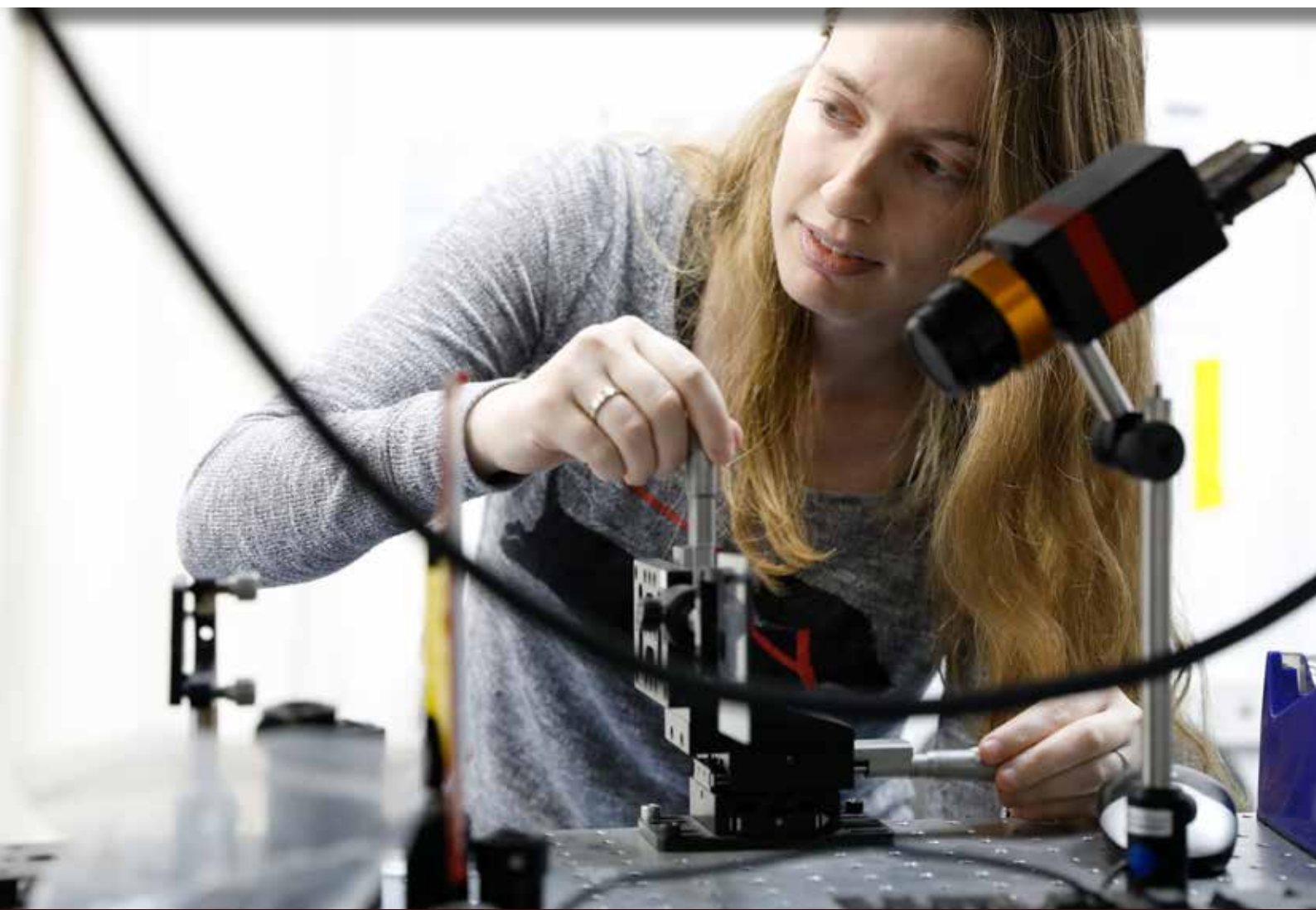


Tel Aviv University Center for Nanoscience & Nanotechnology

SCIENTIFIC REPORT 2018



Tel Aviv University
Center for Nanoscience
& Nanotechnology

Tel Aviv University Center for
Nanoscience & Nanotechnology

Powering Innovation



Tel Aviv University
Center for Nanoscience
& Nanotechnology

Center for Nanoscience & Nanotechnology

SCIENTIFIC REPORT

December 2018

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OVERVIEW

Tel Aviv University's Center for Nanoscience and Nanotechnology was established in 2000, as the first Israeli institute of its kind. Today, with over 100 affiliated research groups, it is one of the largest and most influential centers on campus. Employing its own professional staff of researchers and scientists, it runs a state-of-the-art central facility, and organizes international schools with leading researchers, as well as student exchange events and seminars.

Pioneering a novel multidisciplinary approach, the Center houses a variety of laboratories from entirely different domains, all working side by side under one roof. In addition, it has established strong, longstanding ties with industry, providing extensive services to a growing number of companies – from small startups to large corporations. 18 years of constant growth have thus positioned the Center as an important asset to both the TAU research community and the Israeli industry.

We hope you will find the information in this Report useful for identifying new partnerships, resources and ideas. Comprehensive and constantly updated information about the Nano Center is available on our website at <https://nano.tau.ac.il>.

Hubs of Innovation

The Chaoul Center for Nanoscale Systems

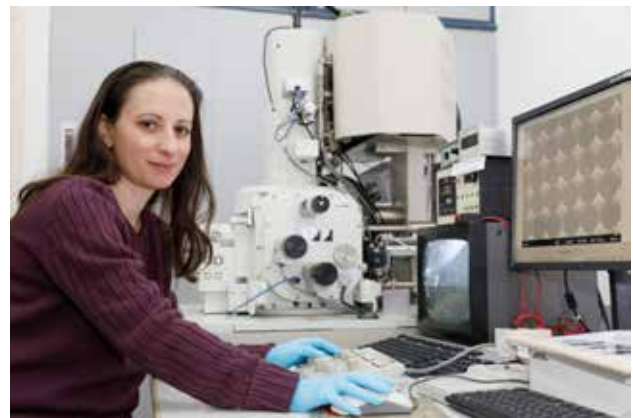


The Center for the Manufacturing and Characterization of Nanoscale Systems at Tel Aviv University, first opened in 2007 and recently re-inaugurated as the Chaoul Center for Nanoscale Systems, is Israel's leading facility of its kind. The Center provides the country's nanotechnology community, in both academia and industry, with access to the field's most advanced R&D services, knowledge and equipment. TAU's new Nanotechnology building, presently under construction and scheduled to open in 2021, designates a special, substantial space for the Chaoul Center and its state-of-the-art devices.

