

Inbal Goshen – Curriculum Vitae

Name: Inbal Goshen
Address: Edmond and Lily Safra Center for Brain Sciences
The Hebrew University, Givat Ram, 91904, Jerusalem, Israel
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Lab Website: <http://www.goshenlab.com>

Education:

1997-2000 B.A. in Psychology
The Hebrew University of Jerusalem
Summa cum laude

2000-2002 M.Sc. in Neurobiology
The Hebrew University of Jerusalem Hadassah Medical School
Summa cum laude

2002-2007 Ph.D. in Psychology and Neurobiology
The Hebrew University of Jerusalem Hadassah Medical School
Supervisors: Prof. Raz Yirmiya (Dept. of Psychology) & Prof. Tamir Ben-Hur (Dept. of Neurobiology)

2008-2012 Post -Doctoral Fellow in Bioengineering
Stanford University, CA, USA
Host: Prof. Karl Deisseroth

Positions:

2020- Associate Professor, The Edmond & Lily Safra Center for Brain Sciences, The Hebrew University, Jerusalem, Israel.

2012-2020 Assistant Professor, The Edmond & Lily Safra Center for Brain Sciences, The Hebrew University, Jerusalem, Israel.

Honors and Awards:

2022 Rector Prize for Excellence in Research

2018 - 2022 FENS-Kavli Network of Excellence (FKNE) Scholar

2013 - 2016 Alon fellowship

2014 NARSAD Young Investigator Award

2013 Golda Meir Fellowship Lectureship award

2013 The Sieratzki Prize for Advances in Neuroscience

2008 - 2011 Machiah post-doctoral fellowship

2008 - 2009 Rothschild post-doctoral fellowship

2008 - 2010 Weizmann institute Women in Science award

2005 - 2007 Rector scholarship - The Isaak Kaye Einstein scholarship.

2004 Rector scholarship - Golda Meir Fellowship Fund.

2003 Rector scholarship for outstanding PhD students.

Intellectual Property:

Goshen I, Deisseroth K. "Control and Characterization of memory function"

U.S. patent (approved) # 10,086,012
European Patent Application No. 11838856.0
Japanese Patent Application No. 2013-537853
Canadian Patent Application No. 281

Invited Lectures

- 2023 Plenary Speaker, Neuroscience Network of Basel, Basel, Switzerland.
- 2023 Plenary Speaker, Leibniz Institute for Neurobiology, Magdeburg, Germany.
- 2023 Plenary Speaker, Polish Neuroscience Society Congress, Torun, Poland.
- 2023 Invited Speaker, KSBNS, Busan, South Korea.
- 2023 Invited Speaker, ISN-ESN meeting, Braga, Portugal.
- 2023 Invited Speaker, Spring Hippocampal Research, Verona, Italy.
- 2023 Invited Speaker, Modulation of Neural Circuits and Behavior GRC, Switzerland.
- 2023 Invited Speaker, IBNS 32nd Annual Meeting, Niagara Falls, Canada.
- 2023 Invited Speaker, Dendrites: Molecules, Structure and Function GRC, Italy.
- 2023 Plenary Speaker, Humanitas Research Hospital, Milano, Italy.
- 2023 Invited Speaker, What is memory? EPFL, Lausanne, Switzerland.
- 2022 Plenary Speaker, Meet the Expert, SFN, San-Diego, USA.
- 2022 Plenary Speaker, Graduate School Neurosciences Amsterdam Rotterdam, Netherlands.
- 2022 Invited Speaker, Bordeaux Brain Conference, France.
- 2022 Invited Speaker, 13th FENS, Paris, France.
- 2022 Plenary Speaker, Center for Experimental Neurology (ZEN), Bern, Switzerland.
- 2022 Invited Speaker, Integrative Center for Learning and Memory, UCLA, USA.
- 2021 Invited Speaker, International Astrocyte School (Zoom).
- 2021 Invited Speaker, 7th Nature International Conference on Glial Biology in Medicine, Virginia, USA (Zoom).
- 2020 Plenary Speaker, CBI-CNRS, Toulouse, France.
- 2019 Plenary Speaker, CGR, Barcelona, Spain.
- 2019 Plenary Speaker, Italian Institute of Technology, Genova, Italy.
- 2019 Invited Speaker, OPTOGEN 2019, Venice, Italy.
- 2019 Plenary Speaker, UCSF Gladstone Institute, CA, USA.
- 2019 Invited Speaker, Glia Gordon Conference, CA, USA.
- 2019 Plenary Speaker, Princeton University, NJ, USA.
- 2019 Invited Speaker, EuroGlia Bi-Annual Conference, Porto, Portugal.
- 2019 Invited Speaker, ICVS Satellite Meeting, Braga, Portugal.
- 2019 Invited Speaker, Cold Spring Harbor Asia, Suzhou, China.
- 2018 Invited Speaker, "More Than Neurons", Torino, Italy.
- 2018 Session Organizer, Chair and Speaker, SFN, San-Diego, USA.
- 2018 Session Organizer, Chair and Speaker, 11th FENS, Berlin, Germany.
- 2018 Invited Speaker, Broad-ISF Symposium, Boston, USA.
- 2018 Invited Speaker, International Astrocyte School, Bertinoro, Italy
- 2018 Invited Speaker, 'Plasticity and Stability of Neuronal Circuits', Tel-Aviv University, Israel
- 2017 Session Organizer, Chair and Speaker, 47th EBBS. Bilbao, Spain.
- 2017 Invited Speaker, EBPS meeting, Crete, Greece.
- 2017 Invited Speaker, 'Neurons in action' conference, Warsaw, Poland.

