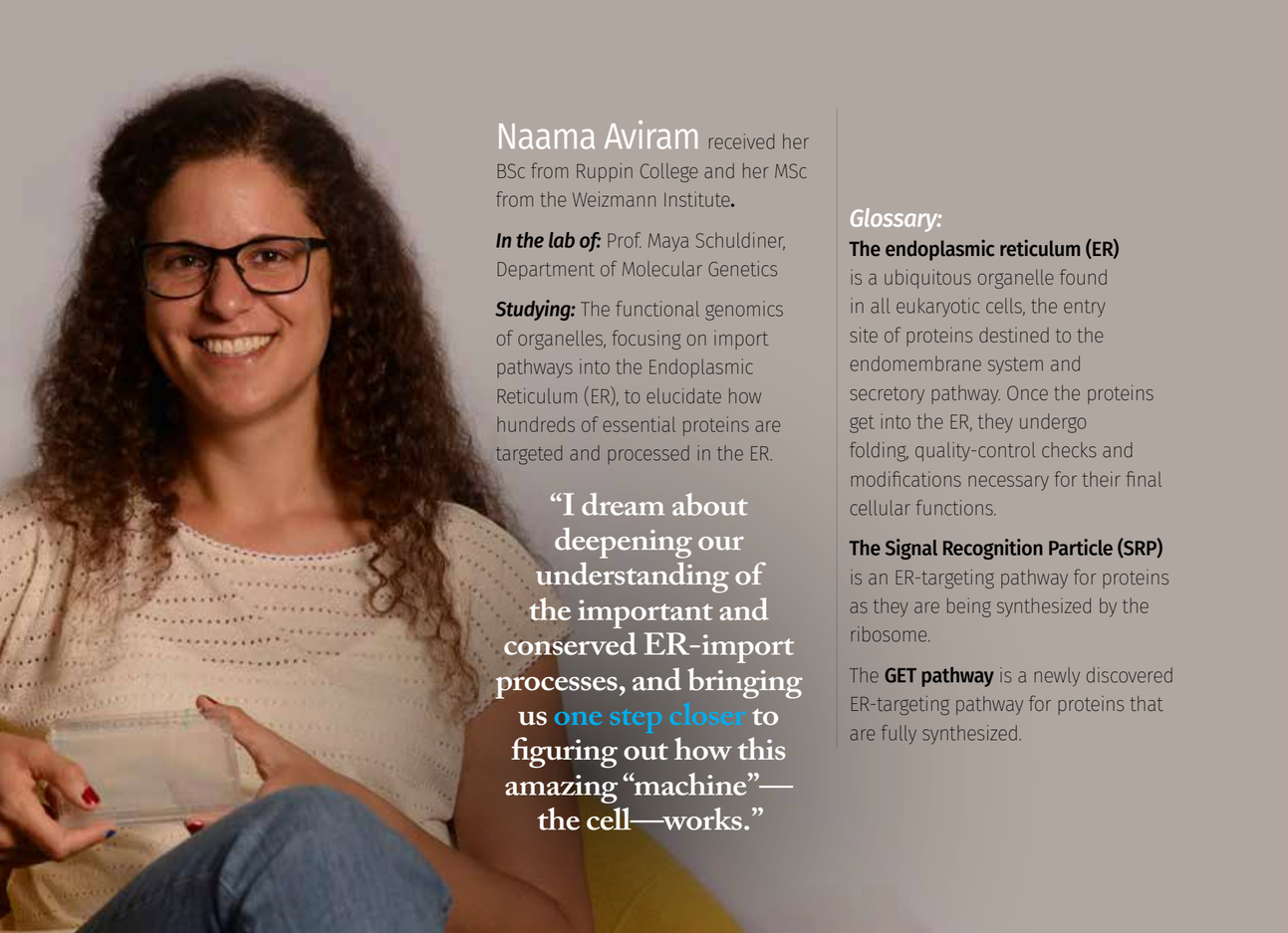
מכון ויצמן למדע
WEIZMANN INSTITUTE OF SCIENCE

Scientists of Tomorrow:

The Feinberg Graduate School's students and postdoctoral fellows

Students:
Scientists of tomorrow



Naama Aviram received her BSc from Ruppin College and her MSc from the Weizmann Institute.