More than 50 academic groups and over 40 companies – from large Israeli corporations to small startups in their earliest stages, currently use the Chaoul Center's professionally managed laboratories, which offer outstanding infrastructures (thanks to a multimillion-dollar investment by both the Israeli government and TAU). The labs' process engineers offer researchers and corporations comprehensive

prototype development services, from small-scale predefined runs to large R&D projects and full-process development, conducted jointly with the customer. Services – including characterization, device design, mask preparation, sample fabrication and backend – are continually improved and expanded, as we add standard operating procedures for more systems, and offer them online.

The Chaoul Center's equipment is among the most advanced and comprehensive in Israel, spanning many types of fabrication methods, and enabling the development of full-process prototypes. Capabilities and technologies at the labs include mask design and fabrication, optical lithography and e-beam lithography, as well as backend techniques such as wire bonding and dicing. Our new laser-cutting and machining system is the first of its kind in Israel. Other novel devices include: an E-beam Evaporator and a Magnetron Sputter, both from Vinci Tech, France, a RAITH150Two – a state-of-the-art Ultra High Resolution Electron Beam Lithography system, which helps realize structures at 5 nm and works with sample sizes from a few mm to 8-inch wafers. A new operational system, BookitLab, was incorporated in 2018 in order to efficiently manage the scheduling, monitoring and financing of the Chaoul Center's services.



International Collaborations

XIN Center

In 2014 the elite Chinese University Tsinghua (THU) of Beijing teamed up with Tel Aviv University to launch XIN Center, a joint venture aiming to power innovation via ties between top Chinese and Israeli researchers in the fields of Nanoscience and Nanotechnology.

The XIN (meaning New in Chinese) Center focuses on collaborative, high-impact applied research, promoting over a dozen applied research programs at both TAU and THU. A unique mentoring system is applied, whereby leading scientists, industrialists and business figures accompany projects throughout all stages of research, combining internal and external resources from both Israel and China. Emphasis is placed on projects conducted jointly by researchers from both universities.

Two joint ISF-NSFC grants for collaborating TAU and THU researchers, who had joined forces through the XIN Center, were approved for 3-year funding starting at the end of 2016: Prof. Daniel Segal of TAU and Prof. Yan-Mei Li of THU won the grant for research on 'Rationally designed glycosylated amino acids as modulators of amyloid aggregation in Alzheimer's Disease'; and Prof. Itai Benhar of TAU and Prof. Xin-Hui Xing of THU won the grant for research on 'Choosing sides for antibody-low-molecular-weight-heparin conjugates applied as novel drugs for treating Inflammatory Bowel Disease'.

Over a dozen PhD and post-doc students from both universities have already participated in exchange visits. In addition, MSc students

from TAU participated in 'Experiencing China – Tsinghua Summer School 2018', which took place in Beijing in July. More recently, PhD students from TAU were hosted by THU's research laboratories.

A delegation of 20 researchers, PhD students and top executives from TAU took part in the 2018 XIN Innovation Forum, held at Tsinghua University on October 9-11. More than 100 experts, entrepreneurs, investors, government representatives and leading industrialists attended the Forum, exchanging views and conducting in-depth discussions on technological innovation and cooperation between China and Israel. During the Forum, teachers, students and Chinese and Israeli research teams reported on beneficial joint projects in the fields of medicine, life sciences, energy, the environment and materials.

Germany-Israel Academia-Industry Nanotechnology Grants

In 2017 Israel and Germany set up a new three-year €30-million plan to promote joint nanotechnology initiatives, calling upon companies and institutions in both countries to submit proposals for funding for projects in this field. Initially supporting 13 joint projects, the program aims to boost cooperation between nanotechnology companies and research centers in Israel and Germany. Five TAU researchers affiliated with the Center – Prof. Yossi Rosenwaks, Prof. Natan Shaked, Prof. Yael Hanein, Prof. Yuval Ebensein and Dr. Ariel Ismach – won five of the initial 13 grants.



Beijing Institute of Technology (BIT)

In 2016 TAU signed a collaboration agreement with the Beijing Institute of Technology (BIT), one of China's leading Universities. Since then joint research projects have been established, mainly in the field of Nano-Energetic materials. A special 'Tel-Aviv University Day' held on the BIT campus in Beijing on September 12th 2017, provided TAU scientists with a unique opportunity to introduce their research to BIT lecturers and students.

A delegation of five students from TAU's **Center for Nanoscience and Nanotechnology** and **Shlomo Shmeltzer Institute for Smart Transportation** attended the Innovative Vehicle course held at BIT in August 2018. The program's participants, 140 students from 13 different countries, heard lectures from researchers in the field of smart transportation and toured automobile factories, including the facility of Beijing Benz Automotive. In the final event, participants were divided into groups of students from different countries, who competed in the design of autonomous miniature vehicle. The group that won first place, based on design, quality and speed, was headed by the Israeli student Eyal Rosenberg of Tel Aviv University.

Tel Aviv University-Northwestern University Nanoscience and Nanotechnology Initiative

In 2018, thanks to a new donation from Mr. Roman Abramovich, the Nano Center launched the Tel Aviv University-Northwestern University Nanoscience and Nanotechnology Initiative.

The Initiative aims to bring together scholars, scientists, engineers and students from both universities for exchange and research in the fields of nanoscience and nanotechnology, thereby facilitating a robust synergy and cross-fertilization of ideas. Ultimately, the joint venture intends to advance R&D activities, leading to economic growth in both countries. The initiative includes: postdoctoral fellowships, student exchange programs, an annual nanoscience and nanotechnology workshop and joint research grants.

Educational Activities

TAU's Center for Nanoscience and Nanotechnology organizes a range of social and scientific activities, including an annual workshop, monthly seminars, a Nano-MBA seminar, monthly Nano-Beer events, student exchange programs and more. Major activities in the years 2018-2019 include:

UK-Israel Summer School on Nanoscale Crystallography for Bio and Materials Research

June 2018, Tel Aviv University

This Summer School was dedicated to the crystallographic characterization required for nanotechnology research, with a balanced view of nanoscale structural characterization for both the life sciences and materials science. The scientific program emphasized nanoscale characterization via electron microscopy (TEM and SEM) and related methods. The Summer School's organizers were Dr. Zahava Barkay and Prof. Amit Kohn of TAU and Prof. Ben Britton of Imperial College.



