Cognitive Neuroscience

Prof. Galia Avidan

My scientific discipline is cognitive neuroscience, and my research focuses on the psychological and neural properties of the human visual system. My work is designed to elucidate the brain mechanisms giving rise to perception of faces, objects and complex scenes and in turn, to visually guided behavior. I adopt an integrative multidisciplinary approach by combining behavioral, eye tracking and imaging techniques (structural and functional MRI). Additionally, my research employs a computational perspective, which enables to study connectivity patters in the human brain that are associated with specific cognitive abilities and individual differences. My work involves healthy individuals as well as individuals with neuropsychological deficits affecting visual perception and cognition.

Prof. Ohad Ben-Shahar

The interdisciplinary Computational Vision Lab (iCVL) studies biological (and in particular, human) vision and machine vision from both theoretical and applied perspectives. We bring together these fields to (1) develop algorithmic solutions to challenges in computer vision and image understanding, (2) devise computational explanations of biological visual function, and (2) employ insights from studying vision for exploration of other types of information processing, both sensory and cognitive. To meet these goals, research is highly interdisciplinary, involving various combinations of computational and mathematical work, machine learning techniques, behavioral exploration and visual psychophysics (with both humans and animals), and inquiry into visual neuroscience.

Dr. Dorit Benshalom

The lab for functional neuroanatomy works on two brain systems:
The language system and the prefrontal cortex. We have published a functional neuroanatomy of the language system (Ben Shalom & Poeppel, 2008), and a functional neuroanatomy of the prefrontal cortex (Ben Shalom & Bonneh, 2019). We are busy testing the predictions of these two theoretical models.

Prof. Andrea Berger

Studies the development of executive aspects of attention and control (e.g., inhibitory control, monitoring, and error detection), and the development of number representations using behavioral and EEG studies.

Prof. Ilan Dinstein

Studies brain function and structure in developmental disorders including autism and ADHD with a strong emphasis on toddlers who have just been diagnosed. Ongoing projects include sensory, motor, and resting-state experiments using EEG and fMRI to study brain function as well as anatomical and DTI MRI scans to study brain structure.

Prof. Dinstein is the director of the National Autism Research Center located in BGU (www.autismisrael.org).

Dr. Nir Fresco

My areas of interest include the conceptual foundations of computational (and non-computational) cognitive and brain sciences, philosophy of computation, philosophy of information as well as skill acquisition and automaticity. To date, my work has been theoretical only, but empirical work on skill acquisition and automaticity is presently planned in collaboration with Dr. Lior Shmuelof and Prof. Joseph Tzelgov.

Prof. Tzvi Ganel

Visual control of action constitutes a fundamental ability that allows people and other organisms to interact with their visual environments. Visual perception of objects, on the other hand, allows people to identify objects in their visual environment. My main areas of research include studying visual perception in general and more specifically, exploring the differences between visual perception and visually guided action. An ongoing research in my perception-action lab is focused on how visual perception and visually guided action differ from one another using established psychophysical and behavioral tools such as testing those two systems under the context of visual illusions and comparing how both systems are affected by basic psychophysical principals.

Dr. Michael Gilead

My field of research is social-cognitive neuroscience. I am mostly interested in phenomena that seem to be the result of the social/cultural and communicative/symbolic capacities of humans (for example, the ability to regulate one's emotions, political conflict). In thinking of these phenomena, we focus on the individual-level mental events that may subserve them (e.g., perspective-taking processes, the workings of motivational systems), often applying a biological perspective (i.e., thinking in terms of evolutionary functions and biological systems, using neuroimaging methods).

Dr. Shelly Levy-Tzedek

In the Levy-Tzedek Lab, we study the effects of aging and disease (such as stroke) on motor control .and motor learning, and we design rehabilitation tools and techniques
Specifically, we design gamified human-robot interactions for healthy aging, as well as for post-stroke rehabilitation.

Dr. Yoav Kessler

The research in my lab focuses on two main topics:

a. The relationship between working memory (WM) and cognitive control. We study how the content of WM is served for the control of thought and action, and how this content itself is controlled. To this end, we use behavioral, EEG/ERP and neuroimaging methods.

b. Group-level cognition. We study the collective psychology of small groups. For example, group-level WM capacity, collective memory, group-level reaction time, decision making, and so forth. We examine the relationship between individual-level performance and group performance, as well as phenomena that are related to the wisdom of crowds.