- 2017 Invited Speaker, 'Trauma's aftermath for individuals, community, and society', WIS, Israel.
- 2017 Invited Speaker, UCL-HUJI Joint Meeting, London, U.K.
- 2016 Invited Speaker, Memory Mechanisms in Health and Disease, Florida, USA.
- 2016 Invited Speaker, The 7th EMCCS-EBBS Satellite FENS meeting, Copenhagen, Denmark.
- 2015 Invited Speaker, Stress, PTSD and psychiatric disorders EBPS meeting, WIS, Israel.
- 2014 Invited Speaker, CIFAR meeting, Montreal, Canada.
- 2014 Invited Speaker, 9th FENS, Milan, Italy
- 2014 Plenary Speaker, McGill University, Montreal, Canada.
- 2014 Invited Speaker, Neurobridges meeting, Gottingen, Germany.
- 2014 Plenary Speaker, University of Bordeaux, France
- 2014 Plenary Speaker, University of Madrid (CSIC-UAM), Spain
- 2013 Invited Speaker, The 45th EBBS meeting, Munich, Germany.

Future commitments:

- 2024 Invited Speaker, 4th Nordic Neuroscience Meeting, Copenhagen, Denmark.
- 2024 Plenary Speaker, Kavli Institute for Systems Neuroscience, Trondheim, Norway.
- 2024 Plenary Speaker, German Center for Neurodegenerative Diseases (DZNE), Bonn, Germany.
- 2024 Invited Speaker, Optogenetics GRC, Italy.
- 2024 Invited Speaker, CNS, Toronto, Canada.
- 2024 Invited Speaker, 13th Annual Meeting of the GDR NeuralNet, Saclay, France.

Funding

- 2023-2028 ERC-CoG. *Astrocytes in Reward and their Bidirectional Relationship with the Dopaminergic System.* 2,300,000 Euro
- 2023-2028 ISF. *Recent and remote memory engrams, and how they are affected by astrocytes.* 1,958,500 nis
- 2018-2023 ERC-StG. *Remote Memory Consolidation Based on Activity, Connectivity and Stability; Contribution of Neurons and Astrocytes.* 1,637,500 Euro
- 2018-2023 ISF. *Hippocampal Astrocytic Domains; Structure, and Function in Memory Allocation and Space Representation.* 1,725,000 nis
- 2018-2021 ISF and CIHR. *Molecular and Structural Mechanisms of Astrocyte-Mediated Cognitive Enhancement.* 1,539,000 nis
- 2015-2016 Milton Rosenbaum foundation. *Contextual fear memory extinction without conscious recall in a PTSD model.* 20,000 \$
- 2013-2018 ISF, Equipment for new faculty member. *An integrated system for behavior monitoring under optogenetic stimulation.* 365,000 nis
- 2013-2018 Israel Science Foundation (ISF). *Astrocytes in Alzheimer's Disease: Studying Glial Contribution to Altered Neuronal Activity and Abnormal Behavior Using a Novel Optogenetic Approach.* 1,110,000 nis
- 2014-2016 NARSAD Young investigator Grant, Brain & Behavior Research Foundation. *Astrocytes in Schizophrenia: Using Optogenetics to Study Glial Contribution to Altered Neuronal Activity and Abnormal Behavior.* 60,000 \$
- 2013-2018 iCORE Centers of Excellence. *Israel Multidisciplinary Center for Mass Trauma Research: From Basic Research to Real Life Application,* 2,000,000 nis

