

BIOGRAPHICAL SKETCH

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NAME Alvaro PASCUAL-LEONE, MD, PhD	POSITION TITLE Professor in Neurology Director, Center for Noninvasive Brain Stimulation Assoc. Director, Harvard-Thorndike Research Ctr.		
eRA COMMONS USER NAME Apleone			
EDUCATION/TRAINING <i>(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)</i>			
INSTITUTION AND LOCATION	DEGREE <i>(if applicable)</i>	YEAR(s)	FIELD OF STUDY
Colegio Alemán, Valencia, Spain	BSc (Abitur)	1979	Physics, Biology
Albert-Ludwigs-Univ., Freiburg, Germany	M.D.	1984	Medicine
Univ. Literaria de Valencia, Valencia, Spain	Licenciado	1984	Medicine
Albert-Ludwigs-Univ., Freiburg, Germany	Ph.D.	1985	Neurophysiology

Positions and Honors.**Positions and Employment**

1984-1985	Intern, Medicine, Staetisches Klinikum Karlsruhe, Germany
1985-1986	Resident, Medicine, Hospital Universitario de Valencia, Valencia, Spain
1986-1989	Medical Staff Fellow, Neurology, University of Minnesota, Minneapolis
1989-1990	Fellow, Clinical Neurophysiology Laboratory, Univ. Minnesota, Minneapolis
1990-1993	Medical Staff Fellow, Human Motor Control Section, NINDS, NIH, Bethesda
1993-1994	Investigador Asociado, Neurobiology Unit, Dept. Physiology, Univ. Valencia, Valencia, Spain
1994-1998	Research Associate in Neuroscience, Instituto Ramon y Cajal, CSIC, Spain
1995-1997	Associate Professor of Physiology and Neurology, Univ. Valencia, Valencia, Spain
1997-present	Staff Physician, Behavioral Neurology Unit, Dept. Neurology, Beth Israel Deaconess Med. Ctr.
1997-2006	Associate Professor of Neurology, Harvard Medical School, Boston, MA
1997-present	Director, Center for Noninvasive Brain Stimulation, Harvard Medical School and BIDMC
1998-present	“Investigador Asociado”, Institute of Bioengineering, Univ. Miguel Hernandez, Alicante, Spain
1999-present	Adjunct Professor of Psychiatry and Neuropsychology, Boston University Adjunct Professor Cognitive Neuroscience, Faculty of Arts and Sciences, Harvard University Associate Director, Harvard-Thorndike General Clinical Research Center, Boston, MA
2001-present	Scientific Advisor, Institute Guttmann, Neurorehabilitation Hospital, Barcelona, Spain
2002-present	Member, Scientific Advisory Board, Northstar Neuroscience (www.northstarneuro.com)
2005-present	Medical and Scientific Advisory Board member, NovaVision (www.novavisiontherapy.com)
2006-present	Professor of Neurology, Harvard Medical School, Boston, MA

Other Experience and Professional Memberships

1996-1998	Co-founder & Member of Initial Steering Committee, International Society for Transcranial Stimulation
1997-1999	Chair, Technology Assessment Committee for TMS, American Academy of Neurology Co-Chair, Special Committee on TMS, International Federation of Clinical Neurophysiology
1998-2004	Executive Board Member, International Society for Transcranial Stimulation
1998-present	Fellow, Mind-Brain-Behavior Initiative Steering Committee, Harvard Medical School, Boston
2000-present	Member of the Board of Honors Tutors, Faculty of Arts and Sciences, Harvard University
2001-present	Chair, Subcommittee for Minorities Inclusion, Center for Faculty Development, BIDMC
2002-present	Member, NIH Study Section BBBP-4: Attention and Perception
2003-present	Steering committee, Faculty Mentoring Program, Center for Faculty Development, BIDMC
2004-present	Member, Standing Committee on Faculty Fellowships, Faculty of Medicine, Harvard University Member, Admissions Committee, Harvard-MIT MD-PhD Program, Harvard Medical School Secretary, Council Member, Organization for Human Brain Mapping
2005-present	Advisory Council Member, Society for Applied Neuroscience Editorial Advisory Board, Essays in Cognitive Neuroscience, Psychology Press

