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# About the Weizmann Institute of Science

The Weizmann Institute of Science is one of the world's leading multidisciplinary basic research institutions in the natural and exact sciences. The Institute's five faculties Biology, Biochemistry, Chemistry, Physics, Mathematics and Computer Science are home to scientists and students who embark daily on fascinating journeys into the unknown, seeking to improve our understanding of nature and our place within it. The Institute has been the venue of pioneering research in neuroscience, nanotechnology and alternative energy, the search for new ways of fighting disease and hunger and creating novel materials and developing new strategies for protecting the environment. Mathematicians and computer scientists working together with biologists are uncovering unseen patterns in everything from our DNA to the ways our cells age to personal nutrition. From participating in the discovery of the Higgs boson at CERN to joining in scientific missions to the planets in our solar system, Weizmann Institute researchers are helping lead international science. The campus comprises of 1.1sq km (280 acres) and includes over 240 buildings, research facilities, administration and housing; 2,500 faculty and staff; 1,400 students and postdocs Research volume annually is of more than \$100m total worth of grants for Weizmann Institute research projects.

# Faculty of Biology

## Department of Neurobiology

Research in Neuroscience in the Department of Neurobiology encompasses a wide variety of subjects, in areas including cellular and molecular biology, neuroanatomy, functional magnetic resonance imaging (fMRI), physiology, pharmacology, psychophysics, and computational sciences.

Basically, the research of the various groups of the Department covers, among others, the following topics: Analysis of the molecular and cellular basis of neuronal and synaptic function. Imaging of neuronal activity underlying higher brain functions. Tracing and characterization of neuronal communication profiles. Characterization of the CNS response to trauma and lesion; developing molecular and cellular therapeutic agents. Determination of the underlying processes and mechanisms of vision, perception, learning, and memory in behaving rodents and primates. Computer modeling of brain function. At the Neurobiology Department, the structure, function, development, and plasticity of the nervous system are studied at various levels of analysis, using different types of cell and experimental animal models. The groups studying neuronal function at the molecular and cellular levels use *in vitro* systems ranging from non-neuronal and neuronal cell lines to primary neuronal and glial cells of cerebellar, hippocampal and cortical origin. In many cases, the cells studied are transfected with genes of interest. These cell systems allow the study of the roles of various components of the nervous system, including cell surface membrane components, specific enzymes, neurotransmitters, neuromodulators, growth factors, neuroreceptors, lipid components, ionic channels and cytoskeletal constituents. Algorithms for the synaptic plasticity between neurons, and the role of dendritic ion channels in synaptic input and information processing, are also being studied. Injury models of nerve lesion and oxidative stress paradigms are applied to examine the principles of CNS regeneration, rescue from ischemia and stroke, and apoptotic cell death and senescence.

The groups studying the CNS at the system level are striving to understand the complex neuronal mechanisms underlying learning, memory, and sensory processing (vision, taste, smell), and to determine the relationship between brain and mind. Using track tracing methods, the rules governing the interconnections in the visual cortex are being unraveled. Behavioral studies focus on principles of learning and consolidation, cortical information processing, learning disabilities, and addiction. Functional brain imaging of the human visual cortex is being studied by various techniques, including fMRI. Psychophysical approaches are being used to define processes involved in image segmentation, learning and memory skill acquisition, motor control, and language. Nearly 20 groups of researchers carry out both independent studies and collaborative research with colleagues from within the Department and outside it.

### **Research activities**

[Prof. Ehud Ahissar](#)

[Prof. Yadin Dudai](#)

[Prof. Tali Kimchi](#)

**Prof. Yitzhak Koch**

[Prof. Ilan Lampl](#)

**Collaboration with:** Heinz Beck, Bonn Alex Binshtok, Hebrew University Nicholas Priebe, Austin

[Prof. Rony Paz](#)

[Dr. Michal Ramot](#)

[Dr. Michal Rivlin](#)

[Prof. Dov Sagi](#)

[Dr. Rita Schmidt](#)

[Prof. Elad Schneidman](#)

[Prof. Michal Schwartz](#)

**Collaboration with:** Prof. Ido Amit

**Collaboration with:** Prof. Eran Elinav

**Collaboration with:** Prof. Naomi Habib, Hebrew University; Prof. Anna Greka, Broad Institute, Boston, USA.

**Collaboration with:** Prof. Judit Aaron, Rambam hospital; Prof. Falik, Hagalil Hospital.

**Collaboration with:** Prof. Ido Amit

**Collaboration with:** Dr. Yifat Marbl

[Prof. Menahem Segal](#)

**Collaboration with:** Dr. Eduard Korkotian

**Collaboration with:** Prof. Dalit Ben Yosef (TAU)

**Collaboration with:** Professor Elisha Moses (Physics)

[Prof. Michail Tsodyks](#)

**Collaboration with:** H. Markram

**Collaboration with:** A. Grinvald, D. Sagi

[Prof. Nachum Ulanovsky](#)

[Prof. Zvi Vogel](#)

**Collaboration with:** Raphael Mechoulam

**Prof. Ephraim Yavin**

[Prof. Ofer Yizhar](#)

**Collaboration with:** Moran Shalev-Benami; Mudi Sheves

**Collaboration with:** Alon Chen

## Department of Immunology and Regenerative Biology

The Department of Immunology and Regenerative Biology (IRB) currently comprises 17 research groups and a total of over 200 people. We are located on the Weizmann campus in the Candiotty, Britannia and Wolfson buildings. Research activities of the IRB Department span a broad spectrum of basic and clinically relevant questions. Topics range from fundamental aspects of cancer, hematopoiesis, cell differentiation, metabolism, inter-cellular communication, extracellular matrix remodeling and the genetic and epigenetic changes that contribute to these processes. With a unique focus on immune cell development and function, we study a wide range of physiological and pathophysiological settings, including the host-pathogen interface, embryonic development, inflammation, tissue regeneration post infection and injury, and vascular and lymph angiogenesis. State-of-the-art approaches developed by our members include intra-vital and whole organ 3D imaging, multiplexed ex vivo staining, conditional gene manipulation in animal models, organoid research, advanced genomics and proteomics, and human-derived samples and their bioinformatic analysis at the single cell level. Combining pre-clinical mouse models and patient samples, we also develop novel therapeutic strategies for improved immunotherapies and vaccinations. The main projects that are currently performed in the department are: Host-pathogen interactions - Dr. Roi Avraham

Gut tissue dynamics -Dr. Moshe Biton Studying Tissue Macrophage Function in Health and Disease - Prof. Steffen Jung Protein degradation by the ubiquitin/proteasome system - Prof. Ami Navon Vascularization during pregnancy and cancer development - Prof. Michal Neeman Leukocyte trafficking and differentiation in inflammation and cancer-&nbsp;Prof. Ronen Alon ECM remodeling: from biophysical principles to drug design - Prof. Irit Sagi Intracellular signaling cascades in health and disease - Prof. Rony Seger Epigenetics in stem cells and cancer: developing and applying single-molecule imaging technologies to study the epigenetic code - Dr. Efrat Shema Cellular functions of long noncoding RNAs - Dr. Igor Ulitsky The development of the vascular system - Dr. Karina Yaniv xxx -Prof. Tsvee Lapidot Growth factors and their receptors in cancer - Prof. Yossi Yarden Cellular structural biology of human amyloid proteins&nbsp;-&nbsp;Prof. Philipp Selenko xxx Prof.&nbsp;Benny Geiger Investigating functional, metabolic and architectural features of normal and malignant tissues with magnetic resonance techniques - Prof. Hadassa Degani The meiotic cell cycle, angiogenic events associated with follicle development and embryo plantation - Prof. Nava Dekel Investigating ovarian follicle physiology, regulation and demise in mammals with emphasis on the ovulatory response, including the control of oocyte maturation, transformation of the follicle into corpus luteum and culminating with the release of the fertilizable ovum - Prof. Alex Tsafirri Elucidation of the mechanisms by which a synthetic tolerogenic peptide ameliorates autoimmune disease manifestations in animal models and in patients with systemic lupus erythematosus (SLE) and Sjogren Syndrome -&nbsp;Prof. Edna Moses Recognition and Signaling by Immunoreceptors.&nbsp;Electron Transfer and Transport Mechanisms Through Protein Matrices -&nbsp;Prof. Israel Pecht

## **Research activities**

[Dr. Avraham Roi](#)

[Dr. Moshe Biton](#)

**Collaboration with:** Prof. Omer Yilmaz, Prof. Eduardo Villablanca, Prof. Yinon Ben-Neriah, Prof. Steffen Yung

[Prof. Hadassa Degani](#)