Northwestern University–Tel Aviv University International Winter School on Nano Materials for Energy Conversion and Storage

January 2019, Tel Aviv University

Our 2019 Winter School, January 14-17, will focus on Nanomaterials for Energy Storage and Conversion. The Winter School is supported by the XIN Center at the TAU Center for Nanoscience and Nanotechnology and by the new TAU-Northwestern Initiative.

Main topics include: battery and super capacitors, fuel cells and SOFC, solar fuel/synthetic fuel, and industrial product Innovation. The school will include lectures by leading researchers and a student poster session

The Winter School's organizers are Dr. Brian Rosen and Prof. Michael Gozin of Tel Aviv University.

INTERNATIONAL WINTER SCHOOL 2019 on:
NanoMaterials for Energy Storage and Conversion
 January 14th-17th, 2019
 Tel Aviv University, ISRAEL

The meeting is expected to provide a wide scientific network for the workshop attendees. We hope you'll join us at Tel Aviv University for sharing new research opportunities! Travel grants are available for non-Israeli PhD students.

Speakers (partial alphabetic list):
 Scott A. Barnett, Northwestern University
 Fikile Brashett, MIT
 Jaephil Cho, UNIST
 Rajiv Dasane, IITB
 Kimberly A. Gray, Northwestern University
 John Irvine, University St. Andrews
 Matthew Kanai, Stanford University
 Kisuk Kang, Seoul National University
 Paul Kenis, University of Illinois at Urbana-Champaign
 Sagar Mitra, IITB
 James Rondinelli, Northwestern University
 Yang-Kook Sun, Hanyang University
 Jang Wook Choi, Seoul National University
 Atsuo Yamada, The University of Tokyo

Organizers
 Prof. Michael Gozin
 and Dr. Brian Rosen

The workshop is supported by XIN Center, Israel Ministry of Science, Technology and Space and Tel Aviv University – Northwestern University Nano Initiative

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<http://nano.tau.ac.il>

The Fred Chaoul 12th Annual Workshop on Nanoscience and Nanotechnology

February 19-21, 2019

The workshop will take place on February 19-21, 2019, at the Dead Sea in Israel. Attended by faculty members, technical staff and research students from TAU, the workshop aims to promote scientific cooperation among TAU scientists, and empower our young researchers. This get-together continues a long tradition

first launched in 2001, which has benefited considerably from the participation of prominent international speakers such as David Weitz, Viola Vogel, Alex Zunger, Kurt Urban, Peter H. Seeberger and others.

Nano-MBA Seminars

Research in the field of nanotechnology has great potential for future applications in a wide range of industries. In order to help our students and researchers realize this potential, we have developed a 6-session program on the prospects and challenges of the business/entrepreneurial arena. Lectures, given by experts on each subject, address a variety of topics: assessing the market potential of an innovation and identifying barriers to commercialization; IP strategies and management; regulatory requirements; establishing startup companies and licensing agreements; resources for financing innovations; managing R&D projects – milestones, junctions and case studies of successes and failures.

Intersecting Pathways

In 2014 the TAU Center for Nanoscience and Nanotechnology and the Amit Foundation established the Intersecting Pathways project, bringing together outstanding Torah scholars and top academic scientists for a joint learning experience on Science and Ethics. The project builds a unique and surprising bond that facilitates curiosity, friendship and scholarship. Over 75 such meetings have already taken place, attracting more than 40 frequent attendees.

School Visits

The Nano Center regularly hosts and guides groups from k-12 schools from all over Israel, in order to enrich knowledge on nanotechnology and promote scientific excellence among the country's younger generation. At TAU's advanced nano facilities our young guests view cutting-edge experiments from the forefront of modern science.

Roman Abramovich Nanoscience and Nanotechnology Building

To fulfill the growing needs of both the Nano Center and TAU's research community, and thanks to the magnanimous support of Mr. Roman Abramovich, the Roman Abramovich Nanoscience and Nanotechnology Building will be built in the near future. The new building has been designed by well-known French Architect Michel Remon. With its original metal/polymeric shell, resembling the nano-structure of a symmetric nano-fabric, the building will form a spectacular new entrance to the University – right next to Gate 2, behind the Diaspora Museum (Beit Hatfutsot). A tender for excavation and construction is currently underway.

The modern 7, 100m² building, offering cutting-edge labs, equipment and research services, will include a basement, an entrance floor and two upper floors. The entrance floor will house

the Chaoul Center for Nanoscale Systems (about 600m² of clean rooms), alongside offices; the upper floors will include 16 core research laboratories, a 100-seat auditorium, offices and team rooms; and the basement will contain facility rooms and a sub-fab stabilizing the state-of-the-art devices of the Chaoul Center for Nanoscale Systems.

Altogether, about 120 engineers and researchers from both academia and industry will use the building as their main hub. A special space will be dedicated to collaboration between the Center's researchers and their guests. Also accessible to the general public, the building will invite visitors from the community to experience cutting-edge science firsthand.



Research Collaborations with Industry in Israel and Abroad

New Ventures

New startup companies based on the innovations of researchers from the TAU Nano Center are constantly being established.

New venture of 2018:

- Galimedix Therapeutics Inc. (Prof. Ehud Gazit) – EG30 for the treatment of Alzheimer's Disease

Agreements with Industry

A considerable number of TAU nanotechnologies have been transferred to industry through license/assignment agreements. In 2018 these included:

- Valentis Nanotech Ltd. (Prof. Shachar Richter) – Super Organic Tunable and White-Light Emitting Diode (OLED) by a Natural Chromophore Separation Matrix
- Biosynth AG (Prof. Doron Shabat) – Chemiluminescent probes for diagnostics and in vivo imaging
- BioCastle Water Technologies Ltd. (Prof. Hadas Mamane and Prof. Dror Avisar) – Oxidative bio-reactor for water treatment
- Applied Biological Materials Inc. (Prof. David Sprinzak) – CHO-N1G4-citrine cell line
- Biosynth AG – Nemis Technologies (Prof. Doron Shabat) – Chemiluminescent probes for diagnostics and in vivo imaging
- BioNTech RNA Pharmaceuticals GmbH (Prof. Dan Peer) – Novel ionizable lipids for delivery of nucleic acids
- BioVision Inc. (Prof. Doron Shabat) – Chemiluminescent probes for diagnostics and in vivo imaging
- ART Bioscience Ltd. (Prof. Dan Peer) – Novel ionizable lipids for delivery of nucleic acids (mRNA, DNA, siRNA)
- Lonza Sales AG (Prof. Itai Benhar) – Bi-specific antibody platform

Recruiting Affiliates and Post Docs

The TAU Nano Center benefits from a vibrant community of nearly one hundred excellent principle investigators and their teams. Over 30 of our affiliates are new recruits who joined Tel Aviv University in the past decade, primarily through the resources put forward by

the Israel National Nanotechnology Initiative (INNI). Three post-doc researchers from Russia and China were recruited over the past year through the Nano Center's post-doc program.



