מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

The Weizmann Institute

The Weizmann Institute of Science, located in Rehovot, Israel, is one of the top-ranking multidisciplinary research institutions in the world. Noted for its wide-ranging exploration of the sciences and technology, the Institute gathers together 2,500 scientists, technicians and research students devoted to adventuring into the unknown. In their labs, located in a landscaped campus environment, they share a vision: To better understand nature and our place within it. Inquisitiveness is their predominant trait. It is this curiosity that propelled Homo sapiens up the slope of evolution. It is this driving curiosity that sees man -- and woman -- through their greatest discoveries. It is the force which pushed earliest civilization to develop agriculture, to learn the hows of constructing shelter, to create the written word, to harness electricity to the wagon of industry and commerce, to contemplate far-off galaxies, to find the cure for disease, to form new materials, and to decipher the genetic code stamped on all living things, be they plant or animal. The desire to continue in this forward stride is the force behind every Institute scientist's efforts to penetrate realms formerly incomprehensible to humankind. And what dwells in these domains? The unknown. The only certainty: revelation encountered along their path. We invite you along to view a selection of landmark discoveries established by Weizmann scientists on a number of their scientific excursions. To look over the shoulder of these scientific trailblazers who go that one step more in furthering this, our civilization. The Weizmann Institute of Science: Shaping the future.

Faculties and Centers

- **Department of Biological Chemistry**
- **Department of Structural Biology**
- **Department of Molecular Cell Biology**

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Department of Biological Chemistry

- Structure, function engineering and directed evolution of proteins, enzymes and protein complexes
- Bioenergetic aspects: Structure and function of ion channels, pumps, other transporters, viral envelope proteins, photosynthesis and photosynthesis proteins
- Mechanisms by which proteins and lipids are transported from their point of synthesis, sorted, and inserted into various organelles
- Signal transduction, and molecular pathogenesis
- Microbial Pathogenesis and anti-microbial drugs
- DNA repair, mutagenesis and cancer risk; Basal and tissue-specific gene expression
- Biomolecular computers

Researchers and Fields of Expert

Prof. Edward A. Bayer

Research Interests: Cellusosme systems; Designer cellulosomes; Cohesin-dockerin interactions; BioFuels; Non-cellulosomal systems

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Bayer/

Mail: ed.bayer@weizmann.ac.il

Prof. Eitan Bibi

Research Interests: Membrane Proteins-Biogenesis, Structure,Function

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Bibi/

Mail: eitan.bibi@weizmann.ac.il

Prof. Rivka Dikstein

Research Interests: Molecular Mechanisms of Transcription Regulation

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Dikstein/rivka_dikstein.html

Mail: rivka.dikstein@weizmann.ac.il

Prof. Michael Eisenbach

Research Interests: Guidance mechanisms in bacteria and sperm; Signal transduction in bacterial chemotaxis

Website:www.weizmann.ac.il/Biological_Chemistry/scientist/Eisenbach/new_pages/abb.html

Mail: M.Eisenbach@weizmann.ac.il

Prof. Zvulun Elazar

Research Interests: Regulation of autophagy in yeast and mammals

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Elazar/zvulun_elazar.html

Mail: Zvulun.Elazar@weizmann.ac.il

Mike Fainzilber

Research Interests: Retrograde injury signaling in lesioned nerve**,** Differentiation/Survival Signaling in neurons or in tumors of neural origin

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Fainzilber/Fainzilber.html

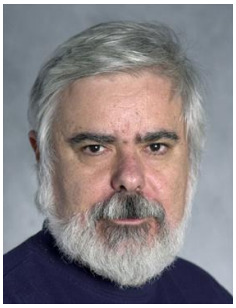
Mail: Mike.Fainzilber@weizmann.ac.il

Tony Futerman

Research Interests: Our laboratory works on sphingolipids, important membrane components. We focus on two main areas: sphingolipid synthesis and signaling, particularly of ceramide, and sphingolipid storage diseases, with an emphasis on mechanistic understanding of disease pathology and also on novel therapeutic approaches.