**Collaboration with:** Dr. Talia Golan and her team, Sheba Medical Center

**Collaboration with:** Dr. Edna Haran,

[Prof. Nava Dekel](#)

[Prof. Erez Ayelet](#)

**Collaboration with:** Eytan Ruppin Uri Tabori Angel Progador

[Prof. Atan Gross](#)

[Prof. Michal Neeman](#)

**Collaboration with:** Prof Nava Dekel, Weizmann Prof Lucio Frydman, Weizmann Prof Joel Garbow, Washington Univ. St Louis Prof Silvio Aime, Univ Torino Prof Simcha Yagel and Dr Ofer Behavior, Hadassah Medical Center Prof Michal Kovo, Meir Medical Center Prof Tal Raz, HUJ

[Prof. Irit Sagi](#)

[Prof. Rony Seger](#)

[Prof. Philipp Selenko](#)

**Collaboration with:** Daniella Goldfarb, Hagen Hofmann, Ori Avinoam, Atan Gross, Ami Navon

**Collaboration with:** Daniella Goldfarb, Hagen Hofmann, Koby Levi

[Dr. Efrat Shema](#)

[Prof. Alex Tsafri](#)

**Collaboration with:** Helena Ashkenazi, Shmulik Motola, Xiumei Cao, Malka Popliker, Seymour Pomerantz, Marco Conti, Stanford

**Collaboration with:** Atan Gross, KerenYacobi

[Prof. Igor Ulitsky](#)

[Prof. Yosef Yarden](#)

**Collaboration with:** Julian Downward Nadege Gaborit Belinda Sanchez Raya Eilam Eli Pikarsky Luis Paz-Ares

## Department of Molecular Cell Biology

The molecular mechanisms ~~governing cell growth, differentiation and fate, and their involvement in embryonic development and cancer are among the primary topics of interest of the Department. These include studies on the mode of action of growth factors and the nature of signals triggered by them in target cells following binding to specific surface receptors. Growth regulation is also approached through the study of suppressor genes encoding such proteins as p53, which inhibit proliferation and drive cells towards differentiation or apoptosis. These studies, focusing on the mechanisms stimulate cell proliferation, differentiation, or death, can elucidate the basis for cancerous transformation in a large variety of systems. Overproduction or hyperactivation of growth-promoting systems was shown to have an oncogenic (cancer-causing) effect, and a similar process may be induced when growth-suppressor or apoptosis-inducing genes~~ ~~governing cell growth, differentiation and fate, and their involvement in embryonic development and cancer are among the primary topics of interest of the Department. These include studies on the mode of action of growth factors and the nature of signals triggered by them in target cells following binding to specific surface receptors. Growth regulation is also approached through the study of suppressor genes encoding such proteins as p53, which inhibit proliferation and drive cells towards differentiation or apoptosis. These studies, focusing on the mechanisms stimulate cell proliferation, differentiation, or death, can elucidate the basis for cancerous transformation in a large variety of systems. Overproduction or hyperactivation of growth-promoting systems was shown to have an oncogenic (cancer-causing) effect, and a similar process may be induced when growth-suppressor or apoptosis-inducing genes~~

fail to function. The levels at which cell structure, activity and fate are studied in this department and the focus of these studies are many and diverse, including the characterization of soluble growth factors and their receptors, the nature of complex signal transduction pathways, the action of specific regulators of cytokine action, rearrangement of genes associated with oncogenic processes, and the properties of tumor suppressor and apoptosis promoting genes. Since such processes involve networks of interacting factors, we are also interested in mathematical modeling and computerized analysis of biological gene circuits.

In addition, there is broad interest in the molecular mechanisms of cell adhesion and their involvement in the regulation of cell fate. These studies include characterization of the basic rules underlying adhesive interactions, the binding of surface-associated adhesion molecules with the cytoskeleton, and the nature of growth- and differentiation-promoting signals triggered by adhesive interactions. Of special interest are proteins such as  $\beta$ -catenin, which play a crucial role in reinforcing cell-cell adhesions as well as triggering gene expression.

### **Research activities**

[Prof. Uri Alon](#)

**Collaboration with:** Nir Friedman

[Prof. Avri Ben-Ze'ev](#)

**Prof. Alexander D. Bershadsky**

**Prof. Eli Canaani**

[Prof. Benjamin Geiger](#)

[Dr. Shalev Itzkovitz](#)

[Professor Emeritus Zvi Kam](#)

**Collaboration with:** Benjamin Geiger, John Sedat, David Agard (UCSF)

[Prof. Valery Krizhanovsky](#)

**Collaboration with:** Uri Alon

**Collaboration with:** Ittai Ben-Porath, Hebrew University

**Collaboration with:** Dr. Tal Biron-Shental, Meir Hospital

[Prof. Sima Lev](#)

**Collaboration with:** Thomas Karn, Eytan Ruppin, Gordon Mills, Flavio Maina, Frank Westermann, Yosef Yarden

[Prof. Gil Levkowitz](#)

[Prof. Moshe Oren](#)

**Collaboration with:** Prof. Michal Lotem, Hadassah Medical Center Prof. Yinon Ben-Neriah, Hebrew University Medical School

**Collaboration with:** Prof. Varda Rotter, Weizmann Institute; Prof. Vassilis Gorgoulis, Athens University Medical School

[Prof. Varda Rotter](#)

[Prof. Yardena Samuels](#)

[Prof. Oren Schuldiner](#)

[Dr. Yonatan Stelzer](#)

[Dr. Ravid Straussman](#)

[Dr. Itay Tirosh](#)

**Collaboration with:** Mario Suva, Massachusetts General Hospital. Sid Puram, Washington University.

[Prof. Eldad Tzahor](#)

[Dr. Leeat Yankielowicz-Keren](#)

**Collaboration with:** Prof. Michal Lotem Prof. Eli Pikarsky Dr. Jonathan Cohen Prof. Yardena Samuels Prof. Steve Hodis Prof. Scott Rodig

**Collaboration with:** Prof. Gerard Socie

**Collaboration with:** Dr. David van Valen

[Prof. Yehiel Zick](#)

## Department of Immunology

The immune system was originally recognized for its role in defense of the organism against pathogens, including bacteria and viruses. However, we have come to realize that the system not only reacts to exogenous pathogen attacks, but also to internal challenges posed by tissue remodeling, aging, metabolic unbalance and cancer. Moreover, immune cells are also critically involved in normal developmental processes and the maintenance of adult homeostasis in light of innocuous and beneficial environmental challenges such as the microbiome. Research in the Department of Immunology addresses the challenge to understand contributions of immune cells to physiology and pathophysiology, with the aim to deepen our knowledge and develop new strategies for therapeutic intervention. Accordingly, our research spans a wide range from studying basic mechanisms of development, inter-cellular communication, cell trafficking and effector functions of immune cells to the definition of their specific roles in aging, autoimmune disorders, allergies and cancer. Department members investigate cellular and molecular mechanisms underlying immune disorders, such as aging, immunodeficiencies, innate immunopathologies, autoimmunity, as well as infectious diseases. Using pre-clinical mouse models and patient samples, we develop novel therapeutic strategies including check-point blockade, immunotherapies and improved vaccination protocols. We develop and employ state-of-the-art approaches ranging from intra-vital imaging and conditional gene manipulation, to advanced bulk and single cell genomics and proteomics to uncover physiological and pathological roles of the immune system. For more details on our exciting research projects and specific groups in the Immunology Department, please see our web page <https://www.weizmann.ac.il/immunology/>

### **Research activities**

[Dr. Jakub Abramson](#)

[Prof. Ronen Alon](#)

**Collaboration with:** Ziv Shulman (WIS) Steffen Jung (WIS)

**Collaboration with:** Natalio Garbi (Bonn)

**Collaboration with:** Moshe Biton (WIS)

**Collaboration with:** Steffen Jung

**Collaboration with:** Kristin Hogquist (U. of Minnesota, MN) Jakob Abramson (WIS)

[Prof. Ido Amit](#)

**Prof. Ruth Arnon**

**Collaboration with:** R. Aharoni

**Collaboration with:** R. Aharoni; M. Sela

**Collaboration with:** M. Sela; R. Aharoni

**Collaboration with:** R. Maron

**Prof. Gideon Berke**

**Collaboration with:** Hassin D. and Sevilya Z.; Assuta Ashdod Medical Center.

[Prof. Irun R. Cohen](#)

[Dr. Rony Dahan](#)

[Prof. Lea Eisenbach](#)

**Collaboration with:** yardena samuels, david bassan, adam solomon, esther tzevoval

**Collaboration with:** David Bassan

**Collaboration with:** Dr Gideon Gross

[Prof. Eran Elinav](#)

[Prof. Steffen Jung](#)

**Collaboration with:** Marco Prinz, University of Freiburg, Germany Pablo Blinder, TAU, Israel Reuven Stein, TAU, Israel Susanne Wolf, MDC, Berlin Soyon Hong, UCL, London, UK Kia Movahedi, VIB, Brussels, Belgium

**Collaboration with:** Avraham Yaron, Weizmann Institute

**Collaboration with:** Neta Shlezinger, HU Bernhard Hube, Leibniz-HKI, Jena, Germany Petra Bacher, University of Kiel, Germany

[Prof. Tsvee Lapidot](#)

**Prof. Edna Mozes**

**Prof. Roald Nezlin**

**Collaboration with:** No

[Prof. Israel Pecht](#)

**Collaboration with:** Prof. Ole Farver, U. of Copenhagen, Denmark. Prof. Scot Wherland, Washington state university, Pullman , USA.