Prof. Ilana Nisky

My students and I apply neuroscience theories about the human sensorimotor control, perception, adaptation, learning, and skill acquisition in the development of human-operated medical and surgical robotic systems. We also use robots, haptic devices, and other mechatronic devices as a platform to

understand the human sensorimotor system in real-life tasks like surgery, and in virtual tasks like virtual reality games or surgical simulation. We hope that this research will improve the quality of treatment for patients, will facilitate better training of surgeons, advance the technology of teleoperation and haptics, and advance our understanding of the brain.

Dr. Niv Reggev

Studies the social, motivational and cognitive processes underlying humans' interactions with and perceptions of other people. He used neuroimaging (fMRI) methods as well as methods from behavioral psychology, economy and more. Specifically interested in how stereotypes shape neural mechanisms and our life.

Dr. Talya Sadeh

The Memory and Forgetting Lab, headed by Dr. Talya Sadeh, investigates the neurocognitive mechanisms underlying Episodic Memory. The term episodic memory was coined in 1972 by the influential memory researcher, Endel Tulving, and is often described as (the perhaps uniquely human) capacity to mentally go back in time and relive events from our past (e.g., your 16th birthday or even yesterday's lunch).

Some of the major questions our lab explores are: Why do we forget things we once remembered? How is memory affected by processes that occur prior to learning? How does social interaction shape episodic memory?

Dr. Lior Shmuelof

I study motor control and motor learning in humans using behavioral and imaging methods. My research includes studying the acquisition of new abilities (such as in the case of BCI), the differential effect of implicit and explicit processes in sensorimotor adaptation, skill learning, critical periods for motor recovery after stroke, and rehabilitation.

Dr. Oren Shriki

Research in the lab of Dr. Oren Shriki uses mathematical analyses of brain activity and machine learning techniques to develop novel diagnostic tools for neurological and psychiatric disorders. The lab also develops computational models of neuronal networks to gain insights into how changes in neural dynamics lead to brain disorders and how neural plasticity may assist in restoring healthy neural dynamics. A major focus of the lab is on translational neuroscience and neurotechnologies, such as brain-computer interfaces, a system for real-time epileptic seizure prediction and a novel pilot helmet which monitor's the pilot's brain.

Prof. Carmel Sofer

The face is a powerful source of people's impressions, drawing quick conclusions about ethnicity, age, gender and personality traits. The face is also a very prominent means of signaling emotional states and intentions.
In our research, we explore the patterns of facial expressions, over the course of long-lasting social interactions, that translate into social meaning. In the analogy of language, we deal with sentences and paragraphs, following on previous research that focused on understanding words (basic facial expressions such as a smile or anger).
The research in the lab is multidisciplinary, combining social and cognitive psychology with mathematical psychology and advanced computational methods. By combining a psychological experimental framework with a computational framework, we aim to create psychologically valid

models of the human facial expression language (the contextual aspect of the sequences of facial expressions). These models describe the use of facial expressions for communication and the way they are perceived socially.

Laboratory research results may be integrated into psychological and medical studies as well as computer applications (computers / robots / machines) to enable natural interfaces between humans and computers.

Dr. Florina Uzefovsky

Studies the biological basis, including genetics and endocrinology, of empathy development in the typical range and atypical range (e.g., autism); and how biological factors interact with environmental influences (social environment, parenting) to shape different trajectories of empathy development.

Dr. Maor Zeev-Wolf

As a clinical psychologist and a researcher, my research intersects with and is reinforced by my clinical background. My main research focuses are language and communication processing, social and emotional perception in individuals with schizophrenia, the influence of stress and maternal depression on the developing brain, and the brain mechanisms underlying dissociative states of consciousness. In my research I utilize a range of behavioral and brain imaging techniques including EEG and MEG.

Prof. Abraham Zangen

Studies the critical alterations within the brain reward system that are associated with pathological conditions, and how localized electromagnetic stimulation (using TMS) of these networks can affect such conditions in animal models and humans with a specific focus on molecular and electrophysiological alterations in reward-related networks that are associated with and may cause depression, addiction and attention deficit disorders.

Theoretical and Computational Neuroscience

Dr. Simona Bar-Haim

The Motor Control and Rehabilitation of Walking Lab (MCRW) is a basic and clinical neuroscience lab dedicated to research and development of novel treatments and technologies in the field of walking rehabilitation.

We investigate mechanisms that control the function of walking in persons with typical walking patterns and those with disabilities due to brain damage.

