

BIOGRAPHICAL SKETCH

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NAME: Merabet, Lotfi

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: Associate Professor of Ophthalmology

EDUCATION/TRAINING (*Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.*)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
University of Ottawa, Ottawa, Ontario	BS	05/1992	Biology
University of Sherbrooke, Sherbrooke, Quebec	MS	05/1995	Physiology and Biophysics
University of Montreal, Montreal, Quebec	PHD	05/1999	Neuroscience
New England College of Optometry, Boston, Massachusetts	OD	07/2001	Optometry
Harvard-MIT Health Sciences Technology (HST), Boston, Massachusetts	MS	05/2003	Clinical Investigation
Harvard School of Public Health, Boston, Massachusetts	MPH	07/2011	Clinical Effectiveness
Harvard Medical School, Boston, Massachusetts	Postdoctoral Fellow	06/2003	Noninvasive Brain Stimulation
Boston University/MGH Martinos Center for Biomedical Imaging, Boston, Massachusetts	Postdoctoral Fellow	06/2004	Neuroimaging

A. Personal Statement

As a clinician-neuroscientist, my main research focus has been studying the visual system and in particular, the neuroplasticity associated with the adaptation to visual impairment and blindness (both of ocular and cerebral causes). My current position as Director of the Laboratory for Visual Neuroplasticity at the Massachusetts Eye and Ear Infirmary allows the opportunity to work within an environment rich in clinical expertise and scientific resources to carry out advanced translational research. Ultimately, the goal is to understand neuroplastic compensatory mechanisms associated with vision loss and modulate brain function in order to optimize behavioral and functional outcomes. The importance of this line of investigation is two-fold: First, findings are likely to impact both the rehabilitation and education of the blind and visually impaired. Secondly, the neuroplastic mechanisms underlying these changes may also serve as a basis to enhance the development of novel rehabilitation approaches that are grounded in neuroscientific investigation.

1. Bauer CM, Hirsch GV, Zajac L, Koo BB, Collignon O, Merabet LB. Multimodal MR-imaging reveals large-scale structural and functional connectivity changes in profound early blindness. PLoS One. 2017;12(3):e0173064. PubMed PMID: [28328939](#); PubMed Central PMCID: [PMC5362049](#).
2. Martín MB, Santos-Lozano A, Martín-Hernández J, López-Miguel A, Maldonado M, Baladrón C, Bauer CM, Merabet LB. Cerebral versus Ocular Visual Impairment: The Impact on Developmental Neuroplasticity. Front Psychol. 2016;7:1958. PubMed PMID: [28082927](#); PubMed Central PMCID: [PMC5183596](#).
3. Connell N, Merabet LB. Uncovering the connectivity of the brain in relation to novel vision rehabilitation strategies. Neurology. 2014 Aug 5;83(6):484-5. PubMed PMID: [24991035](#).
4. Bauer CM, Heidary G, Koo BB, Killiany RJ, Bex P, Merabet LB. Abnormal white matter tractography of visual pathways detected by high-angular-resolution diffusion imaging (HARDI) corresponds to visual dysfunction in cortical/cerebral visual impairment. J AAPOS. 2014 Aug;18(4):398-401. PubMed PMID: [25087644](#); PubMed Central PMCID: [PMC4150820](#).

B. Positions and Honors

Positions and Employment

2001 - 2010	Staff Optometrist, Beth Israel Deaconess Medical Center, Department of Ophthalmology/Surgery
2004 - 2006	Instructor in Neurology, Harvard Medical School, BOSTON, MA
2006 - 2007	Visiting Fellow, Miguel Hernandez University , Department of Bioengineering, Alicante
2006 - 2010	Assistant Professor of Neurology, Harvard Medical School, BOSTON, MA
2007 -	Adjunct Professor of Optometry, University of Montreal, School of Optometry, Montreal, Quebec
2010 - 2011	Associate Director, Vision Rehabilitation Service, Massachusetts Eye and Ear Infirmary, BOSTON, MA
2010 - 2013	Assistant Professor of Ophthalmology, Harvard Medical School, BOSTON, MA
2011 -	Director, the Laboratory for Visual Neuroplasticity, Massachusetts Eye and Ear Infirmary, BOSTON, MA
2013 -	Associate Professor of Ophthalmology, Harvard Medical School, BOSTON, MA
2014 -	Staff Optometrist, Spaulding Rehabilitation Hospital, Department of Physical Medicine and Rehabilitation, Boston, MA

Other Experience and Professional Memberships

1996 -	Member, Society for Neuroscience
2002 -	Member, Organization for Human Brain Mapping
2003 -	Member, Association for Research in Vision and Ophthalmology (ARVO)
2007 -	Ad Hoc Reviewer, Small Business Innovation Research - National Eye Institute (SBIR-NEI)
2012 -	Board of Directors, Program Committee Chair, Carroll Center for the Blind
2012 -	Board of Trustees, National Braille Press
2012 -	Ad Hoc Reviewer, Defense Medical Research and Vision Restoration and Rehabilitation (VRR)