**Collaboration with:** Prof. J. Abramson, WIS.

**Collaboration with:** Pro.Mudi Sheves, WIS. Prof. D.Cahen, WIS.

**Prof. Yair Reisner**

[Prof. Idit Shachar](#)

**Collaboration with:** Dr Michal Haran, Kaplan Medical center

[Dr. Liran Shlush](#)

**Collaboration with:** Amos Tanay Omar abdel Wahab Jon Dick Mark Minden Hofer  
Thomas Elisa Laurenti Paaladinesh Thavendiranathan Hartmut Geiger Benny Geiger  
Dennis Kim MÅ¼ller-Tidow, Carsten Yinon Ben Neria

# Faculty of Biochemistry

## Department of Biomolecular Sciences

The scientific activities in the Department of Biomolecular Sciences span several areas in the Life Sciences. The common thread is the study of the biochemistry of life and disease. Emphasis is given to the examination of proteins, whether soluble or membrane-bound, and their key biological functions and we seek a molecular understanding of their evolution, cellular interactions, structures and functions. A variety of biochemical, biophysical, structural, molecular-biological, and state of the art imaging methodologies are employed in our department. Overlapping interests and inter-group cooperations signify the spirit of our research. The department has more than 20 research groups whose activities are centered around the following foci of interest:

Protein science and macromolecular machines. Several groups investigate the basic principles governing protein-protein interactions; composition, assembly, and architecture of multi-enzyme and other large complexes; catalytic mechanisms and the evolution of proteins and enzymes. A major aim is to understand how the findings relate to intricate biological processes.

DNA and regulation of gene expression. Various aspects of nucleic acids research are addressed in our department including: DNA repair and mutagenesis in mammals; basal and activated transcription; mRNA translation; specific gene expression in the pancreas; phylogenetic analysis of accumulated somatic mutations.

Structure, function, and biogenesis of membrane proteins. We investigate important integral membrane proteins on the biochemical, biophysical, structural, and physiological levels. This includes Na<sup>+</sup> and K<sup>+</sup> channels, Na<sup>+</sup>/K<sup>+</sup> ATPase and its FXYD protein regulators, multidrug transporters, intra-membrane proteases, and peptides that integrate into membranes in various systems.

Membranes, lipids, and organelle structure, function, and biogenesis. Studies in our department include the biosynthetic pathway of membrane proteins; intracellular protein traffic, especially during the process of autophagy; lysosome biogenesis and lipid homeostasis; Calcium homeostasis; and, assembly and function of membrane proteins involved in the immune response, infectious diseases, and viral envelopes.

Signaling within and between cells. Several researchers in the department are interested in problems related to signal transduction. Cell guidance and navigation; axon guidance; cell death and tissue damage; long distance intracellular signaling; regulation of expression of virulence factors; regulation of the circadian rhythm; epigenetic gene silencing; epigenetics and developmental regulation.

Molecular basis of disease. Many research programs in our department involve human disorders, diseases, and syndromes. This includes inflammation, infections by various pathogens and antibiotic resistance, organophosphate detoxification, obesity and diabetes, cancer, and lysosomal storage diseases. Many of these disorders are investigated at the molecular level. A variety of methodologies are being utilized, with an emphasis on biochemistry, biophysics, molecular genetics, advanced light microscopy, computation methods, and structural tools (such as crystallography, atomic force microscope, mass spectrometry). Additional information can be obtained in the department's Home Page.

### Research activities

[Prof. Gad Asher](#)

[Dr. Ori Avinoam](#)

**Collaboration with:**

**Collaboration with:** Prof. Benny Shilo

**Collaboration with:**

[Prof. Ed Bayer](#)

**Collaboration with:** Raphael Lamed, Tel Aviv University Yuval Shoham, Technion, Haifa Itzhak Mizrahi, Ben-Gurion University, Beer Sheva Oded Livnah, Hebrew University of Jerusalem Yitzhak Hadar, Hebrew University of Jerusalem Shi-You Ding, Michigan State University Nicole Koropatkin and Eric Martens, University of Michigan Rafael Bernardi, Auburn University Hermann Gaub, Ludwig Maximilian University Don C. Lamb, Ludwig Maximilian University Bryan White, University of Illinois Klaus Schulten, University of Illinois Bernard Henrissat, Marseille Mirjam Czjzek, Rostok, France Yingang Feng, Ya-Jun Liu and Qiu Cui, Qingdao, China Yannick Bomble, Martin Keller and Michael Himmel, NREL, Golden CO Victor De Lorenzo, Madrid Mariano Carrián-Vázquez, Spanish National Research Council Carlos Fonts, University of Lisbon Marek Cieplak, Polish Academy of Sciences Damien Thompson, University of Limerick Henri-Pierre Fierobe, CNRS, Marseille Harry Flint, University of Aberdeen Harry Gilbert, Newcastle University Gideon Davies, York University Dimitris Hatzinikolaou, University of Athens

[Prof. Eitan Bibi](#)

**Collaboration with:** Gert Bange, Marburg University, Marburg, Germany.

[Prof. Rivka Dikstein](#)

**Collaboration with:** Yuki Yamaguchi, Idit Shachar, Nahum Sonenberg, Yuri Svitkin, Franck Martin, Katsura Asano, Igor Ulitsky, Michael Walker, Neta Regev-Rudsky

[Prof. Michael Eisenbach](#)

[Prof. Zvulun Elazar](#)

[Prof. Michael Fainzilber](#)

[Dr. Sarel-Jacob Fleishman](#)

**Collaboration with:** Dan Tawfik Deborah Fass Gilad Haran Eitan Bibi

[Dr. Nir Fluman](#)

[Prof. Anthony H. Futerman](#)

[Prof. Steven J.d Karlish](#)

[Prof. Zvi Livneh](#)

[Prof. David Mirelman](#)

**Collaboration with:** Rivka Bracha

**Collaboration with:** Aharon Rabinkov, Elena Appel

[Dr. Neta Regev-Rudzki](#)

[Prof. Ziv Reich](#)

[Dr. Ruth Scherz-Shouval](#)

[Prof. Yechiel Shai](#)

[Prof. Michal Sharon](#)

[Prof. Yoram Shechter](#)

[Prof. Michael Walker](#)

[Prof. David Wallach](#)

[Prof. Meir Wilchek](#)

**Collaboration with:** retired, Dr. Talia Miron.

[Prof. Avraham Yaron](#)

## Department of Molecular Genetics

The molecular basis of gene expression and related biological processes are under investigation in our Department. The investigators approach these processes from the most reduced

and reconstructed systems up to more systemic and computational analysis. Different organisms are employed including virus, yeast, Drosophila, mouse and human. These animal models and cell culture systems are used to study the mechanisms of;

- a. Basic processes in gene expression, such as transcription, translation and protein degradation.
- b. Cellular responses to various stimuli, such as cytokines, growth factors and exposure to DNA-damage.
- c. Regulation of cell growth, senescence, differentiation and death.
- d. Development; Mechanistic view of zygote to embryo transition and development of various organs, such as brain, muscles, bones and pancreas.
- e. Genetic and acquired diseases such as cancer and virus infection. Embryonic stem cell biology, early development and advance human disease modeling.
- f. Study of pluripotent stem cell biology and epigenetic reprogramming.
- g. Computational and system biology. The function/evolution of genes and their diversification.

