Research & Services | Understanding Neuron Signaling Mechanisms for Insight into Conditions such as Stroke, Epilepsy, Depression and Drug Addiction (Yissum)

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Scientific Background

- In animals, neurons working together as a nervous system are responsible for the ability to perceive and respond appropriately to environmental changes.
- Sensory neurons perceive the changes and transform the information into electrical signals which are propagated and processed in the nervous system to finally produce physiological and behavioral responses.
- Signaling mechanisms within neurons, between neurons, and between neurons and target organs enable the neurons to perform this complicated process.
- Defects in the molecular components enabling signal sensation, transmission, or processing are highly debilitating.
- Understanding the function of neuronal signaling molecules requires analysis of their function at the molecular, cellular, and whole animal level.
- Many different tools and experimental systems are employed in this work including: electrophysiological responses from intact organisms, brain slices, primary and established cell cultures, or from recombinant molecules expressed in heterologous expression systems.
- Members of the group also use molecular biology, biochemistry, genetics, and behavioral analysis on mammalian cells and tissues and on genetically tractable model organisms.
- The work provides insights into such pathological conditions as stroke, epilepsy, depression and drug addiction which may facilitate the design of better treatments for these diseases.

Research Hub Goals and Activities

- Integration of different experimental approaches and acquisition of the knowledge and experience needed to implement them
- Incorporation of new imaging based techniques such as the FRET-based imaging that enables tracking of dynamic interactions within the cellular environment
- Advance the research of all group members through the purchase of relevant equipment
- Providing the appropriate scientific environment for graduate students through relevant courses and a forum in which to discuss their work and advances in the field
- To extend advancements in these fields to the public sector
- To promote research collaborations with industry bodies for the study and development of new diagnoses and treatments for stroke, epilepsy, depression and drug addiction

Hub Members and Focus

- Lili Anglister: Molecular components of the cholinergic peripheral and central systems, their regulation during development, maintenance and regeneration, and their role in synaptic signaling and in neuromuscular and neurodegenerative diseases
- Alexander Binshtok: Molecular and cellular mechanisms of detection, transmission and perpetuation of pain in peripheral and central nervous system. Targeted delivery of charged membrane impermeant compounds to selectively block pain
- Ruth Gabizon: The role of oxidation in pathogenesis of prion and other neurodegenerative

diseases

- Baruch Kanner: Molecular mechanism of neurotransmitter transport by biochemical and electrophysiological analysis of “insightful” transporter mutants, based on information from high resolution crystal structures of bacterial and archeal homologues
- David Lichtstein: Physiological consequences of the interaction between endogenous cardiac steroids and the Na+, K+-ATPase and their involvement in depressive disorders
- Baruch Minke: Activation mechanism and regulation of the Transient Receptor Potential (TRP) channel which is essential for the high calcium permeability and the light response of Drosophila photoreceptors
- Itzhak Nussinovitch : Biophysical mechanisms underlying the secretion of pituitary hormones: the involvement of ionic conductances and membrane lipid composition
- Hannah Rahamimoff: Involvement of immunophilins in molecular, cellular and pharmacological mechanisms regulating the functional expression of the sodium-calcium exchangers and their impact on cell calcium
- Haim Rosen: Molecular mechanisms in the action and intracellular trafficking of Na+, K+-ATPase in neuronal cells
- Ronit Sharon: Protein missfolding and aggregation in neurodegenerative diseases, biochemical and pathological aspects
- Yael Stern-Bach: Molecular and cellular mechanisms underlying assembly and gating of ionotropic glutamate receptors, the major mediators of excitatory synaptic transmission, and the regulation of these processes by auxiliary proteins
- Millet Treinin: C. elegans as a model organism for the identification and characterization of determinants regulating nicotinic acetylcholine receptor function and of signaling molecules enabling sensation of temperature and mechanical stimuli
- Yoel Yaari: Biophysical mechanisms underlying normal and abnormal neuronal functions in mammalian cortical structures
- Rami Yaka: Elucidating the cellular and synaptic mechanisms by which drugs of abuse alter ion channels function in different brain structures within the reward system
- Joseph Yanai: Mechanisms underlying neurobehavioral teratogenicity and the reversal of these defects via stem cell therapy, development of autologous stem cell therapy using least invasive routes of administration

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