- 2013-2016 Council for Higher Education, The State of Israel. *Alon Fellowship for distinguished young investigators*, 30,000 \$
- 2013-2014 Abisch-Frenkel Foundation. *Are astrocytes directly involved in Autism? A novel optogenetic approach to study the role of glia cells in autistic spectrum disorders*. 45,000 \$

Publication:

Number of Citations 13,150
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Published Papers:

1. Refaeli R, Kreisel T, Ravins-Yaish T, Groysman M, Goshen I. (In press). Astrocytes Control Recent and Remote Memory Strength by Affecting the Recruitment of the CA1→ACC Projection to Engrams. *Cell Reports*.
2. Refaeli R, Kreisel t, Goshen I. (2024). Analyzing Engram Reactivation and Long-Range Connectivity. *STAR Protocols*. 5(1):102840.
3. Refaeli R, Kreisel T, Groysman M, Adamsky A, Goshen I. (2023). Engram Stability and Maturation During Systems Consolidation. *Current Biology*. 33(18):3942-3950.

Highlighted in:

Current Biology: Rashid AJ, Golbabaie A, Josselyn SA. (2023). Memory: Meet the new engram, same as the old engram. 33(18):R955-R957.

4. Doron A, Rubin A, Benmelech-Chovav A, Benaim N, Carmi T, Refaeli R, Novick N, Kreisel T, Ziv Y, Goshen I. (2022). Hippocampal Astrocytes Encode Reward Location. *Nature*. 609(7928):772-778.

Highlighted in:

Nature Reviews Neuroscience: Lewis S, (2022). Rewarding astrocytes. 23(11):645.

5. Goshen I., Yirmiya R, Kol A. (2022). Mentoring, a three generation perspective. *Neuron*. 110(3):363-365.
6. Refaeli R, Goshen I. (2022). Investigation of Spatial Interaction Between Astrocytes and Neurons in Cleared Brains. *J Vis Exp*. 181. doi: 10.3791/63679.
7. Refaeli R, Doron A, Benmelech-Chovav A, Groysman M, Kreisel T, Loewenstein Y, Goshen I. (2021). Features of Hippocampal Astrocytic Domains and Their Spatial Relation to Excitatory and Inhibitory Neurons. *Glia*. 69(10):2378-2390.
Featured as the cover art.
8. Goshen I. (2021). Q&A. *Neuron*. 109(19):3028-3030.
9. Kol A, Goshen I. (2021). The memory orchestra: the role of astrocytes and oligodendrocytes in parallel to neurons. *Current Opinion Neurobiology*. 67:131-137.
10. Kol A, Adamsky A, Groysman M, Kreisel T, London M, Goshen I. (2020). Astrocytes Contribute to Remote Memory Formation by Modulating Hippocampal-Cortical Communication During Learning. *Nature Neuroscience*. 23(10):1229-1239.

Highlighted in:

Nature Neuroscience: Frankland PW & Josselyn SA, (2020). Starring role for astrocytes in memory. 23(10):1181-1182.

11. Doron A, Goshen I. (2020). Glia – the glue holding memories together. *Neuron* 105(1):9-11.

12. Hirbec H, Déglon N, Foo LC, Goshen I, Grutzendler J, Hangen E, Kreisel T, Linck N, Muffat J, Regio S, Rion S, Escartin C. (2020). Emerging technologies to study glial cells. *Glia*. 68(9):1692-1728.
13. Adamsky A, Kol A, Kreisel T, Doron A, Ozeri-Engelhard N, Melcer T, Refaeli R, Horn H, Regev L, Groysman M, London M, Goshen I. (2018). Astrocytic activation generates de novo neuronal potentiation and memory enhancement. *Cell*. 174(1):59-71.