Honors

- 1979-1985 DAAD Scholar ("Deutscher Akademischer Austauschdienst")
1985 "Sobresaliente cum laude" in "Grado de Licenciado" (Spanish Master's Degree in Medicine)
"Summa cum laude" in German PhD in Neurophysiology
1992 Travel Fellowship Award from the American Neurological Association
1993 Fellowship Award from the International Federation of Clinical Neurophysiology
1994 RAMÓN Y CAJAL Award for Research in Neuroscience, Sociedad Española de Neurología
1995 IV Annual Research Award from the Asociación de Parkinson España
1997 Milton Foundation Award
Stanley Vada Foundation Award
1998 Elected Member, American Neurological Association
Independent Investigator Award, National Alliance for Research in Schizophrenia and Depression
International Research Prize, Organización Nacional de Ciegos de España (Spanish Organization for the Blind)
2000 Daniel D. Federman Outstanding Clinical Educator, Harvard Medical School (Boston)
2001 Norman Geschwind Award in Behavioral Neurology, American Academy of Neurology
2004 Elected to Council, Organization of Human Brain Mapping
2004 Friedrich Wilhelm Bessel Research Award from The Alexander von Humboldt Foundation, Germany
2004 Brenda Milner Lecturer in Cognitive Neuroscience, Montreal Neurological Institute, Montreal, Canada

B. Selected peer-reviewed publications (in chronological order).

Publications selected from 271 peer-reviewed publications (209 original and 62 review papers); 49 book chapters, 2 edited books, 1 co-authored book, and 4 patents.

- Pascual-Leone A, et al. Modulation of cortical motor output maps during the development of implicit and explicit knowledge. *Science*, 263:1287-1289 (1994).
Pascual-Leone A, et al. Modulation of muscle responses evoked by transcranial magnetic stimulation during the acquisition of a new fine motor skill. *J Neurophysiol* 74:1037-1045 (1995).
Sadato N, Pascual-Leone A, Grafman J, Ibañez V, Deiber M-P, Dold G, Hallett M. Activation of the primary visual cortex by Braille reading in blind subjects. *Nature* 380: 526-528 (1996).
Pascual-Leone A, Rubio B, Pallardó F, Catalá MD Rapid-rate transcranial magnetic stimulation of left dorsolateral prefrontal cortex in drug-resistant depression. *Lancet* 348: 233-237 (1996).
Cohen LG, Celnik P, Pascual-Leone A, Corwell B, Faiz L, Dambrosia J, Honda M, Sadato N, Gerloff C, Catala MD, Hallett M. Functional relevance of cross-modal plasticity in blind humans. *Nature* 389:180-183 (1997)
Kosslyn SM, Pascual-Leone A, Felician O, Camposano S, Keenan JP, Thompson WL, Ganis G, Sukel KE, Alpert NM The role of area 17 in visual imagery: convergent evidence from PET and rTMS. *Science* 284(5411):167-170 (1999)
Keenan JP, Nelson A, O'Connor M, Pascual-Leone A. Self-recognition and right hemisphere. *Nature* 409 305 (2001)
Pascual-Leone A, Walsh V. Backprojections from the motion (MT+/V5) to the primary (V1) visual area are fast and necessary for visual awareness. *Science* 292: 510-512 (2001)
Hilgetag CC, Theoret H, Pascual-Leone A. Enhanced visual spatial attention ipsilateral to rTMS-induced 'virtual lesions' of human parietal cortex. Is the speech arrest induced by repetitive transcranial magnetic stimulation due to disruption of the motor cortex ? *Nature Neuroscience* 4: 953-957 (2001)
Pascual-Leone A., Hamilton R. The Metamodal Organization of the Brain. *Progr. Brain Res.* Vol 134: 427-445 (2001)
Maeda F, Kleiner-Fisman G, Pascual-Leone A. Motor Facilitation While Observing Hand Actions: Specificity of the Effect and Role of Observer's Orientation. *J Neurophysiol.* 2002 Mar;87(3):1329-35.
Knecht S, Flöel A, Dräger B, Sommer J, Breitenstein C, Henningsen H, Ringelstein EB, Pascual-Leone A Degree of language lateralization determines the susceptibility to unihemispheric brain lesions *Nature Neuroscience* (2002)
Pascual-Leone A., Davey N. Wassermann EM, Rothwell J, Puri B (eds.) *Handbook of transcranial magnetic stimulation.* Arnold Press, London U.K. (2002)
Walsh V, Pascual-Leone A. *Neurochronometrics of Mind: Transcranial magnetic stimulation in Cognitive Science.* MIT Press, Cambridge MA (2003)
Kobayashi M, Pascual-Leone A Transcranial Magnetic Stimulation in Neurology *Lancet Neurology* 2: 145-156 (2003)
Robertson E, Pascual-Leone A, Press D. Awareness modifies skill learning benefits of sleep. *Curr Biol* (2004)
Kobayashi M, Hutchinson S, Theoret H, Schlaug G, Pascual-Leone A. Repetitive TMS of the motor cortex improves ipsilateral sequential simple finger movements *Neurology* 62: 91-98 (2004)