In the lab of: Prof. Maya Schuldiner, Department of Molecular Genetics

Studying: The functional genomics of organelles, focusing on import pathways into the Endoplasmic Reticulum (ER), to elucidate how hundreds of essential proteins are targeted and processed in the ER.

"I dream about deepening our understanding of the important and conserved ER-import processes, and bringing us one step closer to figuring out how this amazing "machine"—the cell—works."

Glossary:

The endoplasmic reticulum (ER) is a ubiquitous organelle found in all eukaryotic cells, the entry site of proteins destined to the endomembrane system and secretory pathway. Once the proteins get into the ER, they undergo folding, quality-control checks and modifications necessary for their final cellular functions.

The Signal Recognition Particle (SRP) is an ER-targeting pathway for proteins as they are being synthesized by the ribosome.

The **GET pathway** is a newly discovered ER-targeting pathway for proteins that are fully synthesized.

Iris Grossman grew up in Haifa and received her BSc in biology and chemistry at the Hebrew University of Jerusalem. She received her MSc from the Weizmann Institute and is on the Direct PhD track.

In the lab of: Prof. Deborah Fass, Department of Structural Biology

Studying: Biomedical engineering, including studying the motion of molecules on the scale of nanometers to truly understand how they communicate, in particular an enzyme called QSOX, using single-molecule fluorescence resonance energy transfer spectroscopy. A second project involves engineering QSOX for therapeutic purposes in the treatment of metastatic cancer.

Glossary:

Enzyme: a macromolecule that interacts with a starting material (substrate) and accelerates its conversion to a product.

Single-molecule experiment: an investigation of the properties of individual molecules, as opposed to measurements on an ensemble or bulk collection of molecules.

Protein conformational change: a transition between alternative three-dimensional structures of a protein.

"My dream is to apply and expand methodologies for controlling biophysical properties of macromolecules, so that I might contribute to the development of new therapies."

Ron Hadas received his BSc from the Hebrew University of Jerusalem and his MSc from the Weizmann Institute of Science. He lives with his wife, Noa, and their two boys, Matan and Dani, on Kibbutz Sarid in the Jezreel Valley.

In the lab of: Prof. Michal Neeman, Department of Biological Reguation, in collaboration with Prof. Nava Dekel of the same department.

Studying: Early pregnancy in mammals, in particular live imaging of vascular function, associated with repeated failure to conceive and other pathologies. This niche is characterized by many synchronized processes between the mother's biology and that of her embryo.

Glossary:

Embryo implantation is the very early stage of pregnancy at which the embryo adheres and invades the wall of the uterus.

Angiogenesis is the generation of new blood vessels from pre-existing vessels.

MRI is a medical imaging technique used to investigate the anatomy and physiology of the body in both health and disease

"This area is so complex and I wish to decipher more of its mysteries in my work."

Eran Kotler lives in Tel Aviv with his wife and one-year-old daughter. In addition to his research, he serves once a week in reserve duty for the Israeli Air Force. He received his BSc from Tel-Aviv University and his MSc from the Weizmann Institute.

In the labs of: **Prof. Eran Segal** from the Department of Computer Science and Applied Mathematics and **Prof. Moshe Oren** in the Department of Molecular Cell Biology.

Studying: The comprehensive characterization of the functional effects of thousands of mutations to the tumor-suppressor p53, by investigating about 10,000 synthetically designed sequence variants.

Glossary:

A **mutation** is a permanent change of the nucleotide sequence of the genome of an organism. Mutations result from damage to DNA which is not repaired (typically caused by radiation or chemical mutagens), errors in the process of replication, or from the insertion or deletion of segments of DNA by mobile genetic elements.