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/futerman/

Mail: tony.futerman@weizmann.ac.il



Haim Garty

Research Interests: Regulation of epithelial sodium and potassium transport

Website: www.weizmann.ac.il/weizsites/haimgarty/

Mail: h.garty@weizmann.ac.il

Prof. Steve Karlish

Research Interests: The Sodium-potassium Pump: structure, function, regulation and pharmacology

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Karlish/steven_karlish.html

Mail: steven.karlish@weizmann.ac.il

Prof. Zvi Livneh

Research Interests: DNA repair and mutagenesis

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Livneh/

Mail: zvi.livneh@weizmann.ac.il

Eitan Reuveny

Research Interests: Ion channels

Website:

www.weizmann.ac.il/Biological_Chemistry/Reuveny/home.html

Mail: e.reuveny@weizmann.ac.il

Prof. Gideon Schreiber

Research Interests: Kinetics of protein-protein association; Cooperativity of non-covalent interactions between proteins; Protein design; Interferon-receptor interactions, from basic understanding to drug design; Bioinformatics of protein-protein interactions; Structural proteomics

Website:

www.weizmann.ac.il/Biological_Chemistry/scientist/Schreiber/home.html

Mail: gideon.schreiber@weizmann.ac.il

Professor Yechiel Shai

Research Interests: Protein-Membrane Interactions and Protein-Protein Recognition within the Cell Membrane: Mode of Action of Membrane Proteins Involved in Cell Permeation in Infectious Diseases

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Shai/

Mail: yechiel.shai@weizmann.ac.il

Prof. Ehud Shapiro

Research Interests: Biomolecular Computer, human cell lineage

Website: www.wisdom.weizmann.ac.il/~udi/labs.html

Mail: ehud.shapiro@weizmann.ac.il

Dr. Michal Sharon

Research Interests: Our group is interested in the relationship between structure and function of the proteasome complex and other molecular machines involved in the ubiquitin-proteasome pathway.

Website:
www.weizmann.ac.il/Biological_Chemistry/scientist/MichalSharon/

Mail: michal.sharon@weizmann.ac.il

Prof. Dan S. Tawfik

Research Interests: Our research is aimed at understanding how proteins, and enzymes in particular, perform their function, and how they evolve.

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Tawfik/

Mail: dan.tawfik@weizmann.ac.il

Prof. Michael Walker

Research Interests: Specific gene expression in pancreatic beta cells

Website: www.weizmann.ac.il/Biological_Chemistry/scientist/Walker/michael_walker.html

Mail: M.Walker@weizmann.ac.il

Prof. David Wallach

Research Interests: TNF/NGF receptors, Signaling for activation of the transcription factor NF-kappaB

Website:

www.weizmann.ac.il/Biological_Chemistry/scientist/Wallach/people.html

Mail: d.wallach@weizmann.ac.il

Dr. Avraham Yaron

Research Interests: Molecular mechanisms governing Axon guidance during embryonic development.

Website:

www.weizmann.ac.il/Biological_Chemistry/scientist/Yaron/yaron.html

Mail: avraham.yaron@weizmann.ac.il

מכון ויצמן למדע
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Department of Structural Biology

Different biological systems are being studied from the atomic to the cellular level of organization using state-of-the-art structural methods such as X-ray crystallography, NMR and electron microscopy as well as other spectroscopic methods and biochemical and molecular biology techniques.

The investigation of the molecular structure of biopolymers such as proteins and nucleic acids is accompanied by structure-function studies.

Major research topics include structural studies on components involved in transcription and translation of the genetic code such as ribosomes (Yonath), tRNA synthetases (Safro), and transcription factors (Shakked). Additional reasearch in this area includes work on helicases (Sagi) and DNA structure (Shakked).

Another major area of activity is work related to structural and dynamical aspects of protein function such as on acetylcholine esterase (Sussman), metalloenzymes (Sagi), chaperonins (Horovitz) and proteins involved in membrane-fusion and virus entry (Fass) into cells.

Research on molecular recognition includes NMR studies (Anglister, Muszkat) on proteins involved in the immune response such as antibodies and interferon (Anglister) and work on antibodies that interact with monolayer and crystal surfaces (Addadi).

Finally, work at the cellular level of organization includes studies on biomineralization (Addadi, Weiner), such as crystal growth by organisms to form skeletal tissues, and on the nanomechanics and dynamics of virus assembly and hearing (Rousso).