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Biomedical Engineering

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Single-walled carbon nanotubes as optical sensors

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Studying brain physiology in health and disease using Organ-on-a-Chip

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Cellular biophysics and imaging

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Nanoscale optics at STM junctions; Electronic properties of clusters

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Nonequilibrium phenomena in chemical and condensed matter physics

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NMR diffusion measurements in supramolecular chemistry

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Theory of complex fluids

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Nano-bio-photonics

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Ultrafast molecular dynamics and coherent control using ultrashort optical and terahertz fields

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Magic-angle spinning (MAS) solid-state NMR of filamentous bacteriophage viruses; Development and theory of MAS NMR for the study of diamagnetic metal-ion-containing compounds – applications to enzymes and materials; Structure and dynamics of macromolecular assemblies by NMR energy storage and conversion

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Synthesis, characterization of materials and study of ion-transport phenomena in new nanostructured electrodes and solid electrolytes for energy-storage devices

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Preparation, characterization and biomedical applications of fullerene/nanotube protein complexes

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Theoretical and computational nanomaterials science

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Single-molecule dynamics, nanomotors and nanofriction (theory)

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Synthesis and physical studies of colloidal nanoparticles and their assemblies

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Electronic processes at molecular interfaces (theory)

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Synthesis and characterization of new nanoscale materials for the development of nano-electronic, electro-optic and electro-magneto-optical devices, and their applications in biology, chemistry and technology

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Nanomaterials and thin films for electrochemical energy storage and conversion

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Design and investigation of nanoscale composite materials for catalysis and biomedical applications

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Optical assembly of new materials and devices

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Interaction of light with molecules at the nano-scale and developing novel methods of controlling the photophysical and chemical properties of materials by photonic structures, which tightly confine the electromagnetic field.

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The physics and chemistry of single-molecule junctions

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Self-immolative molecular systems for drug delivery; Optical properties of organic molecules coupled to optical devices

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Programmable and interactive materials

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Nanotribology (theory)

Electrical Engineering

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Nanoscale electro-optics

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Theory of light-matter interactions, tailored by nanostructured environment

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Microfluidics for self-assembly; nanotubes-neuron interfaces

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Dynamic silicon nanophotonic devices

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Theoretical modeling of novel nanostructures and nanodevices

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Ferroelectric nanodomain polarization reversal, development of a new generation of nonlinear photonic devices

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Nanoprobng, scanning probe microscopy

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Micro-electro-optics

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Solid-state detectors and devices laboratory

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Integrated nanophotonics, slow light and polymer optics

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Nano-chemical processes for microelectronics; Integration of biological materials on chips for acute toxicity detection

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Photonic crystals

Environmental Studies

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Renewable energy and Bio-MEMs

Life Sciences

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Molecular mechanisms of synaptic transmission

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The molecular mechanism of optic nerve degeneration and regeneration

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Targeted drug-carrying phage nanoparticles

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Application of photosynthetic reaction center proteins such as PS I in the fabrication of novel nano-bio-photovoltaic devices

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Nanotechnologies for engineering complex 3D tissues

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Synthetic biology toward living nanomaterials

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Sub-micron light-guided protein localization and super-resolution microscopy for studying division and signaling in bacteria

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Self-assembly of short aromatic peptides: from amyloid diseases to nanotechnology

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Nano-optical sensing of proteins; protein interactions

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Structural biology of cellular signaling

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Marine invertebrates – biomineralization and skeletal properties

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HK022 bacteriophage site-specific recombinase integrase as a tool for human genome manipulation and gene therapy

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DNA-based organic nanowires; Biomedical applications of plasmonic nanoparticle structures

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Biomaterial-based targeted carriers for theranostics of cancer and inflammations

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Microfluidic approaches to the study of cells' developmental decisions

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Glycans in immune recognition and response

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Selective targeting and reprogramming of leukocytes using fully degradable nanomedicines

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Determinants of protein misfolding and self-assembly in amyloid diseases and development of novel inhibitors as therapeutics

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Probing intercellular signaling at the nanoscale level

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Surface characterization methods based on scanning electron microscopy

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Atomistic simulation of materials, with emphasis on ferroelectric and multiferroic materials

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 **PUBLICATIONS**

Publications (sorted by journal)

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Collaborations (sorted by country)