A **tumor suppressor gene** is a gene that protects a cell from one step on the path to cancer. When this gene mutates to cause a loss or reduction in its function, the cell can progress towards cancer, usually in combination with other genetic changes.

An **oncogene** is a gene that has the potential to cause cancer. In tumor cells, they are often mutated or expressed at high levels.

"This area excites me since it has the potential of changing the way cancer patients are treated according to their specific tumor and their personal genetics."

Akiva Rappaport is from New York and came to Israel for his "gap year" between high school and college. He fell in love with the country, joined the Israel Defense Forces, and made aliyah. He received his BSc in neuroscience from Bar Ilan University, his MSc in neurobiology from the University of Haifa, and is studying toward his PhD at the Weizmann Institute.

In the lab of: Prof. Ilan Lampl, Department of Neurobiology

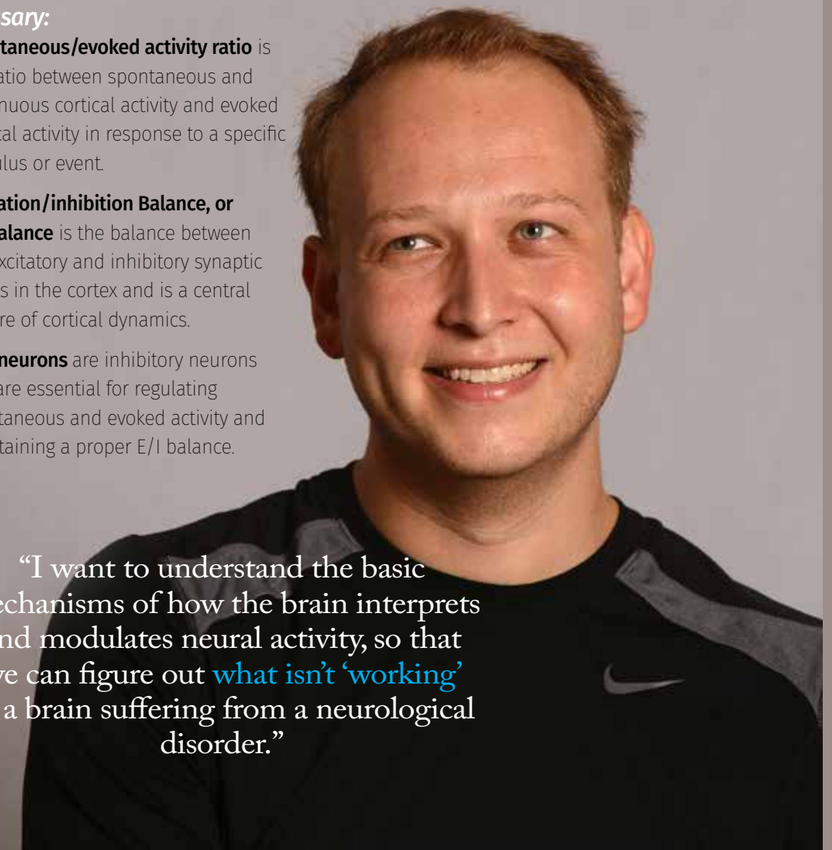
Studying: Neural circuits underlying sensory perception and learning, to elucidate the mechanisms through which neural signals are modulated in the brain's cortex.

Glossary:

Spontaneous/evoked activity ratio is the ratio between spontaneous and continuous cortical activity and evoked cortical activity in response to a specific stimulus or event.

Excitation/inhibition Balance, or E/I balance is the balance between the excitatory and inhibitory synaptic inputs in the cortex and is a central feature of cortical dynamics.

Interneurons are inhibitory neurons that are essential for regulating spontaneous and evoked activity and maintaining a proper E/I balance.



"I want to understand the basic mechanisms of how the brain interprets and modulates neural activity, so that we can figure out what isn't 'working' in a brain suffering from a neurological disorder."

Maya Shamir grew up in Rehovot and received her BSc from the Hebrew University of Jerusalem, in the ETGAR study track for outstanding biology students and the AMIRIM honors science program. She received her MSc at the Weizmann Institute.