Currently, the MCRW has several active studies examining topics such as integrative strategies to increase the role of somatosensation in the control of walking, optimal incorporation of the visual system to improve walking stability and the capacity to cope with perturbation while walking.

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Prof. Shlomi Dolev

My recent research scope in brain science includes holographic memory coding in the brain. Quantum effects in the brain and machine learning based avatar person representation and the interaction among such avatars.

Prof. Opher Donchin

Studies motor control with behavioral, electrophysiology and neuroimaging techniques with a particular interest in understanding the function of the cerebellum.

Prof. David Golomb

I work in the fields of theoretical and computational neuroscience and neurophysics, and study the dynamics of large neuronal networks. My research has focused on information processing in the whisker somatosensory-motor system, where active sensing is crucial for perception. Using theoretical and computational methods, I study how cortical circuits with several types of interneurons process thalamic input. In another project, I investigate the generation and synchronization of whisking and sniffing rhythms in the brainstem, the generation of neuronal signals in response to whisker contact, and the computational role of somatosensory-motor loops in the brainstem.

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Dr. Jonathan Rosenblatt

My research deals with the design of statistical tools that are appropriate for the complicated fMRI data structure, and researchers' hypotheses. Some of my contributions are simple adaptations of existing tools from fields such as multivariate statistics literature, supervised machine learning, multiple testing, etc. The other part of my contributions go back to the philosophy of science and rethink the notion of "brain activation" and "signal" in the context of groups of human brains. My philosophical musings lead to new statistical methodology.

Prof. Maoz Shamir

With the vast advancement of empirical techniques for recording, imaging and manipulating neural responses, the quantitative aspect of brain research is becoming increasingly more important. Theoretical physics offers a wide range of theoretical tools and concepts that were successfully applied in other fields of natural sciences.
In my lab, we apply tools and concepts from Statistical Mechanics, Nonlinear Dynamics, Theory of Disordered Systems and Information Theory to the investigation of the central nervous system. Specifically my lab focuses on two central challenges: the neural code and neural learning theory.

Dr. Oren Shriki

Research in the lab of Dr. Oren Shriki uses mathematical analyses of brain activity and machine learning techniques to develop novel diagnostic tools for neurological and psychiatric disorders. The lab also develops computational models of neuronal networks to gain insights into how changes in neural dynamics lead to brain disorders and how neural plasticity may assist in restoring healthy neural dynamics. A major focus of the lab is on translational neuroscience and neurotechnologies, such as brain-computer interfaces, a system for real-time epileptic seizure prediction and a novel pilot helmet which monitor's the pilot's brain.

Molecular and Cellular Neuroscience

Dr. Claude Brodski

We investigate the molecular and cellular mechanisms controlling neuronal development, which is fundamental for comprehending how the brain is assembled and functions. Moreover, we aim to translate our findings into a better understanding and treatment of brain disorders.

In particular, we explore the genetic pathways controlling the development, survival, function and degeneration of dopaminergic and serotonergic neurons. We combine this basic research approach with studying the pathophysiology of dopamine and serotonin-associated disorders such as Parkinson's disease and mood disorder, thus advancing the development of new therapies for these conditions.

Prof. Ilya Fleidervish

Studies how molecular elements, such as voltage-gated channels, are distributed and regulated in their native environment.

Prof. Alon Friedman

Studies the pathophysiology of several brain disorders and the effects of stress on the nervous system. Human and animal studies focus on dysfunction of the blood-brain barrier in epilepsy and neurodegenerative diseases, developing new imaging methods and novel therapies for the prevention and treatment of injury-related epilepsy and neurodegeneration.

Dr. Daniel Gitler

Studies the mechanisms that control synaptic vesicle dynamics within the presynaptic terminal, and how these affect synaptic function.

Dr. Hava Golan

Studies the neurobiology of autism and other neuro-developmental disorders with a specific focus on understanding how genetics interact with the in-utero environment to control the development of the brain and how this is altered in certain conditions.

Prof. Michal Hershfinkel

Studies the role of a specific zinc-sensing receptor using fluorescence imaging, molecular biology, and biochemical tools. Understanding the role of the mZnR/GPR39 and the mechanism underlying effects of zinc may provide novel therapeutic tools to regulate neuronal activity.

Prof. Adrian Israelson

The main focus of the research in our lab is on the cellular and molecular mechanisms that lead to the onset and progression of neurodegenerative diseases (e.g., Alzheimer's disease, Parkinson's disease, Huntington's disease) with special emphasis on amyotrophic lateral sclerosis (ALS, Lou Gehrig's disease). These devastating diseases represent a major challenge to public health worldwide, especially as our population continues to age.