## Research activities

[Dr. Yaron Antebi](#)

[Prof. Eli Arama](#)

[Prof. Naama Barkai](#)

[Prof. Ari Elson](#)

[Prof. Jeffrey Gerst](#)

**Collaboration with:** Prof. Robert Singer (Albert Einstein College of Medicine) Prof. Markus Landthaler (Max Delbruck Center for Molecule Medicine) Prof. Andre Levchenko (Yale University) Prof. Yitzhak Pilpel (Weizmann Institute of Science)

[Dr. David Gokhman](#)

[Prof. Yoram Groner](#)

**Collaboration with:** The Proprioceptive System Masterminds Spinal Alignment: Insight into the Mechanism of Scoliosis. Blecher R, Krief S, Galili T, Biton IE, Stern T, Assaraf E, Levanon D, Appel E, Anekstein Y, Agar G, Groner Y, Zelzer E. Dev Cell. 2017 Aug 21;42(4):388-399.e3. doi: 10.1016/j.devcel.2017.07.022. PMID: 28829946 Similar articles Select item 28621410 2. The Leo Sachs' legacy: a pioneer's journey through hematopoiesis. Lotem J, Groner Y. Int J Dev Biol. 2017;61(3-4-5):127-136. doi: 10.1387/ijdb.160262yg. PMID: 28621410 Similar articles Select item 28299669 3. Runx3 in Immunity, Inflammation and Cancer. Lotem J, Levanon D, Negreanu V, Bauer O, Hantisteanu S, Dicken J, Groner Y. Adv Exp Med Biol. 2017;962:369-393. doi:

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**Collaboration with:** Amos Tanay Department of Computer Science & Applied Mathematics Eli Zelzer department of Molecular Genetics

[Dr. Dvir Gur](#)

[Dr. Jacob \(Yaqub\) Hanna](#)

[Prof. Eran Hornstein](#)

[Prof. Chaim Kahana](#)

[Prof. Adi Kimchi](#)

[Prof. Doron Lancet](#)

**Collaboration with:** Prof. Rafi Zidovetzki, University of California Riverside Prof. Philippe Schmitt-Kopplin, Helmholtz Center Munich Prof. Daniel Segre, Boston University

[Dr. Orly Laufman](#)

[Prof. Shmuel Pietrokovski](#)

[Prof. Yitzhak Pilpel](#)

[Prof. Orly Reiner](#)

**Prof. Michel Revel**

**Collaboration with:** J. Chebath

**Collaboration with:** J. Chebath

**Collaboration with:** J. Chebath

[Prof. Menachem Rubinstein](#)

**Collaboration with:** Gideon Schreiber

[Prof. Maya Schuldiner](#)

**Collaboration with:** Dr. Einat Zalcvar

[Dr. Schraga Schwartz](#)

[Prof. Yosef Shaul](#)



Plant genome organization: Molecular tools have been developed to examine the fluidity of the plant genome, as described by transposon element, and the evolution of polyploid plants.

### **Research activities**

[Prof. Asaph Aharoni](#)

**Prof. Marvin Edelman**

**Collaboration with:** Barak Cohen, Ron Vunsh

[Prof. Moshe Feldman](#)

**Collaboration with:** Prof. Avi Levy

[Prof. Robert Fluhr](#)

[Dr. Assaf Gal](#)

[Prof. Jonathan Gressel](#)

**Collaboration with:** Michael Burnet

[Dr. Tamir Klein](#)

[Prof. Ron Milo](#)

[Prof. Avigdor Scherz](#)

[Prof. Assaf Vardi](#)

# Faculty of Chemistry

## Department of Chemical and Biological Physics

The Chemical and Biological Physics Department provides an interdisciplinary home to a broad range of topics spanning Physics, Chemistry and Biology. The Department is composed by over 20 tenured and tenure-track physicists and chemists, evenly split between theorists and experimentalists, and working on the following broad areas

Fundamental quantum frontiers are explored with advanced theoretical tools, including topics in the quantum control of atomic and molecular dynamics (Ilya Averbukh, Eli Pollak, David Tannor); light-matter interactions (Ilya Averbukh, Gershon Kurizki, David Tannor, Efi Shahmoon); fundamental issues in quantum information, control and thermodynamics (Gershon Kurizki, David Tannor, Efi Shahmoon); ab-initio quantum chemistry and surface scattering (Eli Pollak); and real time quantum dynamics methods (Eli Pollak, David Tannor). The department has a strong program at the interface between classical physics, chemistry and biology. Eran Bouchbinder studies the plasticity of disordered systems, glassy phenomena, dynamic fracture, frictional interfaces and biophysics. Itamar Procaccia studies turbulence, as well as the physics of fractals, glass formation and mechanical properties of amorphous systems. Theoretical biological physics is the main thrust of research of Nir Gov, who models with predictive power emerging phenomena ranging from cellular shapes to the collective behavior of insects. Samuel Safran employs statistical thermodynamics to study the structure, phase behavior and dynamics of soft matter in biology. The chemistry/biology interface is also studied and evaluated experimentally by Roy Bar-Ziv, who develops and explores living-like systems in cell-free environments, and by Michael Elbaum, who employs advanced microscopic tools to elucidate the complex behavior of cells and biomolecules. Experimental atomic and molecular spectroscopies are also mainstays of the Department. Quantum optics is the focus of Barak Dayan's experiments on atom mediated photon-photon interactions. Light matter interaction, nonlinear laser spectroscopy and plasmonics are the focus of the experimental research of Yehiam Prior. Edvardas Narevicius is a leader in using magnetic field control and the slowing down of molecular beams to study quantum effects in sympathetically cooled systems. Oren Tal has developed unique methods for the study of single molecule conductors, including electronic, spintronic and thermal conductivity effects. Molecular electronics and spin-chemistry are also main themes of research for Ron Naaman, who investigates these using organic-inorganic interfaces via self-assembled monolayers. Single molecule spectroscopy and its application to a broad range of topics, from protein dynamics to nanoplasmonics, are at the center of the experimental program of Gilad Haran. Baran Eren exploits new forms of microscopy and spectroscopy, to understand the chemistry and electronic behavior of solid surfaces under relevant conditions with unprecedented accuracy. A centerpiece of the combined experimental/theoretical program in the Department rests on Magnetic Resonance research. Amit Finkler bridges this topic with optics, in a program relying on optically-detected magnetic resonance as an emerging form of quantum sensing. Lucio Frydman and his group focus on developing and utilizing new concepts and techniques in NMR and MRI, with applications ranging from Physics to Biology and Medicine. Assaf Tal's group focuses on developing new spectroscopy and imaging tools for understanding the brain's physiology in-vivo. Shimon Vega and Daniella Goldfarb are developing and utilizing dynamic nuclear polarization methods for NMR and EPR research, with the Vega group also deeply involved in solid state NMR, and the Goldfarb research also focused on

multiple-resonance high-field EPR techniques applied to biophysics and materials science. The diverse interests as represented above have created an atmosphere of outstanding scientific creativity. Members of the Department have overlapping interests and collaborations among themselves, with other scientists throughout the Weizmann Institute, and with scientists throughout the world. New training opportunities for students and postdocs are always emerging, at whose conclusion participating scientists will have been exposed to a broad spectrum of challenges and acquired state-of-the-art knowledge. If you are interested in joining this elite group of researchers as a M.Sc., Ph.D or postdoctoral trainee, do not hesitate to contact the expert(s) of your choice.