Honors

2001	Feinbloom Award for Excellence in Low Vision, New England College of Optometry
2001	Postdoctoral Fellowship Award, Canadian Institutes of Health Research (CIHR)
2002	Fellow, American Academy of Optometry
2011	Nominee - Young Mentor Award, Harvard Medical School
2014	Editor's Pick, TEDx Lecture Series
2015	Award of Distinguished Speaker , Principles and Practice of Clinical Research, Harvard Medical School
2016	Low Vision Research Award , Research to Prevent Blindness

C. Contribution to Science

1. Neuroplasticity Associated with the Adjustment to Blindness

It is generally believed that blind individuals develop compensatory behavioral strategies through the use of their remaining senses such as touch and hearing. It is now well established that the development of these enhanced sensory behaviors is intimately related to dramatic structural and functional neuroplastic changes occurring within the brain. Given that the brain is highly specialized, we can ask the question: "what is the fate of regions of the brain normally associated with the processing of visual information in an individual who is blind? To answer this question, we employ a variety of behavioral testing paradigms and functional neuroimaging in order to uncover the neural correlates of these compensatory neuroplastic changes.

- a. Pascual-Leone A, Amedi A, Fregni F, Merabet LB. The plastic human brain cortex. Annu Rev Neurosci. 2005;28:377-401. PubMed PMID: [16022601](https://pubmed.ncbi.nlm.nih.gov/16022601/).

- b. Merabet LB, Rizzo JF, Amedi A, Somers DC, Pascual-Leone A. What blindness can tell us about seeing again: merging neuroplasticity and neuroprostheses. *Nat Rev Neurosci*. 2005 Jan;6(1):71-7. PubMed PMID: [15611728](#).
- c. Amedi A, Stern WM, Camprodon JA, Bermpohl F, Merabet L, Rotman S, Hemond C, Meijer P, Pascual-Leone A. Shape conveyed by visual-to-auditory sensory substitution activates the lateral occipital complex. *Nat Neurosci*. 2007 Jun;10(6):687-9. PubMed PMID: [17515898](#).
- d. Merabet LB, Pascual-Leone A. Neural reorganization following sensory loss: the opportunity of change. *Nat Rev Neurosci*. 2010 Jan;11(1):44-52. PubMed PMID: [19935836](#); PubMed Central PMCID: [PMC3898172](#).

2. Novel Rehabilitative Approaches for the Development and Training of Navigation Skill in the Blind

Considerable interest has arisen regarding the educative potential of virtual reality and computer based video games as a means to motivate and improve contextual learning. We have developed a user-centered, computer-based navigation software designed with the purpose of developing navigation skills in the blind through immersive virtual navigation. Using auditory spectral cues, a user navigates through a simulated virtual environment based on a spatial layout that is previously unfamiliar. Following exploration, the user is able to transfer the knowledge gained regarding the spatial layout and navigate their way in the physical building modelled in the virtual environment.

- a. Merabet LB, Connors EC, Halko MA, Sánchez J. Teaching the blind to find their way by playing video games. *PLoS One*. 2012;7(9):e44958. PubMed PMID: [23028703](#); PubMed Central PMCID: [PMC3446956](#).
- b. Connors EC, Chrastil ER, Sánchez J, Merabet LB. Action video game play and transfer of navigation and spatial cognition skills in adolescents who are blind. *Front Hum Neurosci*. 2014;8:133. PubMed PMID: [24653690](#); PubMed Central PMCID: [PMC3949101](#).
- c. Connors EC, Chrastil ER, Sánchez J, Merabet LB. Virtual environments for the transfer of navigation skills in the blind: a comparison of directed instruction vs. video game based learning approaches. *Front Hum Neurosci*. 2014;8:223. PubMed PMID: [24822044](#); PubMed Central PMCID: [PMC4013463](#).
- d. Halko MA, Connors EC, Sánchez J, Merabet LB. Real world navigation independence in the early blind correlates with differential brain activity associated with virtual navigation. *Hum Brain Mapp*. 2014 Jun;35(6):2768-78. PubMed PMID: [24027192](#); PubMed Central PMCID: [PMC3954447](#).

3. Crossmodal Sensory Processing in the Occipital Cortex

Current evidence suggests that the occipital cortex (normally associated with visual perception) actively participates in non-visual sensory tasks. We have investigated the neurophysiology and neuroplasticity of cross-modal sensory interactions through the use of functional neuroimaging and noninvasive brain stimulation. This has contributed to our understanding of how objects are represented within the visual brain and how information obtained from touch contributes to this processing.

- a. Merabet L, Thut G, Murray B, Andrews J, Hsiao S, Pascual-Leone A. Feeling by sight or seeing by touch?. *Neuron*. 2004 Apr 8;42(1):173-9. PubMed PMID: [15066274](#).
- b. Merabet LB, Swisher JD, McMains SA, Halko MA, Amedi A, Pascual-Leone A, Somers DC. Combined activation and deactivation of visual cortex during tactile sensory processing. *J Neurophysiol*. 2007 Feb;97(2):1633-41. PubMed PMID: [17135476](#).
- c. Ramos-Estebanez C, Merabet LB, Machii K, Fregni F, Thut G, Wagner TA, Romei V, Amedi A, Pascual-Leone A. Visual phosphene perception modulated by subthreshold crossmodal sensory stimulation. *J Neurosci*. 2007 Apr 11;27(15):4178-81. PubMed PMID: [17428995](#).
- d. Swisher JD, Halko MA, Merabet LB, McMains SA, Somers DC. Visual topography of human intraparietal sulcus. *J Neurosci*. 2007 May 16;27(20):5326-37. PubMed PMID: [17507555](#).