In the lab of: Prof. Rotem Sorek, Department of Molecular Genetics

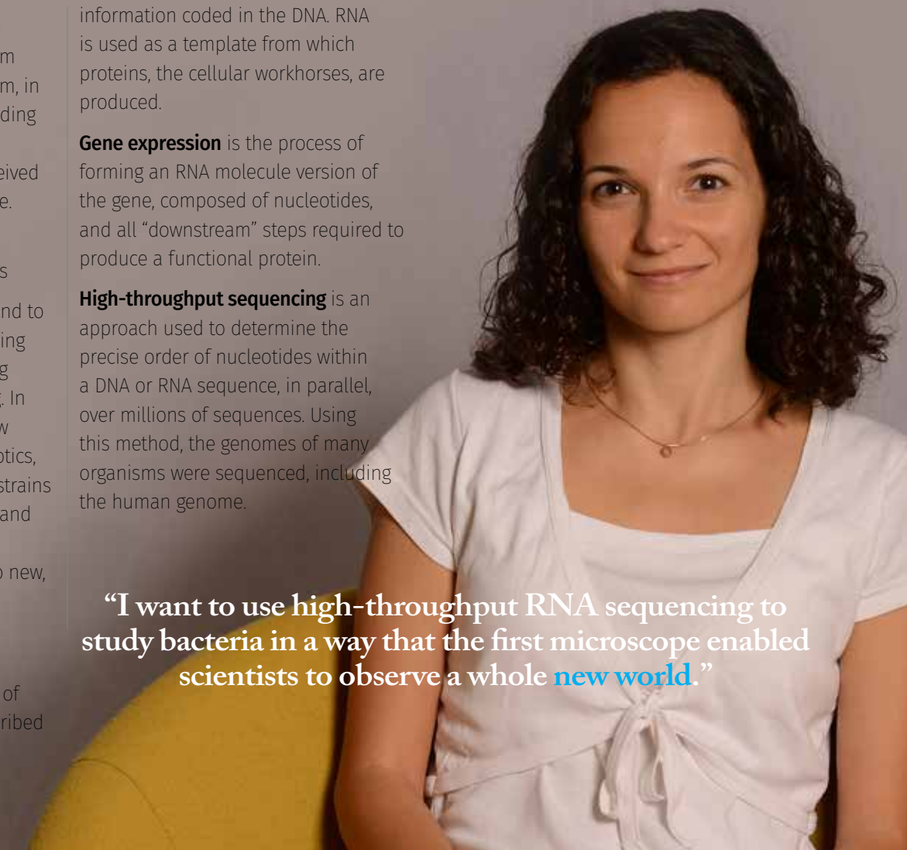
Studying: The way bacteria respond to their environment through changing gene-expression patterns, utilizing high-throughput RNA sequencing. In particular, she is investigating how they develop resistance to antibiotics, giving rise to antibiotic-resistant strains which are spreading in hospitals and becoming a serious public health threat. The research could lead to new, more effective antibiotics.

Glossary:

Ribonucleic acid (RNA) is a class of single-stranded molecules transcribed from DNA which contains the information coded in the DNA. RNA is used as a template from which proteins, the cellular workhorses, are produced.

Gene expression is the process of forming an RNA molecule version of the gene, composed of nucleotides, and all "downstream" steps required to produce a functional protein.

High-throughput sequencing is an approach used to determine the precise order of nucleotides within a DNA or RNA sequence, in parallel, over millions of sequences. Using this method, the genomes of many organisms were sequenced, including the human genome.



"I want to use high-throughput RNA sequencing to study bacteria in a way that the first microscope enabled scientists to observe a whole new world."

Liran Szlak is from Jerusalem. She received a BSc in computer science and bioinformatics at the Hebrew University of Jerusalem, and is completing her MSc in computer science and bioinformatics at the Weizmann Institute.