1. Amit Sitt collaborates with Guohua Jia (Curtin Institute of Functional Molecules and Interfaces, School of Molecular and Life Sciences, Curtin University, Australia) on: Development and characterization of Zn-chalcogenide nanostructures.
2. Ori Cheshnovsky collaborates with Markus Arndt (Faculty of Physics, University of Vienna, Austria) on: Interference of molecules in beams; funded by EU project.
3. Fernando Patolsky collaborates with Markus Arndt (Faculty of Physics, University of Vienna, Austria) on: Full rotational control of levitated silicon nanorods.
4. Roni Ilan collaborates with Marcel Franz (Physics, UBC, Canada) on: Quantum holography in a graphene flake with an irregular boundary.
5. Hagit Eldar-Finkelman collaborates with Zhang Wang (School of Pharmacology, Tsinghua University, China) on: Potential therapies for aging and neurodegeneration; funded by ISF.
6. Daniel Segal collaborates with Yan-Mei Li (Department of Chemistry, Tsinghua University, China) on: Novel mannitol-based small molecules; funded by XIN.
7. Amir Goldbourt collaborates with Ye Xiang (Department of Basic Medical Sciences, School of Medicine, Tsinghua University, China) on: Combining NMR and Cryo-EM to study filamentous phage structure and dynamics; funded by ISF-NSFC.
8. Amit Kohn collaborates with Caiyin You (School of Materials Science and Engineering, Tel Aviv University, Xi'an University of Technology, China) on: Perpendicular magnetic anisotropy in ultrathin Heusler films; funded by ISF.
9. Guy Deutscher collaborates with Pascal Tixador (University of Grenoble, CRNS, EU) on: FastGrid; funded by EU project.
10. Vered Padler-Karavani collaborates with Jean-Paul Soullillou (Centre de Recherche en Transplantation et Immunologie [CRTI], University of Nantes, France) on: Glyconanoparticles for cancer therapy; funded by EU project.
11. Gil Markovich collaborates with Jerome Plain (Physics, Université de Technologie de Troyes, France) on: Aluminum nanoparticles for UV circular dichroism enhancement .
12. Ronit Satchi-Fainaro collaborates with Rainer Haag (Institute of Chemistry and Biochemistry, Freie University of Berlin, Germany) on: Dendrimer-based nanomedicine for cancer therapy.
13. Haim Diamant collaborates with Stefan Egelhaaf (Department of Physics, Heinrich Heine University, Duesseldorf, Germany) on: Colloidal glasses; funded by GIF.
14. Yair Shokef collaborates with Chase Broedersz (Physics, Ludwig-Maximilians-Universität München, Germany) on: Nonequilibrium fluctuations in driven soft and biological networks; funded by TAU-LMU.
15. Moshe Parnas collaborates with Robert Kittel (Department of Animal Physiology, Institute of Biology, Leipzig University, Germany) on: Linking the molecular organization of active zones to temporal neural coding; funded by DFG.
16. Yuval Ebenstein collaborates with Elmar Weinhold (Organic Chemistry, RWTH Aachen, Germany) on: Lab-on-a-chip cancer diagnostics by quantification of epigenetic markers; funded by Nano German-Israel.
17. Rafi Korenstein collaborates with Partners in the NanoToxClass SIINN II ERA-NET Consortium, (Germany, Belgium, Portugal, Romania) on: Establishing nanomaterial grouping/classification strategies according to toxicity and biological effects for supporting risk assessment; funded by the Ministry of Health, Israel.
18. Vered Padler-Karavani collaborates with Raghavendra Kikkeri (Indian Institute of Science Education and Research [IISER], India) on: Glyco-nanotechnology; funded by EU project.
19. Tamir Tuller collaborates with Iftach Yacoby (Faculty of Life Sciences, Tel Aviv University, Israel) on: Gene expression in microalgae; funded by MOST .
20. Tamir Tuller collaborates with Michael Margaliot (Faculty of Engineering, Tel Aviv University, Israel) on: Gene expression modeling; funded by BSF.
21. Hadas Mamane collaborates with Atlantium Ltd. & Yoram Gerchman (Faculty of Natural Sciences, Haifa University, Israel) on: UV-LEDs for water disinfection; funded by Magnaton.
22. Ronit Satchi-Fainaro collaborates with Doron Shabat (Faculty of Exact Sciences, Tel Aviv University, Israel) on: Development of chemoluminescence probes for cancer imaging; funded by Ramot – TAU.
23. Ronit Satchi-Fainaro collaborates with Steffen Jung (Department of Immunology, Weizmann Institute, Israel) on: Modulation of melanoma-stroma interactions using a rationally designed

- nanomedicine combining BRAFi, MEKi and immune therapies; funded by EU project.
24. Haim Diamant collaborates with Yael Roichman (School of Chemistry, Tel Aviv University, Israel) on: Colloidal glasses; funded by GIF.
 25. Haim Diamant collaborates with Samuel Safran (Faculty of Chemistry, Weizmann Institute, Israel) on: Screening in concentrated electrolytes.
 26. Rimona Margalit collaborates with Jonathan Leor (Faculty of Medicine, Tel Aviv University, and Sheba Medical Center, Israel) on: Inflammation-targeted drug carriers; funded by Helmsley.
 27. Eli Eisenberg collaborates with Erez Levanon (Biology, Bar Ilan University, Israel) on: RNA editing – general; funded by ISF.
 28. Gil Markovich collaborates with Ori Cheshnovsky (School of Chemistry, Tel Aviv University, Israel) on: Single chiral particle circularly polarized luminescence detection; funded by ISF.
 29. Gil Markovich collaborates with Yoram Dagan (School of Physics, Tel Aviv University, Israel) on: Semiconductor surface passivation using solution monolayer epitaxy; funded by KAMIN.
 30. Yair Shokef collaborates with Yael Roichman (School of Chemistry, Tel Aviv University, Israel) on:
 31. Nonequilibrium fluctuations in driven soft and biological networks; funded by TAU-LMU.
 32. Yair Shokef collaborates with Roni Ilan and Yoav Lahini (School of Physics, Tel Aviv University, Israel) on: Topological effects in nonlinear metamaterials – from electronics to mechanics and back; funded by MOST.
 33. Ori Cheshnovsky collaborates with Gil Markovich (School of Chemistry, Tel Aviv University, Israel) on: Chirality of individual nanostructures and crystals; funded by ISF.
 34. Ori Cheshnovsky collaborates with Ranny Budnik (Physics, Weizmann Institute, Israel) on: Detectors for low-mass dark-matter particles; funded by PAZI.
 35. Ori Cheshnovsky collaborates with Uzi Even (School of Chemistry, Tel Aviv University, Israel) on: Interference of molecules in beams; funded by EU project.
 36. Yosi Shacham collaborates with Rachela Popovtzer (Faculty of Engineering, Bar Ilan University, Israel) on: Implanted nano-electrodes; funded by MOST infrastructure.
 37. Amit Sitt collaborates with Orit Shefi (Faculty of Engineering, Bar Ilan University, Israel) on: Biocompatible microtubes as growth media for neurites.
 38. Ronit Sagi-Eisenberg collaborates with Koret Hirschberg (Sackler Faculty of Medicine, Tel Aviv University, Israel) on: Exploring the mechanism of exocytosis; funded by BSF .
 39. Ronit Sagi-Eisenberg collaborates with Ofer Merimsky (Tel Aviv Medical Center, Sackler Faculty of Medicine, Tel Aviv University, Israel) on: The role of exosomes in mast cell-cancer crosstalk.
 40. Joel Hirsch collaborates with Bernard Attali (Physiology & Pharmacology, Sackler School of Medicine, Tel Aviv University, Israel) on: Structure-function of Kv7.2-Kv7.3 channels; funded by ISF.
 41. Yuval Ebenstein collaborates with Amit Meller (Biomedical Engineering, Technion, Israel) on: Epigenetic sensing in solid state nanopores; funded by ISF.
 42. Chanoch Carmeli collaborates with Shachar Richter (Materials Science Engineering, Tel Aviv University, Israel) on: Hybrid photosystem protein-nano materials; funded by TAU.
 43. Chanoch Carmeli collaborates with Itai Carmeli (Optical Engineering, Bar Ilan University, Israel) on: Photosystem protein nanoantenna; funded by Bar Ilan University.
 44. Chanoch Carmeli collaborates with Zeev Zalevsky (Optical Engineering, Bar Ilan University, Israel) on: Photosystem nanoantenna; funded by Bar Ilan University.
 45. Chanoch Carmeli collaborates with Haim Suchowski (Condensed Matter Physics, School of Physics, Tel Aviv University, Israel) on: Photosystem-based metamaterials; funded by Tashtiot.
 46. Johann Elbaz collaborates with Ehud Gazit (Biology, Tel Aviv University, Israel) on: Artificial cells; funded by Adelis.
 47. Gil Rosenman collaborates with Giancarlo Morelli (Research Centre on Bioactive Peptides, University of Naples Federico II, Naples, Italy) on: Fluorescent bioinspired materials.
 48. Ronit Sagi-Eisenberg collaborates with Mitsunori Fukuda (Integrative Life Sciences, Tohoku University, Japan) on: The role of Lab GTPases in controlling regulated secretion measured by high resolution confocal imaging; funded by ISF.
 49. Yair Shokef collaborates with Martin van Hecke (Physics, Leiden University and AMOLF,