4. Novel Approaches for Vision Rehabilitation in Hemianopia Combined with Noninvasive Brain Stimulation

Visual field defects are often the consequence of stroke and brain injury. The resulting visual impairment can be debilitating for patients; impeding daily activities such as reading and mobility. However, the development of various visual rehabilitative strategies suggests that visual field defects are partially repairable and a certain degree of function can be improved. We have developed a combined vision training and noninvasive brain stimulation approach aimed at enhancing visual rehabilitative outcomes in patients with brain damage due to stroke.

- a. Plow EB, Maguire S, Obretenova S, Pascual-Leone A, Merabet LB. Approaches to rehabilitation for visual field defects following brain lesions. *Expert Rev Med Devices*. 2009 May;6(3):291-305. PubMed PMID: [19419286](#).
- b. Plow EB, Obretenova SN, Halko MA, Kenkel S, Jackson ML, Pascual-Leone A, Merabet LB. Combining visual rehabilitative training and noninvasive brain stimulation to enhance visual function in patients with hemianopia: a comparative case study. *PM R*. 2011 Sep;3(9):825-35. PubMed PMID: [21944300](#).
- c. Plow EB, Obretenova SN, Jackson ML, Merabet LB. Temporal profile of functional visual rehabilitative outcomes modulated by transcranial direct current stimulation. *Neuromodulation*. 2012 Jul;15(4):367-73. PubMed PMID: [22376226](#); PubMed Central PMCID: [PMC3389571](#).
- d. Plow EB, Obretenova SN, Fregni F, Pascual-Leone A, Merabet LB. Comparison of visual field training for hemianopia with active versus sham transcranial direct cortical stimulation. *Neurorehabil Neural Repair*. 2012 Jul-Aug;26(6):616-26. PubMed PMID: [22291042](#).

D. Additional Information: Research Support and/or Scholastic Performance

Ongoing Research Support

R01 EY019924-08

Merabet, Lotfi (PI)

02/01/10-01/31/19

Audio-Haptic Virtual Environments for Large-Scale Navigation in the Blind

Role: PI

na, Research to Prevent Blindness /Lions Clubs International Foundation Low Vision Research Award

Merabet, Lotfi (PI)

07/01/16-12/31/19

Characterizing the Neurophysiology of Cortical/Cerebral Visual Impairment (CVI) with Combined Structural and Functional Imaging

Role: PI

Completed Research Support

R01 EY019924-06

Merabet, Lotfi (PI)

02/01/10-01/31/15

Audio Based Navigation in the Blind

Role: PI

R01 EY019924-04S1

Merabet, Lotfi (PI)

02/01/10-01/31/15

Audio Based Navigation in the Blind
(supplement to promote diversity)

Role: PI

K23 EY016131-05

Merabet, Lotfi (PI)

08/01/05-07/31/10

The Occipital Cortex in Cross-Modal Sensory Processing

Role: PI

L30 EY015979-03

Merabet, Lotfi (PI)

07/01/08-06/30/09

The Role of Visual Cortex in Tactile Object Processing

Role: PI

F32 EY015608-02

Merabet, Lotfi (PI)

04/19/04-07/31/05

Role of Visual Cortex in Tactile Object Processing

Role: PI

na, The Deborah Munroe Noonan Memorial Research Fund

Lotfi Merabet (PI)

08/01/14-07/01/15

Uncovering the Relationship Between Brain Reorganization and Visual Dysfunction in Adolescents with Cortical Visual Impairment

Role: PI

na, Massachusetts Lions Eye Research Fund

Lotfi Merabet (PI)

08/01/13-07/01/14

Neuroplastic Reorganization in Cortical-Visual Impairment (CVI)

Role: PI

na, The John W. Alden Trust

Lotfi Merabet (PI)

01/01/12-01/01/13

How the Brain Re-wires Itself in Cortical Visual Impairment (CVI)

Role: PI

na, NovaVision Inc.

Lotfi Merabet (PI)

08/01/07-07/01/10

The Use of Transcranial Direct Current Stimulation (tDCS) to Enhance the Rehabilitative Effect of Vision Restoration Therapy

Role: PI

W81XWH-07-2-0011 , United States DoD/Center for Integration of Medicine and Innovative Technology (CIMIT)

Lotfi Merabet (PI)

08/01/06-07/01/09

A Multi-modal Sensory Rehabilitation Strategy for the Augmentation of Functional Vision

Role: PI

na, Massachusetts Lions Eye Research Fund

Merabet, Lotfi (PI)

01/01/15-01/01/16

Development of a Wearable Wireless EEG Recording System to Monitor Brain Activity in the Blind while Performing Real-World Mobility Tasks

Role: PI