## **Research activities**

[Prof. Ilya Averbukh](#)

[Prof. Roy Bar-Ziv](#)

[Prof. Eran Bouchbinder](#)

**Collaboration with:** Prof. Alain Karma (Northeastern University, USA) Prof. Jay Fineberg (Hebrew University, Israel)

**Collaboration with:** Dr. Efim Brener (Forschungszentrum Juelich, Germany) Prof. Jean-François Molinari (EPFL, Switzerland)

**Collaboration with:** Prof. Edan Lerner (University of Amsterdam, Netherlands)

**Collaboration with:** Prof. Chris Rycroft (Harvard University, USA) Prof. Edan Lerner (University of Amsterdam, Netherlands) Prof. Jan Schroers (Yale University, USA)

**Collaboration with:** Prof. Haguy Wolfenson (Technion, Israel)

[Prof. Barak Dayan](#)

[Prof. Michael Elbaum](#)

[Dr. Baran Eren](#)

[Dr. Amit Finkler](#)

**Collaboration with:** Durga Dasari, University of Stuttgart

**Collaboration with:** Danna Freedman, Northwestern University

**Collaboration with:** Michael Stern, Bar-Ilan University Eyal Buks, Technion

[Prof. Lucio Frydman](#)

[Prof. Nir Gov](#)

[Prof. Gilad Haran](#)

**Collaboration with:** Amnon Horovitz, Weizmann, Ron Naaman, Weizmann, Axel Mogk, University of Heidelberg, George Stan, University of Cincinnati

**Collaboration with:** Ronen Alon, Weizmann, Frank Brown, UCSB, Andres Alcover, Pasteur Institute

**Collaboration with:** Ora Bitton, Weizmann, Lothar Houben, Weizmann, Lev Chuntonov, Technion, Javier Aizpurua, San Sebastian

[Prof. Gershon Kurizki](#)

[Prof. Ron Naaman](#)

**Collaboration with:** Yossi Paltiel, Hebrew University David H. Waldeck, University of Pittsburgh USA Claudio Fontanessi, Modena University, Italy E. W. Meijer, Eindhoven, Netherland Michael Therien, Duke University, USA Moh El Nagggar, USC, USA Jonas Fransson, Uppsala, Sweden

[Prof. Yehiam Prior](#)

**Collaboration with:** Ilya Averbukh

[Prof. Itamar Procaccia](#)

**Collaboration with:** George Hentschel, Bhanu Bhowmik, Harish Charan

**Collaboration with:** Valery Ilyin, George Hentschel, Prasenjit Das, Chandana Mondal, Saikat Roy, Avanish Kumar

**Collaboration with:** Eviatar B. Procaccia, Arik Yochelis

**Collaboration with:** Avanish Kumar, Prasenjit Das

**Collaboration with:** Victor L'vov, Anna Pomyalov

[Prof. Samuel Safran](#)

**Collaboration with:** Dennis Discher, Univ. Pennsylvania - DNA damage in migrating cells as a model of metastasis. Talila Volk, Weizmann Institute - muscle cells and nuclear deformation. Gary Karpen, Berkeley - phase separation in the cellular nucleus: experiments; Frank Juilicher - MPI Dresden - phase separation theory. Prof. Zheng Gang Wang - CalTech - theory of polymer interactions applied to chromosome overlap. Tony Hyman - MPI Dresden - phase separation in cells.

[Dr. Ephraim Shahmoon](#)

[Prof. David Tannor](#)

## Department of Structural Biology

The functions of biological systems emerge from the structures of macromolecules, their conformational dynamics, and their higher order assembly. Determination of biomolecular structures and an understanding of their conformational changes and assembly properties provide great insights into biological mechanisms. Much of the research in structural biology at the Weizmann Institute is carried out in the Faculty of Chemistry, using a diverse set of cutting-edge research tools and methods. Investigators in the Structural Biology Department rely on the primary techniques for experimental structure determination, namely X-ray crystallography, NMR, and electron microscopy, but they also employ a variety of other specialized and emerging spectroscopic methods combined with creative molecular engineering to explore macromolecular structures, energetics, and dynamics. Experimental strategies are complemented by computational and theoretical approaches. Among the specific subjects of research in the department are ribosomes, protein chaperones, viruses, extracellular matrices, and biominerals. Processes being investigated include protein aggregation in cells, conformational dynamics of enzymes, formation of skeletal tissues, cell penetration by viruses, DNA recognition by proteins, and protein folding. Efforts are also directed towards the design of potential drugs. The wide variety of research activities in the department are based on a shared appreciation for the physical and chemical foundations of biological activities.

### Research activities

[Prof. Lia Addadi](#)

**Collaboration with:** S. Weiner

**Collaboration with:** B. Geiger

[Prof. Jacob Anglister](#)

**Collaboration with:** F. Naider

**Collaboration with:** F. Naider

**Collaboration with:** J. Piehler

**Collaboration with:** M. Gurevitz, D. Gordon

[Prof. Ron Diskin](#)

[Prof. Deborah Fass](#)

[Prof. Amnon Horovitz](#)

**Collaboration with:** Ron Unger (Bar Ilan University)

**Collaboration with:** Keith Willison (Imperial College, London); Michal Sharon;

**Collaboration with:** Gilad Haran

[Prof. Koby Levy](#)

[Dr. Rina Rosenzweig](#)

[Prof. Zippora Shakked](#)

**Collaboration with:** Donald Crothers (Yale University)

[Dr. Moran Shalev-Benami](#)

**Collaboration with:** Peter McCormick; Ofer Yizhar

**Collaboration with:** Schraga Schwartz;

[Prof. Joel Sussman](#)

**Collaboration with:** Israel Silman

**Collaboration with:** Dan Tawfik & Israel Silman

**Collaboration with:** Israel Silman

**Collaboration with:** Israel Silman

**Collaboration with:** Israel Silman

**Collaboration with:** Tony Futerman & Israel Silman

**Collaboration with:** Jaime Prilusky & Israel Silman

[Prof. Stephen Weiner](#)

**Collaboration with:** Ron Shahar, Hebrew University of Jerusalem

**Collaboration with:** Elisabetta Boaretto,

**Collaboration with:** L. Addadi, Leeor Kronick, Dan Oron

[Prof. Ada Yonath](#)

## Department of Earth and Planetary Sciences

The research in this department is dedicated to understanding the complex inter-relationships among the major Earth Systems and on the human impact on the Earth's environment and climate. In addition, research is conducted on planetary

atmospheres and planetary geomorphologies. The Department's research activities have several general areas of activities. One focuses on water and includes hydrology, geochemistry, land-plant-atmosphere interactions, and oceanography. A second activity is in the use of stable isotopes for reconstructions of paleoclimatic and of biosphere-atmosphere dynamics, and a third is in the area of atmospheric chemistry and dynamics, and cloud physics. The fourth area of research is in planetary sciences. Our research requires knowledge of the interdependent components that together constitute the "environment", as well as a commitment to protect this environment by improving the manner in which air, water, land, and energy are utilized by humans. The Department is distinguished by the interactions among scientists from different backgrounds and expertise, which is critical for achieving a comprehensive understanding of the global environment and planetary sciences. The department promotes international collaborations based on short- and long-term visits for research and training by scientists who complement existing expertise in the Department. The interdisciplinary nature of the Department is well reflected in the academic training of the research students. Their backgrounds vary from physics, chemistry, and mathematics through geology to biology. We encourage the participation of students who are interested in not only investigating in depth a specific subject but who are also interested in a broader and integrative approach to science.

## **Research activities**

[Prof. Oded Aharonson](#)

[Prof. Brian Berkowitz](#)

[Dr. Itay Halevy](#)

[Prof. Yohai Kaspi](#)

[Dr. Yael Kiro](#)

[Prof. Ilan Koren](#)

**Collaboration with:** Dr. Graham Feingold - NOAA Prof. Alex Kostinski - MTU Prof. Alexander Khain - HUJI Prof. Vanderlei Martins - UMBC Prof. Zev Levin - TAU Dr. Lorraine Remer - NASA Prof. Yoav Schechner - Technion Dr. Eitan Hirsch - IIBR Dr. Eyal Agassi - IIBR

**Collaboration with:** Prof. Eli Tziperman - Harvard Dr. Graham Feingold - NOAA Prof. Alex Kostinski - MTU Dr. Mickael Chekroun - Weizmann

**Collaboration with:** Prof. Assaf Vardi - Weizmann Prof. Emmanuel Boss - University of Maine Prof. Yinon Rudich - Weizmann

**Collaboration with:** Prof. Alex Kostinski - MTU Prof. Vanderlei Martins - UMBC Dr. Lorraine Remer - NASA Prof. Yoav Schechner - Technion Dr. Eitan Hirsch - IIBR Dr.

Eyal Agassi - IIBR

[Dr. Shira Raveh-Rubin](#)

**Collaboration with:** Philippe Drobinski, CNRS

[Prof. Yinon Rudich](#)

**Collaboration with:** Prof. Ralf Zimmermann - Helmholtz Center Munich and University of Rostock, Germany Prof. Astrid Kiendler-Scharr - Helmholtz Center Juelich, Germany

**Collaboration with:** Prof. Ido Braslavski - Hebrew University

**Collaboration with:** Dr. Steve Brown - NOAA, Boulder CO Prof. Alexander Laskin - Purdue University

[Prof. Dan Yakir](#)

## Department of Organic Chemistry

The areas of research in the Department of Organic Chemistry include synthetic and mechanistic organic and organometallic chemistry, novel reactions for organic synthesis, bond activation by metal complexes, polymeric reagents and catalysis. Bioorganic chemistry includes the studies of plant antiviral agents, the molecular mechanism of action of rhodopsin, artificial ion carriers and molecular sensors. Biological chemistry includes studies on structure, function, and mode of action of biologically active peptides and proteins; thermophilic enzymes; enzymes involved in DNA repair, DNA and RNA processing; studies of ordered, compact states of nucleic acids; and biomedical applications of EPR and NMR. Computational chemistry deals with the prediction of molecular properties by first principles (ab initio) and semiempirical quantum mechanical calculations.