In the lab of: Prof. Rony Paz, Department of Neurobiology and **Dr. Ohad Shamir**, Department of Computer Science and Applied Mathematics

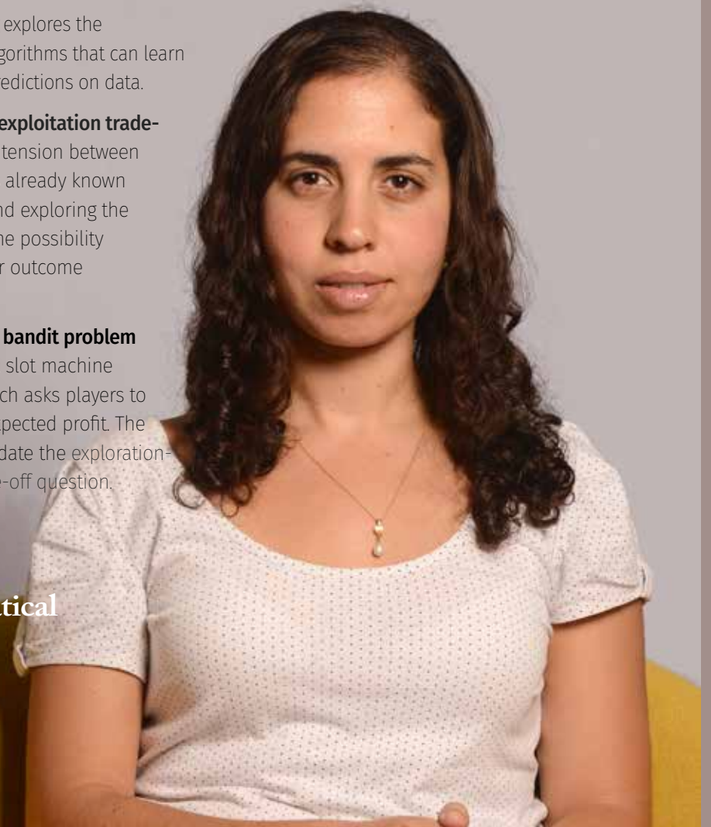
Studying: Machine learning and neuroscience, to develop a mathematical model for the way people learn. She is investigating how the mind balances between exploration—gathering knowledge—and exploitation—using its knowledge to act.

Glossary:

Machine learning explores the construction of algorithms that can learn from and make predictions on data.

The **exploration-exploitation trade-off** describes the tension between exploiting what is already known ("exploitation") and exploring the environment in the possibility of finding a better outcome ("exploration").

The **multi-armed bandit problem** is a game using a slot machine with rewards, which asks players to maximize their expected profit. The game helps elucidate the exploration-exploitation trade-off question.



"I dream about developing a mathematical model that captures human learning, memory and emotions."

Gal Winer lives in Tel Aviv and is married to Danit. He received his BSc and MSc degrees at Tel Aviv University. He enjoys rowing on the Yarkon River and is a member of the Weizmann Institute rowing team.

In the lab of: Dr. Ofer Firstenberg, Department of Physics of Complex Systems

Studying: To better understand how photons, the constituents of light, can be used in the realization of quantum computing and other technologies. In particular, he is constructing a new experiment in which atoms are trapped and manipulated with laser light.

Glossary:

Laser trapping and cooling is a series of methods involving cooling and trapping atoms with light, using the special properties of laser light to exert force on matter. The methods were the basis for the 1997 Nobel Prize in Physics.

Non-linear optics is the branch of optics that describes the behavior of light in nonlinear media, that is, media in which the typical action of a source of light (linear) is not applicable. This often occurs at very high light intensities.

Quantum non-linear optics involves the use of light particles interacting with a single photon to construct quantum logic gates for quantum computing.

Quantum computing involves using the properties of quantum mechanics to perform computations that can push far beyond the boundaries of conventional computation.

"The ultimate goal seems, almost, to reside in the realm of science fiction."

