



NEUROSCIENCE EXCELLENCE IN ISRAEL

Breakthroughs from an international neuroscience research powerhouse

The study of the nervous system, primarily the brain, has long captivated the scientific community. Israel has established itself as a leader in this realm, making substantial advancements in research and innovation and attracting global scientific recognition in terms of funding and citations. From 2007 to 2022, for example, the European Research Council supported 599 neuroscience projects, 58 of which were Israeli, putting the country in fifth place despite its small size. Israel also achieved a 10th-place global ranking in neuroscience citations per document from 1996 to 2021, averaging 39.09 citations, as per Scimago (considering only nations with over 1,000 published papers). Here is a summary of significant contributions made by several Israeli neuroscientists spanning diverse areas: pharmacological breakthroughs, theoretical insights into brain function and therapeutic innovations.

THEORETICAL INSIGHTS INTO NEURAL SYSTEMS

Prof. **Haim Sompolinsky** from the Hebrew University of Jerusalem pioneered computational neuroscience theories, advancing our understanding of cortical dynamics, sensory processing, motor control and memory. His group's main contributions have been in human visual neuroscience and the neuronal underpinning of spontaneous behaviour. Prof. **Rafael Malach** from the Weizmann Institute of Science has made major insights into the neural basis of how humans create visual images, spontaneous thoughts and memories. His discoveries uncovered the organization of human visual areas in general and recognition processes in particular, and pioneered the use of fMRI to clarify how human brain regions contribute to perceptual and cognitive functions.

PARKINSON'S TREATMENT REVOLUTION

Both the monoamine oxidase B inhibitors L-deprenyl (selegiline) and rasagiline (Azilect) were discovered by Prof. **Moussa Youdim** from Technion-Israel Institute of Technology. These two anti-Parkinsonian drugs are widely used worldwide and help millions of patients daily. Another treatment for Parkinson's disease was initially studied in the U.S. by Prof. **Hagai Bergman** from the Hebrew University of Jerusalem and the city's Hadassah Medical Center during his postdoctoral training. Bergman pioneered this deep brain stimulation (DBS) approach via surgically implanted permanent electrodes in Israel. DBS releases adjustable electrical pulses that block tremors, dramatically improving the lives of numerous Parkinson's patients.

STRESS NEUROSCIENCE

The research of Prof. **Hermona Soreq's** group from the Hebrew University of Jerusalem has made groundbreaking contributions to the understanding of the molecular mechanisms underlying neurological disorders, particularly those involving acetylcholine signalling and stress reactions. Additionally, the president of the Weizmann Institute, Prof. **Alon Chen**, has significantly improved the understanding of stress mechanisms. His group's studies at Weizmann and Munich's Max Planck Institute focus on elucidating the molecular and neural mechanisms that regulate the stress response. They have significantly advanced our comprehension of stress-related disorders and hold promise for developing novel therapeutic interventions.

SLOWING THE PROGRESS OF ALZHEIMER'S DISEASE

Alzheimer's disease initially involves the loss of the neurotransmitter acetylcholine, which produces neurons in deep brain nuclei. Prof. **Marta Weinstock-Rosin** from the Hebrew University of Jerusalem is the inventor of rivastigmine (Exelon), a palliative medication for Alzheimer's. It temporarily limits memory loss by inhibiting acetylcholinesterase, an enzyme that breaks acetylcholine down. Recently, Prof. **Michal Schwartz** from the Weizmann Institute of Science discovered the key role played by the immune system in repair processes within the brain, as well as its importance to brain functioning in health and the link between the decline in immune system function and dementia.

THE NEUROBIOLOGY OF HUMAN ATTACHMENT

Prof. **Ruth Feldman** at Reichman University has made significant contributions to understanding the social brain. She discovered the neural basis of social interaction between parents and infants, for example, and found hormonal evidence for the importance of touch to infant development. She has also demonstrated that interventions aimed at improving parenting behaviours can have a powerful impact on childhood development, including in high-risk populations. Prof. **Mario Mikulincer**, also at Reichman, demonstrated the correlation between secure attachment in infancy and better social relationships later in life, such as romantic relationships, and its positive impact on stress coping, cognition, health outcomes and emotional regulation.