### Research activities

[Prof. Mario D. Bachi](#)

[Prof. Yigal Burstein](#)

**Collaboration with:** Moshe Peretz, Orly Dym, Linda Shimon

**Collaboration with:** Zippora Shakked, Oren Zimhony, Ron Diskin, Moshe Peretz, Shira Albeck, Yoav Pelleg, Orly Dym

[Prof. Matiyahu Fridkin](#)

**Collaboration with:** Y. Koch I. Gozes (TAU) I. Offek (TAU) R. Catane (TEL-HASHOMER)

**Collaboration with:** Y. Shechter

**Collaboration with:** M. Youdim ( Technio9n )

[Dr. Nir London](#)

[Prof. Gershom \(Jan\) Martin](#)

**Collaboration with:** D. Milstein, M. van der Boom, R. Neumann, M. A. Iron, L. Kronik, J. L. Sussman

[Prof. David Milstein](#)

[Prof. Ronny Neumann](#)

[Prof. Boris Rybtchinski](#)

[Prof. Abraham Shanzer](#)

## Department of Materials and Interfaces

Activities in the Department ~~Department with a range of topics from soft, composite and hard materials to energy research, nanoscience, and biological materials.~~ A unifying theme is the study of material functionality and its relation to fundamental properties at multiple scales. These properties may be mechanical, structural, chemical, electronic, magnetic, optical, and more. Some examples are: How do shapes and sizes of nm-sized particles affect their properties? How can we tune the properties of solar cells by manipulating their material interfaces? How does friction in knee and hip joints depend on polyelectrolytes that lubricate them? How can we design self-assembling (bio)chemical systems? &nbsp; THE RESEARCH IS BASED ON AN INTERDISCIPLINARY APPROACH, and indeed the scientists bring complementary experience in chemistry and physics, including both theory and experiment.

### Research activities

[Prof. David Cahen](#)

**Collaboration with:** @WIS: S. Cohen, G. Hodes, L. Kronik, L Houben, D. Oron; A. Kahn (Princeton); M. Bäer (Helmholtz Centre Berlin, HZB and Erlangen); H. Bolink (Valencia); P. Nayak (TIFR-H); S Avashti (IISc); H. Ishii (Chiba); P. Schultz, JF. Guillemoles (IPVF-CNRS); T. Kirchartz (Duisburg-JÄ¼lich).

**Collaboration with:** @ WIS: M. Sheves, I. Pecht M. Tornow (TU-Munich); G. Vattya (Budapest); J. Blumberger (Imp. College); L. Zotti (Sevilla); JC Cuevas (Madrid); H. Chen (Zhejiang U);

[Prof. Gary Hodes](#)

**Collaboration with:** D. Cahen (WIS)

[Prof. Ernesto Joselevich](#)

[Prof. Jacob Klein](#)

**Collaboration with:** Sam Safran

[Prof. Leeor Kronik](#)

[Prof. Meir Lahav](#)

**Collaboration with:** Prof Igor Lubomirsky Dr.David Ehre

[Prof. Leslie Leiserowitz](#)

[Dr. Michal Leskes](#)

[Prof. Igor Lubomirsky](#)

**Collaboration with:** Prof. Meir Lahav

[Dr. Sivan Refaely-Abramson](#)

**Collaboration with:** Sara Barja, Centro de Física de Materiales, CSIC-UPV/EHU and DIPC

**Prof. Jacob Sagiv**

[Prof. Reshef Tenne](#)

**Collaboration with:** Dr. R. Arenal, Laboratorio de Microscopías Avanzadas, Instituto de Nanociencia de Aragón, Universidad de Zaragoza, 50018 Zaragoza, Spain Dr. Luc Lajaunie, Departamento de Ciencia de los Materiales e Ingeniería Metalúrgica y Química Inorgánica, Facultad de Ciencias, Universidad de Cádiz, Campus Río San Pedro S/N, Puerto Real 11510, Cádiz, Spain Prof. Ernesto Joselevich, Department of Materials and Interfaces, Weizmann Institute, Rehovot 76100, Israel Dr. Lothar Houben, Chemical Research Support Department, Weizmann Institute, Rehovot 76100, Israel Prof. Alla Zak, Holon Institute of Technology, Israel Prof. Shmuel Kenig and Prof. Hanna Dodiuk, Shenkar College, Israel Prof. Yoshihiro Iwasa, University of Tokyo and the Riken Institute. Japan Prof. Janina Maultzsch, Department of Physics, FAU Erlangen-Nürnberg, 91058 Erlangen, Germany Dr. Iddo Pinkas, Chemical Research

Support Department, Weizmann Institute, Rehovot 76100, Israel

# Faculty of Mathematics and Computer Science

## Department of Computer Science and Applied Mathematics

The principal interests of the Department Head, Prof. Ron Rubinfeld, in the area of computer science and applied mathematics. Research areas include (but are not limited to) algorithms, their design and analysis; biological applications, bioinformatics, system biology, biological modeling; computational complexity, probabilistic proof systems, hardness of approximation, circuit complexity, combinatorial games; computer vision, image processing; cryptography; differential equations; distributed and parallel computing; dynamical systems; fluid dynamics; logic of programs, specification methodologies; machine learning and mathematical statistics; numerical analysis; randomness and its relation to computation; robotics and motion control; visual perception and brain modeling.

The departmental computer facilities include multiple PCs, multiple unix servers, two Linux clusters with multiple nodes, and large data storage systems. In addition, the vision laboratories, robotics laboratories and computational biology laboratories have a combination of experimental equipment and large-scale computing clusters.

### Research activities

[Prof. Achi Brandt](#)

[Prof. Irit Dinur](#)

[Prof. Yonina Eldar](#)

[Prof. Uriel Feige](#)

[Prof. Tamar Flash](#)

[Prof. Aviezri S. Fraenkel](#)

**Collaboration with:** David Klein, Jamie Simpson

**Collaboration with:** Urban Larsson, Lior Goldberg, Haiyan Li, Sanyang Liu, Wen An Liu , Udi Peled, Vladimir Gurchin, Clark Kimberling, Nhan B. Ho, Eric Duchene

**Collaboration with:** George Andrews, James Sellers

[Prof. Oded Goldreich](#)

[Prof. Shafira Goldwasser](#)

[Prof. David Harel](#)

[Prof. Michal Irani](#)

[Prof. Robert Krauthgamer](#)

[Prof. Boaz Nadler](#)

[Prof. Moni Naor](#)

[Dr. Merav Parter](#)

[Prof. David Peleg](#)

[Prof. Vered Rom-Kedar](#)

**Collaboration with:** M. Radnovic, A. Rapoport, E. Shlizerman, D. Turaev

**Collaboration with:** R. Malka, E. Shochat.

**Collaboration with:** R. Aharon, H. Gildor

**Prof. Adi Shamir**

[Dr. Ohad Shamir](#)

[Prof. Ehud Shapiro](#)

**Collaboration with:** E. Shapiro, V. Adalsteinsson, H. Brodi, M. Minden, R. Halaban, C. Klein, M. Meyerson, C. Wu, T. Zukerman, R. Shalom

**Prof. Edriss S. Titi**

[Prof. Shimon Ullman](#)

Department of Mathematics

The principal research interests of the department lie in the broadly understood areas of analysis, probability, algebra, and geometry.

Topics covered in **Analysis** include operator and matrix theory, spectral theory, linear and nonlinear ordinary and partial differential equations, functional and harmonic analysis, ergodic theory and dynamical systems, control theory in its various manifestations, optimization, game theory, approximation and complexity of functions, numerical analysis, singularity theory and robotics. Research in **Probability** theory covers random walks and graphs, motion in random media, percolation, random matrices, Gaussian fields and other probabilistic models in mathematical physics.

Areas of **Geometric** research include the structure of finite and infinite dimensional spaces, analytic, real algebraic and semi-algebraic geometry, typology of foliations and complex vector fields.

The **Algebraic** direction includes some aspects of algebraic geometry, geometric group theory, Lie Theory, representation theory, quantum groups, number theory, automorphic forms, ring theory, statistics of Young diagrams, algebraic combinatorics and enveloping algebras, invariants and crystals.