Foreign postdocs:
At home at Weizmann

Dr. Savani Anbalagan

is from Chennai, India, and he did his PhD in industrial biotechnology at the University of Milano-Biocca, Italy

In the lab of: Prof. Gil Levkowitz, Department of Molecular Cell Biology

Investigating: A brain region named neurohypophysis, through which the brain releases hormones to control activities such as the water/salt balance in the blood and reproduction. ***Why?*** Because he wants to understand the mechanistic basis for the neuroendocrine communication between nerve cells and blood vessels. ***How does he do it?*** by imaging the transparent zebrafish brain.

"The brain is a self-assembling bioelectrical circuit whose sheer complexity fascinates me. How are connections made, assembled, and maintained? I want to know."

"Israel is a unique and important place for studies in archaeology."

Dr. Valentina Caracuta is

from Lecce, Italy. She received her PhD in archaeology at the University of Foggia in Italy in 2011.

In the lab of: Dr. Elisabetta Boaretto, Scientific Archeology Unit

Investigating: The role of plants in the history of human beings, with a focus on the study of agricultural practices and food habits of prehistoric men. ***Why?*** Because she has always been interested in the study of the origin of food. To date, she has found the earliest evidence of domestication of the fava bean, which was found in Israel 10,000 years ago. ***How does she do it?*** With advanced archaeological chemistry methods, and other cutting-edge tools.

"My work is exciting because it aims to develop a new method to detect metastasis, identify early response to anti-tumoral treatment, and/or to elucidate the maternal-fetal exchange."

FRANCE

Dr. Anne Fages is from Orsay, France. She received her PhD in chemistry from the Ecole Normale Supérieure de Lyon in France.

In the lab of: Prof. Lucio Frydman, Department of Chemical Physics

Investigating: The detection and characterization of metabolism in real time. ***Why?*** Because she wants to elucidate altered metabolism in cancers and other diseases. ***How does she do it?*** By magnetic resonance imaging and spectroscopy using a new technique called Dynamic Nuclear Polarization.

GERMANY

"It has always been a dream of mine to discover and invent, and I'm living this dream in its full intensity in experimental laser physics."

Dr. Michael Krueger is from Burghausen, Germany, and has his PhD in physics from the Ludwig Maximilian University of Munich and the Max Planck Institute of Quantum Optics in Garching, Germany.

In the lab of: Prof. Nirit Dudovich, Department of Physics of Complex Systems

Investigating: The dynamics of electrons bound to the nucleus of atoms and molecules. ***Why?*** Because he wants to see how ultrafast electron dynamics induce chemical reactions, on time scales as short as one billionth of a billionth of a second—one attosecond. ***How does he do it?*** By using very bright, very short flashes of ultraviolet light.

"This is the best place in the world to do research in biomineralization"

Dr. Benjamin Palmer is from Cardiff, Wales, and did his PhD at Cardiff University in organic solid state chemistry.

In the lab of: Prof. Lia Adaddi, Department of Structural Biology

Investigating: How biological organisms control crystal growth with intricate sophistication, in particular crystals in the eyes of crayfish, lobsters, and shrimp, which utilize reflective rather than refractive optics for producing vision. ***Why?*** So that we might understand how the arrangement of organic crystals in these tissues determines the optical properties of the eye, and in general, how we might harness some of the natural minerals and functional principles to design new synthetic materials. ***How does he do it?*** Using cryo-electron microscopy and *in situ* X-ray diffraction techniques with optical simulations.

Dr. Nicolas Panayotis is from Marseille, France and he did his PhD at the Aix-Marseille University (La Timone Faculty of Medicine).

In the lab of: Prof. Mike Fainzilber, Department of Biological Chemistry

Investigating: Importins, a family of proteins involved in neuronal and nuclear transport, which are central in enabling neurons to convey signals within the brain. ***Why?*** To shed light on the involvement of importins in neuropsychiatric and memory disorders, building on his research on Rett syndrome, a severe genetic neurodevelopmental disorder. ***How does he do it?*** With mice models.

"Neurons are fascinating cells. Research in this area may help tackle many debilitating neurological and psychiatric disorders and illnesses."

Study, Investigate, Discover