ALS is a progressive adult-onset neurodegenerative disorder characterized by the selective loss of upper and lower motor neurons in the brain and spinal cord, followed by paralysis and ultimately death within 2-5 years. The typical age of onset is between 50 to 60 years for most forms of ALS. The disease significantly affects the patient's quality of life, being characterized by progressive muscle weakness, atrophy and spasticity. Today, the disease is incurable, and there is no effective treatment to cure or even significantly slow disease progression.

We combine biochemistry, molecular biology and use both cellular and in vivo models to investigate the molecular mechanisms involved in ALS pathogenesis.

Our long-term aim is to identify new candidate agents that will be able to slow or stop the progression of the disease. These agents will be tested in pre-clinical studies and will be the basis to develop new drugs for the treatment of ALS and other neurodegenerative disorders.

Dr. Shira Knafo

In the Molecular Cognition Laboratory (shiraknafo.com) we seek to identify the molecular and synaptic mechanisms underlying learning and memory, cognitive malfunction and cognitive enhancement. The final goal of our research is the development of new tools to treat memory loss. To this end, we use a variety of molecular, genetic and pharmacological tools that can be later on translated to treatment of humans, especially Alzheimer's patients.

Prof. Israel Sekler

We study the link between mitochondrial Ca2+ signaling and metabolism to learning and memory process. Toward this goal, we have devised cutting edge stagey that facilitate a precise on and off control of metabolic activity in district neuron population by light. We apply this approach to also interrogate the basis of major health syndromes such as stroke and Alzheimer disease with the aim to develop effective therapeutic tool for these devastating syndromes.

Dr. Deborah Toiber

Investigates how epigenetic modifications and chromatin structure influence DNA repair, the roles of several uncharacterized proteins in the DNA damage signaling have on aging, and brain related diseases, as well as changes in epigenetic modifications and DNA damage in neurodegeneration.

Dr. Florina Uzefovsky

Studies the biological basis, including genetics and endocrinology, of empathy development in the typical range and atypical range (e.g., autism); and how biological factors interact with environmental influences (social environment, parenting) to shape different trajectories of empathy development.

Dr. Gad Vatine

Our research aims to understand the mechanisms that underlie rare neurological disorders and develop personalized therapeutic approaches. We generate patient-specific stem cells, by reprogramming skin fibroblasts or blood cells that are collected from patients, back into a pluripotent stage termed induced pluripotent stem cells (iPSCs). These cells are then differentiated into various cell types of the human brain, including neurons, astrocytes, oligodendrocytes and endothelial cells, and used to recreate diseases-in-a-dish. By studying monogenic diseases, we study the molecular mechanisms that underlie the disease, and develop platforms for drug screening.

Traditional culture systems fail to represent the complexity of our physiology. The solution to some of these problems lies in microfluidic devices, also known as Organs-on-Chip, which provide 3D multicellular architectures and can mimic tissue-tissue interfaces, physicochemical

microenvironments and vascular perfusion of the body, giving levels of tissue and organ functionality not attainable with traditional culture systems. In collaboration with our commercial partners, we develop bioengineered platforms of the human blood brain barrier (BBB) and brain, which are specifically designed for predictive personalized medicine. Using these platforms, we develop approaches to predict and tailor optimal available treatments per individual.

Dr. Ofer Yifrach

Studies the involvement of voltage-dependent potassium channels in action potential generation, propagation and transmission.

Dr. Noam Zilberberg

Studies the regulation of potassium leak (K2P) channel activity, including the search for specific potassium channel modifiers, the effects of native neurotoxins (isolated from various venoms) on potassium channels, and the development of a screening system for the identification of recombinant channel-blockers

Neurobiology of Diseases and Rehabilitation

Dr. Simona Bar-Haim

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In Cerebral Palsy, we investigate muscle oxygenation and hemodynamics as well as low-grade inflammation and additional health biomarkers following endurance versus strength training.