- Netherlands) on: Mechanical metamaterials.
50. Ronit Satchi-Fainaro collaborates with Helena Florindo (Pharmacy, University of Lisbon, Portugal) on: Drug delivery; funded by EU project .
 51. Eli Eisenberg collaborates with Meng-How Tan (School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore) on: RNA editing in development; funded by ISF.
 52. Ronit Satchi-Fainaro collaborates with Lorenzo Albertazzi (Biomedical Engineering, Eindhoven University of Technology, Spain) on: Bio-orthogonal catalysis for cancer therapy; funded by EU project.
 53. Roni Ilan collaborates with Jens Bardarson (Physics, KTH, Sweden) on: Perfect transmission in rippled topological insulator nanowires.
 54. Yuval Ebenstein collaborates with Fredrik Westerlund (Biophysical Chemistry, Chalmers University, Sweden) on: DNA mapping in nanochannels; funded by EU project.
 55. Uri Ashery collaborates with Maria Grazia Spillantini (Department of Clinical Neurosciences, Cambridge University, UK)
 56. Rafi Korenstein collaborates with the HISENTS Consortium (European Partners: UK, Germany, Austria, Ireland, Spain, Norway, Slovakia) on: High-level integrated sensor for nano-toxicity screening; funded by EU project.
 57. Tamir Tuller collaborates with Eduardo D. Sontag (Mathematics, Northwestern University, USA) on: Gene expression modeling; funded by BSF.
 58. Roni Ilan collaborates with Dmitry I. Pikulin (Microsoft Station Q, USA) on: Bulk-boundary quantum oscillations in inhomogeneous Weyl semimetals.
 59. Ilan Goldfarb collaborates with Yongmei Jin (Department of Materials Science and Engineering, Michigan Technological University, USA) on: Micromagnetic simulations of epitaxial magnetic nano-islands.
 60. Eli Eisenberg collaborates with Joshua Rosenthal (Eugene Bell Center, Marine Biology Lab, Woods Hole, USA) on: RNA editing in cephalopods; RNA engineering; funded by BSF.
 61. Alexander Golberg collaborates with Martin Yarmush (Biomedical Engineering, Rutgers University, USA) on: Wound healing with pulsed electric fields; funded by BSF.
 62. Yair Shokef collaborates with Bulbul Chakraborty and Aparna Baskaran (Physics, Brandeis University, USA) on: Influence of mechanical stress on structure and dynamics of tissues and cell sheets; funded by BSF.
 63. Ronit Sagi-Eisenberg collaborates with Stephen J. Galli (Pathology, School of Medicine, Stanford University, USA) on: The role of Rab5 in controlling secretory granule fusion; funded by BSF.
 64. Amir Boag collaborates with Vitaliy Lomakin (Electrical and Computer Engineering, University of California, San Diego, USA) on: High-performance algorithms for computational nano-electromagnetics coupled with density functional theory; funded by BSF.
 65. Yuval Ebenstein collaborates with Natalie R. Gassman (USA Mitchell Cancer Institute, University of South Alabama, USA) on: DNA damage in cancer; funded by NIH.
 66. Yuval Ebenstein collaborates with Kevin Dorfman (Chemical Engineering and Materials Science, University of Minnesota, USA) on: Fabrication of nanodevices for DNA manipulation.

Special Awards

Researchers

1. David J. Bergman was elected President of the International ETOPIM Society.
2. Brian Rosen was listed on The Marker – Top 40 under 40 in Israel.
3. Tal Dvir received the Rappaport prize from the Rappaport Foundation.
4. Tal Dvir received the Juludan prize from the Technion Foundation.
5. Roey Amir received the ICS Prize for Outstanding Young Scientists from the Israel Chemical Society.
6. Shachar Richter received the CSIRO 2019 Distinguished Visiting Scientist Award from CSIRO, Australia.
7. David Sprinzak received the ERC Consolidator Grant from the European Research Council.
8. Abraham Nitzan received the Hirschfelder Prize in Theoretical Chemistry from the University of Wisconsin.

9. Abraham Nitzan was named Donner Professor of Physical Sciences by the University of Pennsylvania.
10. Abraham Nitzan received the Earle K. Plyler Prize for Molecular Spectroscopy & Dynamics from the American Physical Society.
11. Ronit Satchi-Fainaro received the Research Prize for Exceptional Publication from Tel Aviv University.
12. Ronit Satchi-Fainaro received an ICRF Professorship from ICRF – Israel Cancer Research Foundation.
13. Michael Urbakh was appointed Distinguished Visiting Professor by Tsinghua University.
14. Gili Bisker received the Zuckerman Faculty Scholars Scholarship from the Zuckerman STEM Leadership Program.
15. Guy Deutscher was appointed IPS Fellow.

Students

1. Hadar Greener received a Doctoral Fellowship – Outstanding Women in the Fields of High-Tech, from the Council for Higher Education (CHE).
2. Zohar Arnon was appointed Clore Scholar 2017 by Clore Scholars Programme.
3. Zohar Arnon received the Research Excellence Award for a PhD Student 2017 from the Faculty of Life Sciences, Tel Aviv University.
4. Katherine Akulov received the Shulamit Aloni Scholarship from Israel's Ministry of Science, Technology and Space.