For the research done at our sister department, the Department of Computer Science and Applied Mathematics, see [here](#).

## Research activities

[Prof. Avraham Rami Aizenbud](#)

**Collaboration with:** Nir Avni, Raf Cluckers, Dmitry Gourevitch

**Collaboration with:** Nir Avni, Dmitry Gourevitch, Shachar Carmeli, Eitan Sayag.

**Collaboration with:** Dmitry Gourevitch, Shachar Carmeli, Raf Cluckers

[Prof. Itai Benjamini](#)

[Prof. Vladimir Berkovich](#)

**Prof. Ehud Friedgut**

[Prof. Stephen Gelbart](#)

[Prof. Maria Gorelik](#)

**Collaboration with:** Dimitar Grantcharov, Victor Kac, Vera Serganova.

[Dr. Dmitry Gourevitch](#)

**Collaboration with:** Avraham Aizenbud, Eitan Sayag, Siddhartha Sahi, Eyal Kaplan

**Collaboration with:** Siddhartha Sahi, Avraham Aizenbud, Eitan Sayag, Eyal Kaplan

**Collaboration with:** Henrik P. A. Gustafsson; Axel Kleinschmidt; Daniel Persson; Siddhartha Sahi

[Prof. Anthony Joseph](#)

**Collaboration with:** Yasmine Fittouhi

[Prof. Yakar Kannai](#)

[Prof. Boaz Klartag](#)

**Prof. Gady Kozma**

**Prof. Erez Lapid**

[Prof. Dmitry Novikov](#)

[Prof. Amitai Regev](#)

**Collaboration with:** Allan Berele, Doron Zeilberger

[Prof. Gideon Schechtman](#)

[Dr. Ran Tessler](#)

**Collaboration with:** Dr. Chaim Even Zohar Mr. Tsviqa Lakrec Dr. Xavier Blot Dr. Sybille Rosset Dr. Yizhen Zhao Mr. Elad Tzalik. Prof. Tali Kaufman

[Prof. Sergei Yakovenko](#)

[Prof. Yosef Yomdin](#)

[Prof. Ofer Zeitouni](#)

# Faculty of Physics

## Department of Condensed Matter Physics

The scientific activity of the department is primarily concentrated around the experimental and theoretical research in quantum solid state physics. It includes experimental research of mesoscopic physics, quantum Hall physics, topological states of matter, high temperature superconductors, two and one dimensional superconductors, metal-insulator transition, carbon nanotubes, semiconductor nanowires, and study of material growth. The theoretical efforts concentrate on similar subjects with added work on disordered materials, cold atoms, and quantum optics.

The Braun Center for sub micron research is an integral part of the department. It is a modern and well equipped center, with growth (three MBE's) and characterization systems, which allows to conduct experiments on sub micron semiconductor structures under high magnetic fields, conventional and high temperature superconductors, and nanowires made of carbon nanotubes and semiconductor nanowires.

### **Research activities**

[Prof. Israel Bar-Joseph](#)

[Dr. Haim Beidenkopf](#)

[Prof. Erez Berg](#)

**Prof. Alexander Finkelstein**

**Prof. Yuval Gefen**

[Prof. Moty Heiblum](#)

[Prof. Shahal Ilani](#)

[Prof. Shimon Levit](#)

[Prof. Yuval Oreg](#)

[Dr. Serge Rosenblum](#)

**Prof. Adi Stern**

[Prof. Binghai Yan](#)

[Prof. Eli Zeldov](#)

## Department of Particle Physics and Astrophysics

The Department of Particle Physics and Astrophysics is engaged in both experimental and theoretical research, in various directions. These include elementary particle physics, field theory, string theory, theoretical astrophysics, observational astrophysics, particle astrophysics, relativistic heavy ion physics, molecular physics, nuclear physics, plasma physics, and radiation detection physics.

### Research activities

[Prof. Ofer Aharony](#)

**Collaboration with:** D. Kutasov, A. Giveon, N. Itzhaki, S. Dubovsky, N. Barel

**Collaboration with:** F. Benini, O. Mamroud, P. Milan

**Collaboration with:** S. Chester, E. Urbach, T. Solberg, T. Sheaffer

**Collaboration with:** L. Yung, T. Sheaffer

**Collaboration with:** E. Palti, Y. Breitstein

**Dr. Sagi Ben-Ami**

**Collaboration with:** Yossi Shvartzvald

[Prof. Micha Berkooz](#)

[Dr. Kfir Blum](#)

[Prof. Amos Breskin](#)

[Dr. Shikma Bressler](#)

**Collaboration with:** RD51 collaboration

[Dr. Ran Budnik](#)

**Prof. Ehud Duchovni**

[Prof. Avishay Gal-Yam](#)

**Prof. Doron Gepner**

[Prof. Eilam Gross](#)

**Collaboration with:** Students: Michael Pitt and Jonathan Shlomi

**Prof. Shmuel Gurvitz**

**Collaboration with:** Xin-Qi Li, D. Sokolovski

**Collaboration with:** A. Aharony, O. Entin-Wohlman, Xin-Qi Li, Wei-Min Zhang

[Prof. Haim Harari](#)

**Prof. Uri Karshon**

**Collaboration with:** ZEUS Collaboration, DESY, Hamburg

**Collaboration with:** ZEUS Collaboration, DESY, Hamburg

**Collaboration with:** ZEUS Collaboration, DESY, Hamburg

[Dr. Boaz Katz](#)

[Dr. Doron Kushnir](#)

[Prof. Yitzhak Maron](#)

**Collaboration with:** Cornell Univ. , Princeton Univ. , Sandia National Laboratories , Naval Research Laboratory, University of Jena in Germany , HZDR Institute-Dresden , Michigan State Univ. , Univ. of CA in San Diego , LLNL- NIF facility

**Collaboration with:** University of Jena and HZDR-Dresden in Germany , LLNL - National Ignition facility, Sandia National Laboratories.

**Prof. Giora Mikenberg**

**Collaboration with:** E. Duchovni, E. Gross, L. Levinson, D. Lellouch

**Collaboration with:** E. Duchovni, E. Gross, L. Levinson, D. Lellouch

[Prof. Mordehai Milgrom](#)

[Prof. Alexander Milov](#)

[Dr. David Mross](#)

[Prof. Yosef Nir](#)

**Collaboration with:** Marta Losada, Elina Fuchs

**Collaboration with:** Marta Losada, Gilad Perez

**Collaboration with:** Maytal Eran-Jona, Daphna Birenbaum-Carmeli, Sharon Diamant-Pick

[Prof. Eran Oded Ofek](#)

[Prof. Gilad Perez](#)

[Dr. Noam Tal Hod](#)

**Collaboration with:** NIKHEF, The University of Michigan, University of Wuppertal

**Collaboration with:** Multiple institutions (mostly from Canada, Chile, Russia, China and the USA)

**Collaboration with:** DESY, Albert-Ludwig Universitaet Freiburg, Max-Planck Institute of Structure and Matter, Helmholtz-Zentrum Jena, Friedrich-Schiller Universitaet Jena, Queens University Belfast, University College London, University of Plymouth, Tel Aviv University, Technion

**Prof. Igal Talmi**

**Collaboration with:** Shalom Shlomo, Texas A & M University

[Prof. Itzhak Tserruya](#)

**Collaboration with:** I. Ravinovich

**Collaboration with:** I. Ravinovich

**Collaboration with:** I. Ravinovich

**Prof. Vladimir Usov**

**Collaboration with:** G.Z. Machabeli

**Collaboration with:** A.K. Harding, D.B. Melrose, M. Milgrom, A.G. Muslimov, A.E. Shabad

**Collaboration with:** A.E. Shabad

**Collaboration with:** K.S. Cheng, T. Harko, M. Milgrom, F. Weber

**Collaboration with:** N.N. Pilyugin

[Prof. Eli Waxman](#)

**Collaboration with:** Avishay Gal-Yam, Boaz Katz, Doron Kushnir, Eran Ofek, Yossi Shvartzvald

**Collaboration with:** Sagi Ben-Ami, Avishay Gal-Yam, Eran Ofek, Yossi Shvartzvald

[Dr. Barak Zackay](#)

**Collaboration with:** Matias Zaldarriaga - IAS Princeton Tejaswi Venumadhav - UCSB

**Collaboration with:** Tsevi Mazei - Tel Aviv University

**Collaboration with:** Thomas Prince - Caltech Victoria Kaspi - McGill University

[Prof. Daniel Zajfman](#)

**Collaboration with:** Oded Heber

## Department of Physics Core Facilities

The Department of Particle Physics and Astrophysics is engaged in both experimental and theoretical research, in various directions. These include elementary particle physics, field theory, string theory, theoretical astrophysics, observational astrophysics, particle astrophysics, relativistic heavy ion physics, molecular physics, nuclear physics, plasma physics, and radiation detection physics.