Researchers and Fields of Expert

Prof. Lia Addadi

Research Interests: Mechanism of crystal nucleation and modulation of crystal growth and properties in biomineralization (bone, mollusk shells, echinoderms); bulletInteractions between crystals and antibodies in pathological crystallizations; bulletAntibodies that recognize crystal surfaces; bulletMechanism of cell adhesion using crystal substrates

Website: www.weizmann.ac.il/sb/faculty_pages/Addadi/home.html

Mail: lia.addadi@weizmann.ac.il

Prof. Jacob Anglister

Research Interests: HIV-1 envelope glycoproteins (gp120 and gp41); Interferon with its interferon receptor; α-Scorpion toxins and sodium-channel

Website: www.weizmann.ac.il/sb/faculty_pages/Anglister/

Mail: jacob.anglister@weizmann.ac.il

Deborah Fass

Research Interests: We are currently focusing on the mechanism by which proteins are enzymatically cross-linked with disulfide bonds upon entry into the endoplasmic reticulum or export from the cell.

Website: www.weizmann.ac.il/sb/faculty_pages/Fass/index.html

Mail: deborah.fass@weizmann.ac.il

Prof. Amnon Horovitz

Research Interests: The focus of our research activities is to understand the molecular basis of allosteric transitions in proteins and how they relate to their function.

Website: www.weizmann.ac.il/sb/faculty_pages/Horovitz/

Mail: amnon.horovitz@weizmann.ac.il

Yaakov Levy

Research Interests: We are focused on advancing our understanding of biomolecules (the sequence-structure-function problem) using a battery of computational and theoretical methods that capture their chemical and physical nature as well as the billions of years of evolutional design.

Website:
www.weizmann.ac.il/Structural_Biology/faculty_pages/Levy/index.html

Mail: koby.levy@weizmann.ac.il

Itay Pousso

Research Interests: Our research focuses on the interrelations between the structure, nanomechanics and function of large biological complexes. Currently our laboratory is engaged with the investigation of the physical properties underlying retrovirus replication, and the role of the mammalian tectorial membrane in hearing micromechanics.

Website: www.weizmann.ac.il/sb/faculty_pages/Rousso/

Mail: itay.rousso@weizmann.ac.il

Prof. Mark Safro

Research Interests: X-Ray analysis of phenylalanyl-tRNA synthetase from Thermus thermophilus complexed with tRNA and other functional ligands. Aminoacyl-tRNA synthetases and disease. The aaRSs-tRNA encounter complexes and electrostatic interactions. Amino acid biogenesis, evolution of the genetic code and aminoacyl-tRNA synthetases

Website: www.weizmann.ac.il/sb/faculty_pages/Safro/

Mail: mark.safro@weizmann.ac.il

Irit Sagi

Research Interests: From molecular biophysics and structural biology to drug design: application of a multidisciplinary experimental approach to the study of metalloenzymes

Website: www.weizmann.ac.il/sb/faculty_pages/Sagi/home.html

Mail: irit.sagi@weizmann.ac.il

Prof. Zippora Shakked

Research Interests: Structural Studies of DNA, Structural and Biochemical Studies of Proteins involved in Transcriptional Regulation

Website: www.weizmann.ac.il/sb/faculty_pages/Shakked/

Mail: zippi.shakked@weizmann.ac.il

Prof. Joel L. Sussman

Research Interests: We are currently studying the 3D structure/function of nervous system proteins, such as acetylcholinesterase, cholinesterase-like adhesion molecules, snake toxins, β-glucosidase, β-secretase and paraoxonase. We are also studying how proteins adapt to extreme environments, *e.g.* halotolerant proteins from *Dunaliella*, and why certain proteins appear to be *natively unfolded*.

Website: www.weizmann.ac.il/sb/faculty_pages/Sussman/res_obj.html

Mail: joel.sussman@weizmann.ac.il

Professor Steve Weiner

Research Interests: Biomineralization

Website: www.weizmann.ac.il/sb/faculty_pages/Weiner/home.html

Mail: steve.weiner@weizmann.ac.il

Prof. Ada E. Yonath

Research Interests: Ribosomal crystallography

Website: www.weizmann.ac.il/sb/faculty_pages/Yonath/home.html

Mail: ada.yonath@weizmann.ac.il

Department of Molecular Cell Biology

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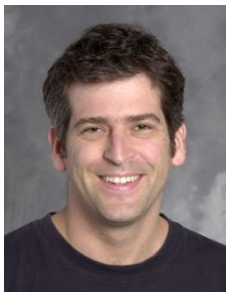
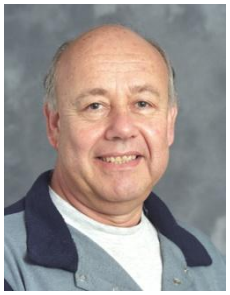
General Research Activities:

