

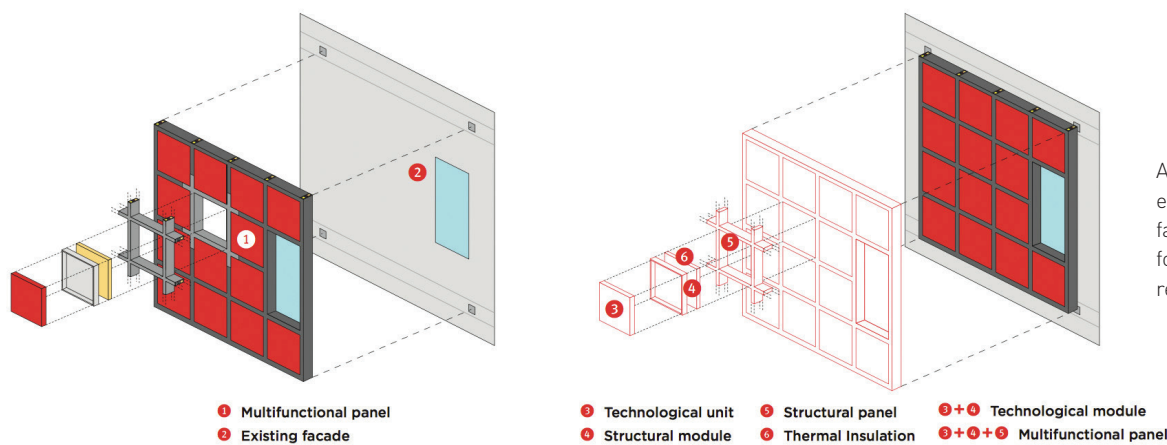
SCIENCE OF SUSTAINABILITY

By Rebecca Kopans

Sustainability has become an international mantra, expressing hope that a looming disaster can be averted if only everyone would behave more responsibly. In almost every aspect of our lives, it is essential to improve current standards in order to meet reasonable goals of sustainability. Technion is determined to take the reins in this area – prioritizing scientific research in relevant fields and breathing life into its Green Campus initiative. Many of the challenges

of sustainability are scientific and at Technion, scientists and researchers are anticipating the future with basic research and applied ingenuity.

From alternative energy to waste management, ecological architecture, 'green' transportation, eco-friendly food and more, Technion researchers are engineering new forms of global responsibility.



A multifunctional energy efficient façade system for building retrofitting

Life Cycle Assessment

At the Faculty of Civil and Environmental Engineering, Prof. Sabrina Spatari is an expert in Life Cycle Assessment. This is an analytical framework used for evaluating environmental impact which supports decision-making, especially when selecting materials for manufacturing products. The technique evaluates all stages of a product's life: raw material extraction, materials processing, production, distribution, use, repair and maintenance, and disposal or recycling.

"In the last 10-15 years, Life Cycle Assessment has been used to set energy policies in the U.S. and Europe, for example with the goal of replacing gasoline with renewable fuel," Prof. Spatari explains. "We look at the fuel's full life cycle, including the

energy used for extraction, the resources consumed and the emissions to the environment."

Prof. Spatari researches sustainability issues in a variety of fields, including 'green' transportation, construction and electricity. She recently published a paper on "Life Cycle Environment and Cost Implications of Isostearic Acid Production for Pharmaceutical and Personal Care Products" in the journal *ACS Sustainable Chemistry & Engineering*. Having recently moved to Israel, Prof. Spatari sees the potential to greatly decarbonize Israel's economy through investment in solar energy in its buildings within cities.

Prof. Sabrina Spatari holds a Women's Division Career Advancement Chair.



Prof. Sabrina Spatari



Prof. Guedi Capeluto

Zero-energy buildings

"Thirty years from now, Israel's population will double, and we must therefore double the physical space. The challenge lies in both the quantity and the quality," says Prof. Guedi Capeluto of the Faculty of Architecture and Town Planning. Prof. Capeluto is a former Chair of the Architecture Program and has been involved with sustainable architecture for many years. "We must plan buildings that are energy efficient," he says.