Prof. Sigal Berman

My research in the intelligent systems engineering laboratory (www.bgu-isel.org) in the department of Industrial Engineering and Management, at Ben-Gurion University of the Negev, focuses on analysis and engineering of intelligent systems capable of dexterous motion. We develop deterministic and stochastic models for motion generation and representation, and apply them to the analysis of human motion and to the synthesis of robotic motion. Based on our models we study the interaction between perception and action in physical, virtual, and augmented environments. Finally, we apply our findings to design and construct intelligent, integrated systems capable of dexterous motion in various application fields (agriculture, rehabilitation, the digital factory). In systems developed for agriculture, we hope our studies will enhance production yield along with sustainability. In systems developed for upper-limb rehabilitation, we hope our studies will lead to improvement in patient's quality of life. In systems developed for the digital factory, we hope to attain robustness and high performance in remote scenarios.

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Prof. Alon Monsonego

Investigates interactions between the central nervous system and the immune system with a particular emphasis on vaccine and cell-based therapies during advanced stages of development.

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Cognitive Robotics and Neuro-Engineering

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Dr. Aharon Bar-Hillel

My lab is conducting research mostly related to computer vision and robotics, using machine learning techniques and specifically deep neural networks. Research topics include:
 - Visualization and modeling of the activity in deep artificial neural networks
 - Development of modular and efficient network architectures
 - Computer vision problems: visual object tracking, parts and wholes interaction.
 - Addressing robotics tasks using deep learning approaches
 - Applying deep learning and computer vision techniques to several problem domains, including ultra sound imaging, agricultural phenotyping, and several others.

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Neuroethology

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Prof. Frederic Libersat

Our goal is to investigate how parasites, using a cocktail of neurotoxins and neuromodulators, manipulate neuronal circuits to control the behavior of their hosts.
We approach this goal at the molecular, cellular, network and behavioral levels.
As a consequence, we are also interested in motor control and the pharmacology of neurotoxins and neuromodulators.

Prof. Ronen Segev

We are interested in information processing in the visual system. Specifically how the information, which enters the eye in the form of light, enables the animal to find and identify objects in space. In addition, we are interested in how animal navigated in the world; a task is heavily linked with learning and memory of the environment.

System Neuroscience

Prof. Rony Azouz

I believe that the function of sensory networks and consequently sensory processing depend critically on the cellular properties of neurons, their anatomical organization and the properties of their synaptic interactions. At present, we understand a great deal separately about each of these aspects of neuronal organization but we lack essential information linking these areas of knowledge. Our goal is to piece together these aspects underlying tactile perception. I believe that this approach is essential for the understanding of how neuronal networks encode and store information, taking into account the full capabilities of the member neuron in the network. This in turn may provide us with fundamentally innovative tools to understand the relations between behavior and cellular function.

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Dr. Jennifer Resnik

Sensory perception may appear as a straightforward process. The sensory stimulus is detected and its characteristics are passed "forward". However, perception is shaped by numerous factors, such as our environment, emotional state & health. For instance, the sound of approaching footsteps is perceived as safe when walking down a well-lit street but as dangerous when walking down a dark alley. Understanding how sound is transformed into a sensory experience necessitates studying all levels of resolution- from the molecular mechanisms to the organism's behavior. To achieve this, we combine state of the art circuit neuroscience tools such as in-vivo electrophysiology, optogenetics, rodent behavior and in-vivo two-photon imaging, to study brain activity and network connectivity as animals engage in auditory perceptual tasks. Our ultimate goal is to understand the link between auditory sensation and the perceptual experience; and how changes in auditory perception can sometimes improve our daily decision-making, while other times, distort the neural representation of sensory stimuli, contributing to sensory and mental health disorders.

Prof. Ronen Segev

We are interested in information processing in the visual system. Specifically how the information, which enters the eye in the form of light, enables the animal to find and identify objects in space. In addition, we are interested in how animal navigated in the world, a task is heavily linked with learning and memory of the environment.

Prof. Maoz Shamir

With the vast advancement of empirical techniques for recording, imaging and manipulating neural responses, the quantitative aspect of brain research is becoming increasingly more important. Theoretical physics offers a wide range of theoretical tools and concepts that were successfully applied in other fields of natural sciences.

In my lab, we apply tools and concepts from Statistical Mechanics, Nonlinear Dynamics, Theory of Disordered Systems and Information Theory to the investigation of the central nervous system. Specifically my lab focuses on two central challenges: the neural code and neural learning theory.

Prof. Abraham Zangen

Studies the critical alterations within the brain reward system that are associated with pathological conditions, and how localized electromagnetic stimulation (using TMS) of these networks can affect such conditions in animal models and humans with a specific focus on molecular and electrophysiological alterations in reward-related networks that are associated with and may cause depression, addiction and attention deficit disorders.