- Merabet L, Thut G, Murray B, Hsiao S, Pascual-Leone A. Feeling by sight or seeing by touch? *Neuron* 42: 173-9 (2004)
- Robertson E, Pascual-Leone A, Miall CR Current concept in procedural consolidation. *Nat Rev Neurosci* 5: 576-82 (2004)
- Merabet L, Rizzo J, Amedi A, Somers D, Pascual-Leone A What blindness can tell us about seeing again: Merging neuroplasticity and neuroprostheses. *Nat Rev Neurosci* 6: 71-77 (2005)
- Martin PI, Naeser MS, Theoret H, Nicholas M, Kurland J, Fregni F, Seekins H, Doron K, Pascual-Leone A Transcranial magnetic stimulation as a complementary treatment for aphasia *Semin Speech Lang* 25: 181-191 (2004)
- Theoret H, Halligan E, Kobayashi M, Fregni F, Tager-Flusberg H, Pascual-Leone A. Impaired motor facilitation during action observation in individuals with autism spectrum disorder. *Current Biology* 15: R84-R85 (2005)
- Naeser MS, Martin PI, Nicholas M, Baker EH, Seekins H, Kobayashi M, Theoret H, Fregni F, Tormos JM, Kurland J, Doron KW, Pascual-Leone A Improved Picture Naming in Chronic Aphasia after TMS to Part of Right Broca's Area, an Open-Protocol Study *Brain and Lang* 93: 95-105 (2005)
- Valero A, Payne B, Jarrett Rushmore R, Lomber SG, Pascual-Leone A. Impact of repetitive transcranial magnetic stimulation of the parietal cortex on metabolic brain activity in the cat *Exp Brain Res* Feb 2 [Epub ahead of print] (2005)
- Mansur CG, Fregni F, Boggio PS, Riberto M, Gallucci-Neto J, Santos CM, Wagner T, Rigonatti SP, Marcolin MA, Pascual-Leone A. A sham-stimulation controlled trial of rTMS of the unaffected hemisphere in stroke patients. *Neurology* 64: 1802-1804 (2005)
- Pascual-Leone A, Amedi A, Fregni F, Merabet L. The plastic human brain cortex *Ann Rev Neurosci* 28: 377-401 (2005)
- Sack AT, Camprodon J, Pascual-Leone A, Goebel R. The Dynamics of Inter-Hemispheric Compensatory Processes in Mental Imagery. *Science* 29: 702-704 (2005)
- Thut G, Ives, JR Kampmann F, Pastor MA, Pascual-Leone A A new device and protocol for combining TMS and online recordings of EEG and evoked potentials. *J Neurosci Methods* 15:141(2): 207-217 (2005)
- Thut G, Nietzel A, Pascual-Leone A Dorsal posterior parietal rTMS affects voluntary orienting of visuospatial attention *Cerebral Cortex* Sep 1 [Epub ahead of print] (2004)
- Fregni F, Boggio PS, Nitsche M, Berman F, Antal A, Feredoes E, Marcolin MA, Rigonatti SP, Silva MTA, Paulus W, Pascual-Leone A. Anodal Current Stimulation of Prefrontal Cortex Enhances Working Memory. *Exp Brain Res* 166(1): 23-30 (2005)
- Fierro B, Brighina F, Vitello G, Piazza A, Scalia S, Giglia G, Daniele O, Pascual-Leone A. Modulatory effects of low- and high-frequency repetitive transcranial magnetic stimulation on visual cortex of healthy subjects undergoing light deprivation. *J Physiol* 565(Pt 2):659-665 (2005)
- Fregni F, DaSilva D, Potvin K, Ramos-Estebanez C, Cohen D, Pascual-Leone A, Freedman SD. Treatment of chronic visceral pain with brain stimulation. *Ann Neurol* 58(6): 971-972 (2005)
- Amedi A, Malach R, Pascual-Leone A. Negative BOLD differentiates visual imagery and perception. *Neuron* 48, 858-872 (2005)
- Cohen D, Pascual-Leone A, Press DZ, Robertson EM. Off-line learning of motor skill memory: a double dissociation of goal and movement. *PNAS* Dec 5 [Epub ahead of print] (2005)