"My dream is that we will have a zero-energy campus by 2030"

Working on a national and global level, Prof. Capeluto is a founder of the Climate

and Energy Laboratory and a member of the Israeli Climate Change Information Center. He has developed the official Energy Rating System for Buildings in Israel, which ranks buildings according to their expected energy performance and which is used in order to accredit green buildings. "Buildings must be planned with maximum natural lighting and minimum pollution," he maintains. Prof. Capeluto has also helped develop several innovative systems to improve the energy efficiency of existing buildings. He was recently involved in an international consortium that designed a multifunctional energy efficient façade system for retrofitting buildings. Another project uses a lightweight structural mesh system to save as much as 60% of a building's energy. Both systems are currently being tested at sites in Europe.

"Technion can be a leader in this field. We have an opportunity to lead change and put Technion on the map as a sustainable institution," asserts Prof. Capeluto. "My dream is that we will have a zero-energy campus by 2030. We must insist that all new Technion buildings meet green standards." Since Technion trains Israel's future

architects and urban planners, he believes it is imperative for all students to be exposed to the subject as much as possible during their studies. He is especially proud of the fact that there is now a leading Master's program in Green Architecture offered at the Faculty.

Green transportation

Prof. Karel Martens, Chair of the Urban and Regional Planning program at the Faculty of Architecture and Town Planning, approaches the field of sustainability through the lens of justice. In his research, he develops a new approach to transportation planning. In contrast to the traditional method, Martens' approach does not aim to optimize the functioning of the transportation system but, rather, seeks to provide a



Prof. Karel Martens

well-functioning transportation system that serves everyone, irrespective of people's abilities, income or background.

Prof. Martens believes that Technion should be a leader in socially responsible transportation. "The university should give clear preference to green modes of transportation by making the campus more convenient for pedestrians, giving priority to buses and providing incentives for faculty and students to leave their cars at home," he asserts, adding that, "Parts of the campus could be closed to traffic and parking lots can be moved away from buildings in order to make car use less attractive."

footprint, contamination and animal death which comes with conventional meat production. Thanks to Prof. Levenberg's pioneering work, Technion is part of the global effort to develop sustainable alternatives to animal meat.

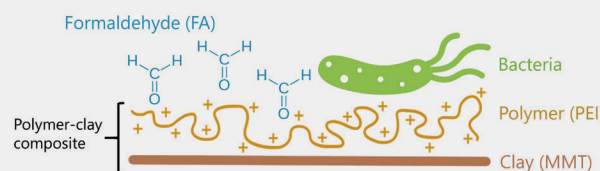
Prof. Shulamit Levenberg is holder of the Stanley and Sylvia Shirvan Chair in Cancer and Life Sciences.

formaldehyde decomposition, the material cleans itself for another round.

The research was led by Prof. Adi Radian and Ph.D. student Yael Zvulunov of the Faculty of Civil and Environmental Engineering, in collaboration with Prof. Ayelet Fishman and Dr. Zohar Ben-Barak Zelas of the Faculty of Biotechnology and Food Engineering. The team's findings were recently published in the *Chemical Engineering Journal*.



Prof. Adi Radian



According to Prof. Radian, the development may also be relevant for other uses, such as adsorption and degradation of pesticides that threaten to contaminate groundwater. The study was supported by the Russell Berrie Nanotechnology Institute (RBNI) at Technion and the Israeli Ministry of Science and Technology.

Prof. Adi Radian is holder of the Andre Deloro Career Advancement Chair in Engineering.

GTEP Grand Technion Energy Program

Power of the Future

The Nancy and Stephen Grand Technion Energy Program (GTEP) has been shining a spotlight on sustainability issues at Technion since 2007. A multidisciplinary research and education initiative, GTEP unites experts from around the world and inspires sustainable solutions for the global energy challenge.

One of GTEP's most impressive outcomes is the recent establishment of the start-up H2Pro, which developed an innovative production technology for the wide-scale adoption of sustainable hydrogen fuel (See Page 1). Other GTEP breakthroughs include photoelectrochemical cells that promise renewable, clean production of energy from sunlight; developments in heterogeneous catalysis; alkaline fuel cells and many others.

"The program has had a big impact on campus," asserts GTEP director Prof. Yoed Tsur of Technion's Wolfson Faculty of Chemical Engineering. "Today there are dozens of faculty and students involved in sustainability-related research."



GREEN CAMPUS INITIATIVE

The Technion Sustainable Campus Initiative is thriving, with plans to upgrade environmental awareness at Technion through teaching, research and institutional performance. The initiative is headed by Prof. Daniel Orenstein of the Faculty of Architecture and Town Planning, who is a world expert in ecosystem service assessment and environmental policy in the face of ecological change.