- growth regulation
- determination of cell fate and differentiation
- cell adhesion and movement
- intracellular trafficking

Departmental Researchers



Uri Alon focuses on the cell-wide analysis of protein activity, and how cells make decisions and process information. A systems biologist working to develop a “blueprint” of a living cell, he has determined that the biochemical circuitry in the cell is composed of repeating circuit patterns called network motifs, each of which performs a specific information-processing task.
Mail: urialon@weizmann.ac.il



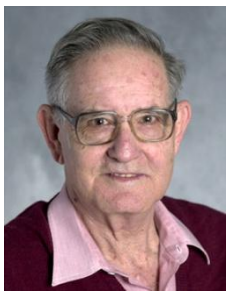
Abraham Amsterdam focuses on investigating the control of ovulation and factors, which may explain the risk factors for ovarian cancer. We used ovarian transcriptsomes as a tool for global approach of genes, modulated by gonadotropic hormones in human ovarian granulosa cells. Combined studies by DNA microarrays, biochemical and physiological approaches revealed that epiregulin (Ep) and amphiregulin (Ar), members of the mitogenic epidermal growth factor (EGF), are highly expressed on the level of the genes and the proteins, following gonadotropin stimulation. In contrast, in ovarian cancer, these EGF like factors are expressed constitutively. Mail: Abraham.Amsterdam@weizmann.ac.il

Avri Ben-Ze’ev studies the genes and cellular mechanisms involved in cancer. In focusing on beta-catenin, a gene that is abnormally activated in colorectal and many other types of cancer, he has clarified the consequences of beta-catenin hyperactivation in cancerous cells, and identified some of the signals unleashed by this gene in instances of malignancy.
Mail: avri.ben-zeev@weizmann.ac.il

Alexander Bershadsky studies how cells move, and the physical forces necessary for cells to attach themselves to the substrate and to one another. In exploring the points of contact, which act as mechanical “sensors” that provide the cell with information about its environment and determine its behavior, he has learned that in cancer cells, the activity of these “sensors” is disrupted, which likely accounts for the cell’s difficulty in adhering to substrates and, consequently, their greater mobility.
Mail: **Alexander**.**Bershadsky**@weizmann.ac.il

Eli Canaani investigates the *MLL* gene and its protein products, in order to understand their biochemical activities and the mechanism by which they trigger leukemia. Leukemias associated with rearrangement of the *MLL* gene account for the majority of acute lymphocytic and myelocytic leukemias in infants, and in therapy-related leukemias.
Mail: **Eli**.**Canaani**@weizmann.ac.il

Benjamin Geiger focuses mainly on the mechanisms responsible for communication between cells, both normal and cancerous. He is attempting to identify and trace the specific molecular involved in intercellular recognition and communication, and to investigate the molecules and signaling processes which mediate such interactions.
Mail: Benny.**Geiger**@weizmann.ac.il



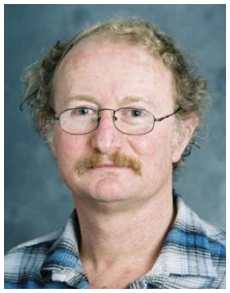
David Givol investigates the tumor suppressor gene p53, the most frequently mutated gene in all cancers, and focuses on mechanisms that activate p53 and the way p53 activates target genes, using microarrays. He also studies the effect of p53 on different chemotherapies. Recently he has been studying connection between stem cells and cancer, exploring the properties of "cancer stem cells" that are responsible for the propagation of malignant tumors. He isolates such stem cells from leukemia and glioblastoma and compares gene expression profiles of stem and non-stem tumor cells and test differential drug response in these cells.
Mail: **David**.**Givol**@weizmann.ac.il

Zvi Kam is developing and applying high-resolution automated cell-based screening microscopy for functional analysis of cells. Multiple perturbations by compound libraries and by siRNA are applied to reporter cells cultured in multi-well plates, cell images are recorded, and quantitative image analysis scores the responses. This high-throughput platform provides systems biological experimental approach for studying complex cellular mechanisms.
Mail: **zvi**.**kam**@weizmann.ac.il