## Department of Physics of Complex Systems

The Department of Physics of Complex Systems is engaged in fundamental and applied physics. Research in optics and atomic physics includes nonlinear optics, ultra fast optics and high harmonic generation, quantum optics, slow light, discrete optics, nano optics and nonlinear microscopy, laser cooling and trapping of atoms and ions, studies of Bose Einstein condensation, precision spectroscopy and quantum information processing. Theoretical and experimental research in soft condensed matter is concentrated on equilibrium and non-equilibrium statistical physics, clustering of data, bioinformatics and systems biology, electrokinetics of ions and charged particles in low dielectric liquids, colloids, soft materials and complex fluids. Experimental and theoretical hydrodynamics concentrates on turbulence, spatio-temporal chaos, turbulent

Rayleigh-Benard convection, liquids at interfaces, droplet impact, sedimentation and dynamics of single micro-objects, such as polymers, vesicles, capsules and hydrodynamics of their solutions. Turbulence theory is developed in general and in applications to cloud physics. Classical and quantum chaos, statistics of nodal lines in quantum systems and turbulence are studied theoretically. Mathematical and computational methods for archaeological research are developed. Theoretical physical biology deals with modeling living information systems, their molecular components and the way they evolve. Experimental bio-physics deals with bio-molecules, neural cultures, neurophysics, physics of the brain, physics of bio-systems and decision making in ant colonies.

## **Research activities**

[Dr. Hillel Aharoni](#)

[Dr. Rotem Arnon-Friedman](#)

[Prof. Nir Davidson](#)

**Collaboration with:** Ofer Firstenberg Ephi Sachmoon and Yaov Sagi

**Collaboration with:** Roei Ozeri

**Collaboration with:** Asher Friesem, Hui Cao, Oren Raz

**Collaboration with:** Ofer Firstenberg

**Collaboration with:** Ofer Firstenberg

[Prof. Eytan Domany](#)

**Collaboration with:** A. P. Young (UCSC)

**Collaboration with:** Several research groups at Weizmann, in the USA and in Europe; see below.

[Prof. Nirit Dudovich](#)

[Prof. Efi Efrati](#)

[Prof. Gregory Falkovich](#)

**Collaboration with:** Natalia Vladimirova, Michal Shavit, Vladimir Lebedev

**Collaboration with:** Anna Frishman, Vladimir Lebedev, Natalia Vladimirova, Bjorn Hof.

**Collaboration with:** Michal Shavit, Natalia Vladimirova

**Collaboration with:** Leonid Levitov, Andrey Shytov, Andre Geim.

[Dr. Ofer Feinerman](#)

[Prof. Ofer Firstenberg](#)

[Prof. Asher Friesem](#)

[Prof. Ulf Leonhardt](#)

[Prof. Victor Malka](#)

**Collaboration with:** HZDR in Germany, Ecole Polytechnique in France, and UM from US

[Dr. Ziv Meir](#)

[Prof. Elisha Moses](#)

[Prof. David Mukamel](#)

**Collaboration with:** S. Ruffo A. Campa

**Collaboration with:** S. Majumdar G. Schehr M. Barma A. Kundu

[Prof. Roei Ozeri](#)

[Dr. Alexander Poddubny](#)

**Collaboration with:** Ofer Firstenberg

**Collaboration with:** Serge Rosenblum, Johannes Fink (IST Austria)

**Collaboration with:** Arno Rauschenbeutel (Humboldt University, Berlin)

**Collaboration with:** Marcus Aspelmeier (University of Vienna)

[Dr. Oren Raz](#)

[Dr. Osip Schwartz](#)

**Prof. Adam Schwimmer**

[Prof. Uzy Smilansky](#)

[Prof. Joel Stavans](#)

[Prof. Victor Steinberg](#)

**Collaboration with:** Prof. G. Falkovich, Prof. V. Lebedev, Prof. Y. Dubief, Prof. H. Stark

# Dean for Educational Activities

## Department of Science Teaching

The Department of Science Teaching main interrelated missions are to advance the academic discipline of science and mathematics education, to enhance the quality and effectiveness of mathematics and science education in Israel, and to develop academic and practical leadership in science and mathematics education in Israel and overseas. The Department carries out educational research and development primarily for grades 7-12 in mathematics, physics, chemistry, computer science, earth sciences and life sciences, and in science and technology for junior high school. The Department targets both the general student population and those who are majoring in one or more of these disciplines. The Department carries out interrelated and continuous long-term academic activities, including research, development and implementation of innovative learning materials, pedagogical models, and teachers' professional development (PD). The Department has many avenues of collaboration with other departments on campus and with the educational system in Israel; it has a significant impact on science education research, practice, and policy in Israel and overseas. As the Department is currently shifting from mainly textual teaching and learning materials developed in the Department to primarily digital platforms, the demand for techno-pedagogical support has increased tremendously in recent years. This shift allows the incorporation of new methodologies for both teaching and learning, as well as in the way research is carried out in the Department. The large amount of data on teachers'™ and students'™ performance accumulating in databases promote the development and use of new research methodologies. AI tools are currently being developed to improve both the teaching and learning that take place on these platforms, as well as to expand the Department's™ research possibilities. These days Department is establishing a core facilities unit, entitled EduCore, that is expected to provide the needed services (e.g., software development, technological design, data science services, etc.) and to support both research and development in the various research groups, as well as other units and faculties at the Weizmann Institute that are in need of techno-pedagogical services.

### **Research activities**

[Prof. Abraham Arcavi](#)

**Collaboration with:** Dr. Ronnie Karsenty

**Collaboration with:** Dr. Sue Magidson

**Collaboration with:** Dr. Nurit Hadas

[Prof. Michal Armoni](#)

[Prof. Mordechai Ben-Ari](#)

**Collaboration with:** Francesco Mondada, Ecole Polytechnique Federale de Lausanne

[Prof. Ron Blonder](#)

[Prof. Ruhama Even](#)

[Prof. Bat Sheva Eylon](#)

**Collaboration with:** U. Ganiel

**Collaboration with:** U. Ganiel

**Collaboration with:** E. Bagno, U. Ganiel

**Collaboration with:** Z. Scherz, I. Hopfeld, N. Orion, O. Kedem, Y. Ben-Hur

**Collaboration with:** Z. Scherz, N. Orion, S. Rosenfeld, U. Ganiel

[Prof. David Fortus](#)

**Collaboration with:** Yoni Yeshayahu, Head of Pediatrics and Juvenile Endocrinology, Samson Assuta Hospital

**Collaboration with:** Joe Krajcik - Michigan State University Knut Neumann - Leibniz Institute for Science and Mathematics Education (IPN), Germany Jeff Nordine - University of Iowa Bob Geier - Michigan State University

**Collaboration with:** Itai Berger - Head of Pediatric Neurology - Samson Assuta Hospital

**Collaboration with:** Troy Sadler - University of North Carolina at Chapel Hill

[Prof. Avi Hofstein](#)

**Collaboration with:** R. Mamlok

**Collaboration with:** Rachel mamlok-Naaman,

[Prof. Nir Orion](#)

[Prof. Anat Yarden](#)

**Collaboration with:** Prof. Zohar Livnat, Bar-Ilan University

**Collaboration with:** Prof. Ute Harms, IPN, Kiel, Germany

**Collaboration with:** Dr. Irit Sadeh, Ministry of Education

**Collaboration with:** Prof. Baruch Schwarz, Hebrew University; Prof. Boris Koichu, WIS; Prof. Michal Tabach, Tel-Aviv University; Dr. Einat Heyd-Metzuyanin, Technion

**Collaboration with:** Prof. Ruhama Even, Prof. Vered Rom-Kedar

**Collaboration with:** Dr. Giora Alexandron, Dr. Yael Shwartz, Prof. Ron Blonder

[Prof. Edit Yerushalmi](#)

**Collaboration with:** A. Hofstein, S. Livne, Y. Roth, R. Blonder, A. Yarden, S. Safran, B. Eylon, B. Geiger

**Collaboration with:** C. Singh, E. Cohen, E. Bagno, B. Eylon

**Collaboration with:** R. Safadi, E. Bagno, A. Rozen

**Collaboration with:** C. Henderson, K. Heller, P. Heller, V. Quo, E. Cohen