Prof. Orenstein's mission is for Technion to provide an exemplary model for national and global sustainability through its educational and research programs and its institutional behavior. "The university is committed to taking steps. Since last spring, the Green Campus initiative has been reinvigorated, with more funding," he notes.

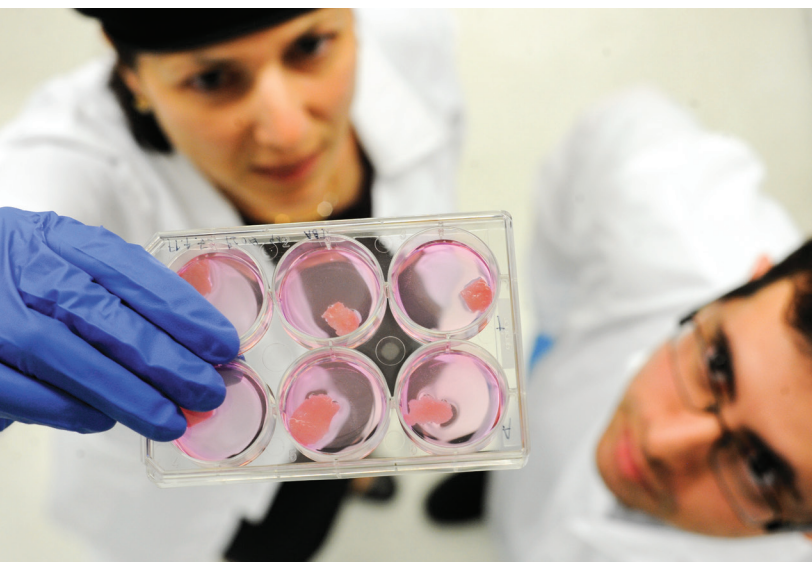
Courses focusing on sustainability issues are increasingly being offered in all faculties, and efforts are being made to create new classes on these subjects in departments where they are currently lacking. Prof. Tali Tal, head of the informal science and environmental education research group at the Faculty of Education in Science and Technology, is spearheading efforts to prioritize environmental education.



Prof. Daniel Orenstein

Prof. Orenstein also seeks to elevate the exposure of Technion researchers who are involved in scientific research related to the environment and sustainability. "The knowledge is here," he stresses, adding that Technion has relative advantages in a number of relevant fields.

As far as the campus itself is concerned, Prof. Orenstein admits that there is still a long way to go, but he is optimistic. Student initiatives, such as a special course on climate change organized by doctoral student Orr Gallant, are receiving greater attention and encouragement. Moreover, a long-term plan has been formulated with the aim of significantly improving Technion's performance as a green leader. New guidelines will rid the campus of single-use plastics, encourage composting, and favor more efficient energy use and waste flow systems – among other goals.



Prof. Shulamit Levenberg is developing the next generation of laboratory-produced meat

Laboratory-produced 'clean meat'

Environmentalists lament the fact that greenhouse gases produced by the meat industry are responsible for more emissions than all methods of transportation combined.

Prof. Shulamit Levenberg, Dean of the Faculty of Biomedical Engineering, is the chief scientific officer of Aleph Farms, a Technion research-based start-up aiming to produce the next generation of laboratory-produced meat. An expert on tissue engineering, she is responsible for important breakthroughs in producing human tissue outside the body for use in restoring damaged tissue. Taking this technology one step further, Prof. Levenberg and her colleagues were able to create a steak from bovine cells. Slaughter-free meat involves taking a sample of cow cells and replicating them outside of the animal: without the antibiotics, environmental

Wastewater purification

Researchers at Technion have developed an innovative technology for the cost-effective removal of formaldehyde from wastewater.

Formaldehyde is used in the production of glue and is common in the wood, paper and textile industries. Since removing formaldehyde from water is very expensive, some companies simply keep the contaminated water in barrels, waiting for the day that a satisfactory solution is discovered. The material developed by the Technion team is based on montmorillonite clay that has been modified using a polymer that changes the overall negative charge to positive. Thanks to this modification, the clay absorbs the formaldehyde and reduces its concentration. Bacteria that break down the substance are pre-attached to the material. After each cycle of