Valery Krizhanovsky studies molecular mechanisms of cellular senescence (a permanent cell cycle arrest) and its role in human diseases. His lab utilizes elaborate mouse models and tissue culture techniques to understand how senescent cells communicate with their microenvironment to impact wound healing response, cancer progression and aging.
Mail: **valery.krizhanovsky**@weizmann.ac.il

Sima Lev studies the molecular mechanisms of membrane trafficking pathways in mammalian cells. These pathways mediate the transport of proteins, lipids, and sugars to their final cellular destinations and are fundamental to normal cell function and survival. Defects in these pathways are associated with many human diseases and can affect cell cycle progression. She is currently focusing on mechanisms that control the lipid composition of membrane domains along the secretory pathway, as well as the regulation of membrane trafficking events during cell division.
Mail: **sima.lev**@weizmann.ac.il

Gil Levkowitz utilizes zebrafish embryos as a vertebrate model organism to investigate how coordinated development of multiple neuronal types is achieved in the brain. The lab studies the development and maintenance of dopaminergic neurons and of several neuropeptides- secreting neurons, which reside in the hypothalamus. Understanding these processes is relevant to prospective therapies for neurological disorders as aberrant development of the dopaminergic system might be a major factor contributing to Parkinson's disease and impairments in hypothalamic neurons are associated with defects in energy balance, and in neuro-endocrine and psychiatric disorders.
Mail: **Gil.Levkowitz**@weizmann.ac.il



Moshe Oren is studying the regulation of the p53 tumor suppressor and its relevance to cancer. Specific interests include the analysis of signal transduction pathways that modulate p53 activity in response to various stress signals, exploration of the molecular basis for the ability of p53 to elicit different cell fate changes in response to different triggers, the role of p53 in the interaction between tumor cells and their microenvironment, and (in collaboration with V. Rotter) the analysis of gain of function activities of cancer-associated p53 mutants. In addition, the group is studying the regulation and function of the Mdm2 oncoprotein, a major component of the p53 network.
Mail: **Moshe.Oren**@weizmann.ac.il

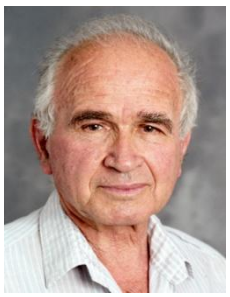
Elior Peles focuses on the biology of Schwann cells and oligodendrocytes, the myelinating glial cells of the peripheral and central nervous system, respectively. His group is studying how these cells recognize and wrap axon with myelin, an insulating lipid membrane that enables the rapid and efficient conduction of nerve impulses. His laboratory is also studying how axon-glia interaction control the molecular organization of the axonal membrane, which is required for the normal function of myelinated nerves and is disturbed in Multiple Sclerosis, as well as in a wide range of other neurological diseases.
Mail: **Peles**@weizmann.ac.il

Varda Rotter focuses on the p53 gene, which as a wild type protein plays a pivotal role in protecting cells from becoming cancerous, but when mutated or inactivated causes the accumulation of genetic instabilities, which in turn induces malignant transformation of cells. On the question of mutant p53 gain of function, which is central in her research, she is collaborating with Moshe Oren and Eytan Domany. As it is well accepted that malignant transformation is a stepwise process involving various defined gene signatures it is the challenge of her studies to discover which of these gene networks involve the p53 protein.
Mail: **varda**.**rotter**@weizmann.ac.il

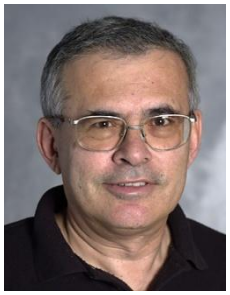
Oren Schuldiner studies the molecular mechanism of neuronal remodeling. His lab uses the fruit fly as a model to investigate axon pruning. Using sophisticated genetic and microscopic tools to create and visualize a single mutant neuron in a heterozygous brain, it is possible to study cell autonomous processes that occur late during development *in vivo*. To understand the mechanisms that regulate axon pruning, his lab focuses finding and characterizing novel proteins that play a role in cell-cell interactions (specifically neuron-glia interactions), cargo trafficking, and signaling within the neurons. His lab also studies the molecular switch that induces re-growth of the axons following pruning. Axon fragmentation during pruning shares molecular similarities with processes occurring in neurodegenerative diseases. Therefore, uncovering the molecular mechanisms underlying pruning and axon re-growth will promote our understanding of axon fragmentation and regeneration during development and disease.
Mail: **oren**.**schuldiner**@weizmann.ac.il