Spinoffs

Startups

- Galimedix Therapeutics Inc. (2018) – EG30 for the treatment of Alzheimer's disease. Lead researcher: Prof. Ehud Gazit
- Optomechanic Cube Ltd. (2017) – A company developing 3D modular optics for 3D optical alignment. Lead researcher: Dr. Haim Suchowski
- CliniCrowd (2016) – A crowd monitoring website to evaluate Mannitol for the treatment of Parkinson's. Lead researcher: Prof. Daniel Segal
- Pntlloxx Ltd. (2016) – A company developing Peptide Nanotubes for energy storage applications. Lead researcher: Prof. Ehud Gazit
- QuLab Medical Ltd. (2016) – A company developing multiplex real-time monitoring of cellular metabolic activity in physiological solutions using a Redox-reactive nanowire biosensor. Lead researcher: Prof. Fernando Patolsky
- Unispectral Ltd. (2016) – A company developing a sequential color imaging scheme and implementation within compact camera modules. Lead researchers: Prof. Slava Krylov and Prof. David Mendlovic
- NanoLock (2015) – A company developing a technology to enable any solid-state memory to be physically "locked," preventing unauthorized access at the hardware level. Furthermore, complete functionality of CPUs and MicroControllers can also be "locked" and disabled. Lead researcher: Prof. Slava Krylov
- NanoAir (2014) – A startup company developing paper-thin active cooling

for thin devices. Lead researchers: Prof. Slava Krylov and Prof. Yosi Shacham

- Cine'al (2014) – A startup company developing jellyfish-derived super absorbents for fluids, with a focus on absorbing blood and proteins. Lead researcher: Prof. Shachar Richter
- Honeycomb Battery (2014) – A startup company based on 3D concentric on-chip silicon microbattery technology, enabling fabrication of 10-30K microbattery units in the perforated chip. Lead researchers: Prof. Diana Golodintsky, Prof. Emanuel Peled and Prof. Menachem Nathan
- StoreDot Ltd (2013) – A leader in the innovation of materials and their device applications, developing groundbreaking technologies based on a unique methodology for the design, synthesis and tuning of new organic compounds. These proprietary compounds dramatically improve the performance of a range of devices, including batteries, displays, sensors and digital memory. Lead researcher: Prof. Gil Rosenman
- NoAm ColorTech (2013) – A startup company developing novel hair coloring using unique strongly adhering coating beads. Lead researcher: Prof. Amihay Freeman
- Savicell Diagnostics (2012) – A cancer diagnostic kit. Lead researcher: Prof. Fernando Patolsky
- Quiet Therapeutics (2010) – A startup company developing a drug delivery technology. Lead researchers: Prof. Rimona Margalit and Prof. Dan Peer
- Tracense Systems (2010) – A startup company developing a nanotech-based "electronic nose" to sniff out security threats like bombs, biological

warfare agents and toxic liquids. Lead researcher: Prof. Fernando Patolsky

License Agreements

- Valentis Nanotech Ltd. (2018) – Super organic tunable and white-light emitting diode (OLED) by a natural chromophore separation matrix. Lead researcher: Prof. Shachar Richter
- Biosynth AG (2018) – Chemiluminescent probes for diagnostics and in vivo imaging. Lead researcher: Prof. Doron Shabat
- BioCastle Water Technologies Ltd. (2018) – Oxidative bio-reactor for water treatment. Lead researcher: Prof. Hadas Mamane and Prof. Dror Avisar
- Applied Biological Materials Inc. (2018) – CHO-N1G4-citrine cell line. Lead researcher: Prof. David Sprinzak
- Biosynth AG – Nemis Technologies (2018) – Chemiluminescent probes for diagnostics and in vivo imaging. Lead researcher: Prof. Doron Shabat
- BioNTech RNA Pharmaceuticals GmbH (2018) – Novel ionizable lipids for delivery of nucleic acids. Lead researcher: Prof. Dan Peer
- BioVision Inc. (2018) – Chemiluminescent probes for diagnostics and in vivo imaging. Lead researcher: Prof. Doron Shabat
- ART Bioscience Ltd. (2018) – Novel ionizable lipids for delivery of nucleic acids (mRNA, DNA, siRNA). Lead researcher: Prof. Dan Peer
- Lonza Sales AG (2018) – Bi-specific antibody platform. Lead researcher: Prof. Itai Benhar
- 3PEMS Ltd. (2017) – 3D Printed electromagnetic systems for RF

applications. Lead researcher: Prof. Yosi Shacham

- BIOSYNTH AG (2016) – Chemiluminescent probes for diagnostics and in vivo imaging. Lead researcher: Prof. Doron Shabat
- Sepal Pharma (2016) – Drug delivery via sublingual delivery. Lead researcher: Prof. Dan Peer
- Semiconductor Research Corporation SRC, Intel Corporation (2016) – Synthesis conversion to high Phosphorus Nitride thin films. Lead researcher: Prof. Fernando Patolsky
- Aerie Pharmaceuticals (2015) – First-in-class therapies for anti-beta amyloid small molecules for the treatment of patients with glaucoma and dry AMD and other eye diseases. Lead researcher: Prof. Ehud Gazit
- Dexcel Pharma Technologies (2015) – Parkinson's disease therapy, based on the identification of new beta-synuclein recognition modules. This disease-modifying treatment may enable inhibition of disease progression, in contrast to current symptomatic therapy that does not arrest disease progression. Lead researcher: Prof. Ehud Gazit
- Civan Advanced Technology (2015) – Development of a high-power laser based on the coherent combination of fibers. Lead researcher: Prof. Shlomo Ruschin
- Variantyx Ltd. (2014) – Clinical grade, end-to-end genome analysis services for physicians and hospitals worldwide. Lead researcher: Dr. Noam Shomron
- Hall Effect Multi-bit Magnetic Random Access Memory (MRAM), signed with Samsung Global MRAM Innovation.

