke in each of two sessions – Big Data and Cancer – and the audience voted for best talk. First and third place were won by Big Data students.

Cyber Security Research Center

By Amanda Jaffe-Katz



Israel is considered a world leader in cyber security solutions, with exports to the sum of \$6 billion in 2014 – eight percent of the total global market – according to the National Cyber Bureau.

PM Benjamin Netanyahu, writing in Globes in April 2016 on the cyber revolution, declared that, “Everything is penetrable in the cyber era: our personal details, commercial and defense secrets, national infrastructure – anything can be stolen, disrupted, and destroyed. The worst cyber attacks against organizations and countries in recent years around the world have taught us an obvious lesson – cyber defense is an essential condition for national security and economic growth in the 21st century.”

“We are therefore fostering an environment of cyber innovation in cooperation with government, academic institutions, and industry,” he continued.

And indeed, Technion’s Cyber Security Research Center was inaugurated in April 2016.

Dr Eviatar Matania, Head of Israel’s National Cyber Bureau, Prime Minister’s Office, said at the opening that Technion was the first institute of higher learning approached about the project. “We approached Technion about establishing a center of this caliber because of its reputation for excellence,” he said. “Its academic capabilities, along with its technological prowess that has placed it among the top leading institutes of the world, promise that the cyber field will advance in new directions.”

Matania also said that he views cyber as an enabler that provides an opportunity for economic and social growth. “From my acquaintance with the brilliant minds that have come together to found this center, I am certain that it will become a top leading cyber security research facility that

will contribute greatly to the field,” said Technion President Prof. Peretz Lavie.

Head of the Center Prof. Eli Biham, who holds the Joseph Israel Freund Chair in the Faculty of Computer Science, described the proposed scope for the center.

It will involve several faculties and collaborations with other Technion research centers, including Technion Computer Engineering (TCE), Technion Autonomous Systems Program, and others.

Biham, a world-renowned expert in cryptography and cryptanalysis explained, “We must promote interdisciplinary research that relies on the capabilities of the Technion. The study topics will focus on security and explore the weaknesses that endanger systems and methods of protection. The center will foster

awareness of these issues and keep engineers working in cyber security abreast of the latest developments in the field. We invite industry collaboration and will be happy to host researchers and postdoctoral fellows from Israel and abroad.”

“The study topics will focus on security and explore the weaknesses that endanger systems and methods of protection.”

PAINT IT BLACK

Recycled painted soda cans and the desert sun create sustainable central heating for village

By Amanda Jaffe-Katz

When you think of the desert, you first conjure up images of heat. But in Israel's Negev, the harsh climate also includes uncomfortably cold winters.

So, when the Negev group of Technion's Engineers Without Borders (EWB) led by Angel Sussman established contact with the Bedouin settlement of Abu-Ashibe, and learned how this off-grid community would most appreciate a safe and easily obtainable means to heat the village kindergarten, the student team set about finding an optimal solution.

"We spoke to members of the community and understood that their biggest concern was heating and cooling, especially at their poorly insulated early childhood education establishments that particularly suffer in the cold months," tells Sussman, who has just completed her BSc in environmental engineering. "We visited three different kindergartens and heard the same story at each. The teachers have to be very creative and find activities that will warm the children sufficiently during the day."



EWB-Negev leader Angel Sussman on site with local children of the Abu-Ashibe Negev community.

"Being group leader gave me purpose, and I could use what I studied in a meaningful way."

"We started to look for easy to build systems, using simple materials, but also something that is environmentally friendly and cheap," adds Sussman's successor as team leader, Alon Avidor, a 3rd-year student in the Faculty of Materials Science and Engineering. "Our system is based on an idea used successfully in Canada."

The group set to work, built, and tested two prototypes at Technion. Using empty soda cans, mainly contributed by the Technion Students Association, painting them black and assembling

them in a wooden frame, the students – all of whom are volunteers – erected the first prototype on the roof of the Sherman Environmental Engineering Center. Even on cloudy days in Haifa, which enjoys less sun than southern Israel, the system worked to increase the temperature of the air passing through it.

The second prototype already employed scale-up. It was not only larger but was also tested in an "experimental room" provided by the Faculty of Civil and Environmental Engineering. The team added a data logger to keep track of the data round the clock. Matteo Laterza, a PhD student in aerospace engineering from Italy, was responsible for making all the necessary calculations.

In December 2015, the EWB team erected six individual systems on site at the Abu Korinat kindergarten. After three construction visits, in which many of the local residents including the youngest of children helped, the system is fully operational since March 2016 and brings hot air into the building. The teaching staff can control

each of the systems separately, from the inside. "We are now in the monitoring phase and collecting data to compare to our theoretical calculations," says Sussman. "We want to be thorough and we'll create a manual once everyone is satisfied with the results."

There are currently some 15 members of the Negev group, founded by environmental engineering student Meiron Zollman, who come from a wide range of engineering disciplines as well as architecture. Meetings are conducted in English, since many volunteers are international.

"Most members – myself included – stay on with the group in some capacity even when no longer at

Technion, because we feel that we are doing something good," says Sussman. "I loved it more than anything else I did at Technion. Being group leader gave me purpose, and I could use what I studied in a meaningful way. It gives an amazing perspective on life as well as on engineering."

"Giving time to the group and its goals moves beyond all logic and becomes a passion," adds Avidor. "The group is more than the sum of its individual

members, and we expect it to continue long after we leave Technion."

The group's activities are supported by the nonprofit AJEEC-NISPED (Arab-Jewish Center for Equality, Empowerment and Cooperation – Negev Institute for Strategies of Peace and Development) as well as the Abu-Ashibe community. "You can't achieve anything unless the community is excited about it," the student leaders conclude.



The solar heating system is constructed from used soda cans, later painted black.

Autonomous Vehicle Competition

Hundreds of students from Argentina, Israel, Mexico, Russia, Ukraine, and the USA participated at the Nadav Shoham RoboTraffic Competition held at the Technion in March 2016. Competitors program small autonomous vehicles to drive safely along a track simulating road conditions. The overall goal is to provide young drivers with the knowledge and skills necessary for safe driving, to minimize their involvement in road accidents.

Nadav Shoham was an engineer and Master's student at the Faculty of Mechanical Engineering, who lost his life in a devastating snowstorm in Nepal. "Nadav loved to watch the teams compete and regularly attended the competition each year," said Prof. Moshe Shoham, Head of the Leumi Robotics Center and father of the late Nadav. "He especially enjoyed viewing the designs of the school-aged children and teenagers from Israel and around the globe, and appreciated their abilities to build complex systems and their creativity already from an early age. Naming the competition after him honors his engineering talent, curiosity for technology, and volunteering spirit working with youth over many years."