Eran Segal develops computational models aimed at understanding how biological processes are regulated at various levels. These include models that integrate transcription factors and DNA sequences, aimed at explaining how complex patterns of gene expression are encoded in DNA sequences and read by cells, and sequence-based models for chromatin structure that explain how nucleosomes get positioned on genomes and how they consequently affect gene expression.
Mail: **Eran**.**Segal**@weizmann.ac.il

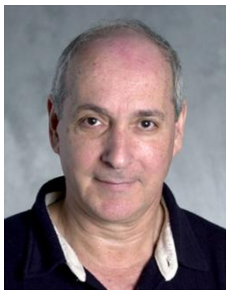
Uri Nudel and David Yaffe are investigating the structure, evolution and function of products of the dystrophin gene, which is defective in Duchenne muscular dystrophy (DMD). Gene inactivation techniques were used to study the function of Dp71, the major non-muscle product of the DMD gene, and its possible involvement in development and in learning capacity. Cloning and analysis of the homologous genes from sea urchin and drosophila have important implications with regard to the evolution of the DMD gene family and function of the DMD gene products. These studies showed a very impressive conservation during evolution of the structure of the DMD gene and its multiple products. Functional studies indicated a number of abnormalities associated with mutants of the drosphila orthologue of the DMD gene, including defects in learning capacity. It is interesting to note that in humans, DMD is also often associated with cognitive impairments. Dr. Rachel Sarig, of the same group is also investigating the topic of adult stem cells and their potential application for cell therapy. Recent studies have indicated the prevalence and importance of adult stem cells in development, maintenance and regeneration of various tissues. Muscle progenitor cells are of special interest as an excellent, easy accessible cell type, with well-characterized markers and transcription factors associated with its various differentiation stages, thus offering a convenient model system. The team has isolated, from mouse skeletal muscle a population of slow adherent myogenic cells that can proliferate for extended periods, as suspended clusters of cells (myospheres). Myosphere cells express myogenic markers, and differentiate to muscle fibers both *in vitro* and *in vivo*. Cloned populations of these cells and of human myogenic cells are being examined for their plasticity and ability to transdifferentiate into other cell lineages. Preliminary results suggest that these cells can be reprogrammed into neuronal cells.



Uri Nudel Mail: **Uri**.**Nudel**@weizmann.ac.il, David Yaffe Mail: **David**.**Yaffe**@weizmann.ac.il



Yehiel Zick studies the molecular basis of insulin resistance with a particular emphasis on the role of Ser/Thr kinases as negative-feedback regulators of this process. He also works to understand the activities of galectin-8, one of a family of animal lectins implicated in the development of prostate cancer. Demonstrating that galectin-8 as a modulator of cell cycle progression and as an inducer of cell growth arrest, he is working toward a novel, potentially curative treatment for prostate cancer.
Mail: **Yehiel**.**Zick**@weizmann.ac.il



Dov Zipori focuses on the nature of the mesenchyme, primarily on the tendency of this tissue to generate cells in the stem state. Research in this laboratory is divided into three categories. The first is concerned with the molecular basis of stemness. The research team discovered that mesenchymal cells have promiscuous gene expression pattern in that they express genes of various lineage (e.g. T cell receptor components). The functional significance of this unexpected gene expression is a major subject for investigation in the laboratory. The second category relates to the regulation of stem cell self-renewal and differentiation. Previous studies of this research team suggested that the maintenance of the stem state is imposed by differentiation restraining molecules such as transforming growth factor ? superfamily members. The group recently showed that Toll-like receptor ligands convey signals that block mesenchymal stem cell (MSC) differentiation. The generality of this phenomenon and its mechanism are now being studied. The third category relates to the practical use of MSC. These cells are used as a therapeutic modality in animal models for human diseases including osteoarthritis and multiple myeloma.

Mail: **dov**.**zipori**@weizmann.ac.il