Highlighted in:

Cell: Covelo A, Araque A. (2018). Stimulating astrocytes to remember. 174(1):12-13.

Faculty of 1000: Sala, C (2018). Rated "Exceptional". F1000Prime.com/733283387#eval793548051.

14. Doron A, Goshen I. (2018). Investigating the transition from recent to remote memory using advanced tools. *Brain Research Bulletin*. 141:35-43.
15. Atlan G, Terem A, Peretz-Rivlin N, Sehrawat K, Gonzales BJ, Pozner G, Tasaka GI, Goll Y, Refaeli R, Zviran O, Lim BK, Groysman M, Goshen I, Mizrahi A, Nelken I, Citri A. (2018). The Claustrum Supports Resilience to Distraction. *Current Biology*. 28(17):2752-2762.
16. Adamsky A, Goshen I. (2018). Astrocytes in memory function: Pioneering findings and future directions. *Neuroscience*. 370:14-26.
17. Milshtein-Parush H, Frere S, Regev L, Lahav C, Benbenishty A, Ben-Eliyahu S, Goshen I, Slutsky I. (2017). Sensory Deprivation Triggers Synaptic and Intrinsic Plasticity in the Hippocampus. *Cerebral Cortex*. 27(6):3457-3470.
18. Daadi MM, Klausner JQ, Bajar B, Goshen I, Lee-Messer C, Lee SY, Winge MC, Ramakrishnan C, Lo M, Sun G, Deisseroth K, Steinberg GK. (2016). Optogenetic Stimulation of Neural Grafts Enhances Neurotransmission and Downregulates the Inflammatory Response in Experimental Stroke Model. *Cell Transplant*. 25(7):1371-80.
19. Goshen I. (2014). The optogenetic revolution in memory research. *Trends in Neurosciences* 37(9):511-22.
20. Prakash R, Yizhar O, Grewe B, Ramakrishnan C, Wang N, Goshen I, Packer AM, Peterka DS, Yuste R, Schnitzer MJ, Deisseroth K. (2012). Two-photon optogenetic toolbox for fast inhibition, excitation, and bistable modulation. *Nature Methods* 9(12):1171-9.
21. Goshen I, Brodsky M, Prakash R, Wallace J, Gradinaru V, Ramakrishnan C, Deisseroth K. (2011). Dynamic retrieval strategies for remote memories. *Cell* 147(3):678-89.

Highlighted in:

Cell: Suzuki W, Naya Y. (2011). Two routes for remembering the past. 147(3):493-5.

Nature Reviews Neuroscience: Welberg L, (2001). Learning and memory: CA1 triggers the trace. 12(12):705.

Trends in Cognitive Sciences: McKenzie S, Eichenbaum H (2012). New approach illuminates how memory systems switch. 16(2):102-3.

Faculty of 1000: Four reviews: Giacomo L, Moser E (2011) rated "Exceptional", Hawk J, Abel T (2011) rated "Must Read", Sahay A (2012) rated "Exceptional", Holtzman D and Bero A (2012) rated "Exceptional". F1000.com/13357417.

22. Yizhar O, Fenno LE, Prigge M, Schneider F, Davidson TJ, O'Shea DJ, Sohal VS, Goshen I, Finkelstein J, Paz JT, Stehfest K, Fudim R, Ramakrishnan C, Huguenard JR, Hegemann P, Deisseroth K. (2011). Neocortical excitation/ inhibition balance in information processing and social dysfunction. *Nature* 477(7363):171-8.