Lead researcher: Prof. Alexander Gerber (2014)

- PEG-dendrimer hybrids as novel nano-carriers for pesticide delivery, signed with Makhteshim Chemical Works Ltd. Lead researcher: Dr. Roey J. Amir (2014)
- A novel approach to fuel marking, signed with Eurocontrol Technics Group Inc. (TSX Venture: EUO). Lead researcher: Prof. Fernando Patolsky (2014)
- Discrimination of white blood cell populations with label-free digital holographic microscopy, signed with Siemens AG. Lead researcher: Dr. Natan Tzvi-Shaked (2014)
- Optical interferometry microscopy system and algorithms for non-destructive optical inspection, signed with Applied Materials Israel Ltd. Lead researcher: Dr. Natan Tzvi-Shaked (September 2014)
- Electrochemical deposition of hydroxyapatite on dental implants, signed with SGS International Ltd. Lead researcher: Prof. Noam Eliaz (2014)
- Nonpharma, polypeptide nanostructures for use in products of field effect transistors, signed with The Technical University of Denmark (DTU). Lead researcher: Prof. Ehud Gazit (2013)
- Fluorescent nanomaterial for product authenticity verification, signed with Tata Steel Ltd. Lead researcher: Prof. Gil Markovich (2013)
- Phenylalanine fibrils antibodies related to PKU, signed with EMD Millipore Corporation. Lead researcher: Prof. Ehud Gazit. (2013)

- New drugs to treat schizophrenia and bipolar disorder, signed with Mental-Heal Ltd. Lead researchers: Prof. Moshe Portnoy, Prof. Avi Weizman and Dr. Irit Gilad (2013)
- Targeted cancer therapy based on miR-21, signed with Tickro Technologies. Lead researchers: Dr. Ella Sklan and Dr. Rina Rosin-Arbesfeld (2013)
- Improving laser efficiency in OPO laser systems for airborne defense systems against heat-seeking missiles, signed with Elbit Systems-Elop. Lead researcher: Prof. Ady Arie (February 2012)
- Coral-derived collagen for tissue engineering, signed with ExceeMatrix Ltd. Lead researcher: Prof. Dafna Benayahu (2012)
- Drug-eluting composite structures, signed with Active Healing Bio Medical Ltd. Lead researcher: Prof. Meital Zilberman (2012)
- Transparent conductive coating with nanowires for flat panel applications, signed with Nepes. Lead researcher: Prof. Gil Markovich (2012)
- A new drug for Parkinson's disease, signed with Bioline Rx. Lead researcher: Prof. Ehud Gazit (2012)
- Peptide nanotube electrodes for energy storage applications, signed with an Israeli defense industry company. Lead researchers: Prof. Ehud Gazit and Prof. Gil Rosenman (2010)
- Transparent conducting nanowires, signed with an Israeli startup in the field of photovoltaic coatings. Lead researcher: Prof. Gil Markovich (2009)

Staff

Core Staff

Prof. Yael Hanein	Director
Mr. Zvi Kopolovitch	Managing Director
Ms. Michal Shenhar	Administrative Director
Ms. Noa Shafir	Secretary
Dr. Stanislav Stepanov	Process Engineer, Electron & Ion Beam Lithography & Laser Micromachining Manager
Dr. Gal Radovsky	Bio-AFM Laboratory Manager
Mr. Valery Gerber	Chief Engineer & Business Development
Dr. Netta Handler	SEM Microscopy & E-Beam Lithography Manager
Dr. Youry Borisenkov	Process Engineer
Mr. Gidon Jacob	Equipment Engineer
Mr. Eli Brosh	Equipment Engineer
Mr. Yuval Kupitz	Head of International Collaborations
Mr. Moshe Levi	Building Custodian

Core Members

Prof. Shachar Richter	Department of Materials Science & Engineering
Prof. Yael Hanein	School of Electrical Engineering
Prof. Fernando Patolsky	School of Chemistry
Prof. Koby Scheuer	School of Electrical Engineering
Prof. Dan Peer	Faculty of Life Sciences
Prof. Roy Beck-Barkai	School of Physics & Astronomy

Scientific Committee

Prof. Ori Cheshnovsky	School of Chemistry (Chairperson)
Prof. Rimona Margalit	Faculty of Life Sciences
Prof. Yoram Dagan	School of Physics & Astronomy
Prof. Yael Hanein	School of Electrical Engineering (Director)
Prof. Fernando Patolsky	School of Chemistry
Prof. Dan Peer	Faculty of Life Sciences
Prof. Jacob Scheuer	School of Electrical Engineering
Prof. Inna Slutsky	Faculty of Medicine
Prof. Amit Kohn	Department of Materials Science & Engineering

Acknowledgments

Centers and Institutes

- The Marian Gertner Institute for Medical Nanosystems
- The Chaoul Center for Nanoscale Systems
- The Jack H. Skirball National Center for Biomedical Nanoscience
- James Russell DeLeon – The Center for Nanostructuring
- The Ilona Rich Institute for Nanoscale Bioscience and Biotechnology

Laboratories

- Di Laudadio Laboratory for Photolithography (2014)
- Robert Goldberg Laboratory for Focus Ion Beam Nano Structuring (2007)
- The Dr. Teodoro Jack and Dorothea Krauthamer Laboratory for Scanning Electron Microscopy (2006)
- A.V.B.A. Student Laboratory for Electron Beam Lithography (2002)

New Building and Facilities

- Mr. Roman Abramovich – new building (2018)
- Mrs. Aviva Moldawsky (2018)
- Norman and Doreen Kingston (2017)
- Ms. Sara Weis (2014)
- Biderman Estate (2008)

Scientific equipment

- Mr. Renaud Presberg (2016)
- Infrastructure Equipment for Nanotechnology Research – Wolfson Family Charitable Trust (2003)

Chairs

- The Bernard L. Schwartz Chair in Nanoscale Information Technology (2006)
- The Edouard Seroussi Chair for Protein Nanobiotechnology (2006)
- The Raymond and Beverly Sackler Chair in Clusters and Nanoparticles (2003)
- The Hermann and Kurt Lion Chair in Nanosciences and Nanotechnologies (2000)

Research Funds

- Frank Lowy (2007)
- Nanotechnology Research Fund in Cooperation with Clal Biotechnical Industries (2005)
- Support for Nanotechnology Research donated by the Gilman Foundation

Scholarships

- Claire and Thierry Jabes (2018)
- Berthe Jabes (2018)
- Francoise and Sylvain Reingewitz (2018)
- The Cohen Family Doctoral Fellowship for the Study of Nanoscience (2015)
- The Herbert and Sharon Glaser Fund (2015)
- Elie Horn (2014)
- Ezekiel Solomon (2014)
- The Buchman Heyman Fund (2013)
- Brian Leaver (2013)
- Shlomo Eliahu (2011)
- Walanpatrias Stiftung Fund (2006)

General

- The Israel Nanotechnology National Initiative (INNI) program, founded by TELEM (2007-2016)

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