23. Licht T*, Goshen I*, Avital A, Kreisel T, Zubedat S, Eavri R, Segal M, Yirmiya R, Keshet E. (2011). Reversible modulations of neuronal plasticity by VEGF. *Proc Natl Acad Sci U S A* 108(12):5081-6.
24. Yirmiya R, Goshen I. (2011). Immune modulation of memory functioning, neural plasticity and neurogenesis. *Brain, Behavior and Immunity*, 25(2):181-213.
25. Anikeeva P, Andalman AS, Witten IB, Warden MR, Goshen I, Grosenick L, Gunaydin LA, Frank LM, Deisseroth K. (2011). Optetrode: a multichannel readout for optogenetic control in freely moving mice. *Nature Neuroscience*. 15(1):163-70.
26. Ben Menachem-Zidon O, Avital A, Ben-Menahem Y, Goshen I, Kreisel T, Shmueli EM, Segal M, Ben Hur T, Yirmiya R. (2011). Astrocytes support hippocampal-dependent memory and long-term potentiation via interleukin-1 signaling. *Brain, Behavior and Immunity* 25(5):1008-16.
27. Lee JH, Durand R, Gradinaru V, Zhang F, Goshen I, Kim DS, Fenno, LE, Ramakrishnan C, Deisseroth K. (2010). Global and local fMRI signals driven by neurons defined optogenetically by type and wiring. *Nature* 465(7299):788-92.
28. Gradinaru V, Zhang F, Ramakrishnan C, Mattis J, Prakash R, Diester I, Goshen I, Thompson KR, Deisseroth K. (2010). Molecular and cellular approaches for diversifying and extending optogenetics. *Cell* 141(1):154-65.
29. Licht T, Eavri R, Goshen I, Shlomai Y, Mizrahi A, Keshet E. (2010). VEGF is required for dendritogenesis of newly-born olfactory bulb inter-neurons. *Development* 137(2):261-71.
30. Goshen I, Avital A, Kreisel T, Licht T, Segal M, Yirmiya R. (2009). Environmental enrichment restores memory functioning in mice with impaired IL-1 signaling via reinstatement of long-term potentiation and spine size enlargement. *J Neuroscience* 29(11):3395-403.
31. Goshen I, Yirmiya R (2009). Interleukin-1 (IL-1): a central regulator of stress responses. *Front Neuroendocrinol* 30(1):30-45.
32. Ounallah-Saad H, Beeri R, Goshen I, Yirmiya R, Renbaum P, Levy-Lahad E, (2009). Transcriptional regulation of the murine Presenilin-2 gene reveals similarities and differences to its human orthologue. *Gene* 446(2):81-89.
33. Goshen I, Kreisel T, Ben-Menachem-Zidon O, Licht T, Weidenfeld, J., Ben-Hur T and Yirmiya R. (2008). Brain interleukin-1 mediates chronic stress-induced depression in mice via adrenocortical activation and hippocampal neurogenesis suppression. *Molecular Psychiatry* 13(7):717-28.
34. Ben Menachem-Zidon O, Goshen I, Kreisel T, Ben Menahem Y, Reinhartz E, Ben Hur T, Yirmiya R. (2008). Intrahippocampal transplantation of transgenic neural precursor cells overexpressing interleukin-1 receptor antagonist blocks chronic isolation-induced impairment in memory and neurogenesis. *Neuropsychopharmacology* 33(9):2251-62.
35. Goshen I, Kreisel T, Ounallah-Saad H, Renbaum P, Zalzstein Y, Ben-Hur T, Levy-Lahad, E, Yirmiya R. (2007). A dual role for interleukin-1 in hippocampal-dependent memory processes. *Psychoneuroendocrinology* 32(8-10):1106-15.
36. Wolf G, Yirmiya R, Kreisel T, Goshen I, Weidenfeld J, Poole S, Shavit Y. (2007). Interleukin-1 signaling modulates stress-induced analgesia. *Brain, Behavior and Immunity* 21(5):652-9.
37. Yirmiya R, Goshen I, Bajayo A, Kreisel T, Feldman S, Tam J, Trembovler V, Csernus V, Shohami E, Bab I. (2006). Depression induces bone loss through stimulation of the sympathetic nervous system. *Proc Natl Acad Sci U S A*. 103(45):16876-81.
38. Bajayo A*, Goshen I*, Feldman S, Csernus V, Iverfeldt K, Shohami E, Yirmiya R, Bab I. (2005). Central IL-1 receptor signaling regulates bone growth and mass. *Proc Natl Acad Sci U S A*. 102(36):12956-12961.

39. Shavit Y, Wolf G, Goshen I, Livshits D, Yirmiya R. (2005). Interleukin-1 antagonizes morphine analgesia and underlies morphine tolerance. *Pain* 115(1-2):50-59.
40. Weidenfeld J, Itzik A, Goshen I, Yirmiya R, Ben-Hur T. (2005). Role of the central amygdala in modulating the pituitary-adrenocortical and clinical responses in experimental herpes simplex virus-1 encephalitis. *Neuroendocrinology*. 81(4):267-272.
41. Goshen I, Yirmiya R, Iverfeldt K, Weidenfeld J. (2003). The role of Interleukin-1 (IL-1) in HPA axis regulation following stress and adrenalectomy. *Endocrinology*, 144(10):4453-4458.
42. Avital A*, Goshen I*, Kamsler A*, Segal M, Iverfeldt K, Richter-Levin G, Yirmiya R. (2003). Impaired interleukin-1 (IL-1) signaling is associated with defects in memory processes and neural plasticity. *Hippocampus*. 13:826-834.
43. Wolf G, Yirmiya R, Goshen I, Iverfeldt K, Holmlund L, Takeda K, Shavit Y. (2003). Impairment of Interleukin-1 (IL-1) signaling reduces baseline pain sensitivity in mice: genetic, pharmacological and developmental aspects. *Pain* 104:471-480.
44. Yirmiya R, Winocur G, Goshen I. (2002). Brain interleukin-1 is involved in spatial memory and passive avoidance conditioning. *Neurobiology of learning and memory*, 78:379-389.
45. Barak O, Goshen I, Ben-Hur T, Weidenfeld J, Taylor AN, Yirmiya R. (2002). Involvement of brain cytokines in the neurobehavioral disturbances induced by HIV-1 glycoprotein120. *Brain Research*, 933:98-108.
46. Pollak Y, Orion E, Goshen I, Ovadia H, Yirmiya R. (2002) Experimental autoimmune encephalomyelitis-associated behavioral syndrome as a model of 'depression due to multiple sclerosis'. *Brain, Behavior and Immunity*, 16:533-543.
47. Barak O, Weidenfeld J, Goshen I, Ben-Hur T, Taylor AN, Yirmiya R. (2002). Intracerebral HIV-1 glycoprotein 120 produces sickness behavior and pituitary-adrenal activation in rats: role of prostaglandins. *Brain, Behavior and Immunity*, 16:720-735.
48. Pollak Y, Ovadia H, Goshen I, Gurevich R, Monsa K, Avitsur R, Yirmiya R. (2000). Behavioral aspects of experimental autoimmune encephalomyelitis. *Journal of Neuroimmunology*, 104:31-36.

* **Equal contribution**

Book Chapters:

1. Regev L and Goshen I (2018). Employing Optogenetics in Memory Research. In: *"Optogenetics: A Roadmap"* a Neuromethods series book, 1st edition. Elsevier. Chapter 12 pp. 219-256.
2. Goshen I, Shapir A, and Mor Y (2015). Advancing fear memory research with Optogenetics. In: *Cognitive Enhancement: Pharmacologic, Environmental and Genetic Factors*. 1st edition. Elsevier. Chapter 12, pp. 219-256.
3. Goshen, I & Yirmiya, R. (2010). Brain Interleukin-1 (IL-1) mediates stress-induced alterations in HPA activation, memory functioning and neural plasticity. In: *Stress- from molecules to behavior*. Wiley-Blackwell. Chapter 13, pp. 243-260.
4. Goshen, I & and Yirmiya, R. (2006). The role of pro-inflammatory cytokines in memory processes and neural plasticity. in *Psychoneuroimmunology*, 4th edition. Academic Press. Chapter 16, pp. 337-377.
5. Goshen I, Weidenfeld J, Ben-Hur T, Yirmiya R. (2004). The role of Interleukin-1 in HPA axis activation and regulation. *Stress, Behavior, Immune response*. Proceedings of the 1st International Alfred-Krupp-Wissenschaftskolleg Symposium. Greifswald, Germany, pp. 89-106.