C. Research Support

NIH-NEI: RO1-EY12091 (Pascual-Leone – PI): Neuroplasticity in the Adjustment to Blindness.

The major goals of this project are to study mechanisms of recruitment of the occipital striate cortex for Braille reading in the blind by visually depriving sighted volunteers and teaching them intensively how to read Braille by touch. Cortical activation will be studied using functional MRI.

NIH-NCRR: K24 RR018875 (Pascual-Leone - PI): Study and Modulation of Brain Plasticity

The major goal of this project is to provide mentoring and guidance for young investigators studying investigate brain plasticity and how to modulate it and enhance recovery of function after brain injury. Role: PI

NIDCD: R01-EB 005047-01 (Pascual-Leone- co-PI): Safety of Repetitive TMS in Chronic Subcortical Stroke

This is a phase I, 2 dose-tier study with concurrent controls to evaluate the safety of image-guided 20 Hz rTMS in the treatment of patients with hemiparesis after stroke. The main hypothesis is that 20 Hz rTMS to the motor cortex of the damaged hemisphere in patients with subcortical stroke will be safe and enhance neurological recovery if coupled with occupational therapy. Joint project with Steve Cramer at UC Irvine

NIH-NEI: R21EY0116168 (Pascual-Leone- PI): Seeing with the mind's ears

This R21 proposal seeks to study the potential of visuo-auditory transformation as a sensory substitution system in the blind

CIMIT: Office of Technology Development (Pascual-Leone- PI): DSI-Guided TMS

We propose to use a new MRI-based technology, diffusion spectrum imaging or DSI, to reveal tissue characteristics in order to maximize the focal specificity of the effect of TMS on a given brain region. Eventually this new methodology of DSI-guided TMS will be integrated with results of a previous CIMIT grant to provide an optimal system for precise stimulation of the brain with TMS

NIH-NIDCD: RO1-DC05672 (M. Naeser - PI): Transcranial Magnetic Stimulation to Improve Speech

The major goals of this project are to study the role of the right hemisphere in the recovery of speech in non-fluent aphasia and evaluate the possibility of enhancing recovery by suppressing activity in right Broca's homologue, Broadman's area R-BA 45. Role: PI for subcontract at BIDMC

NIH-NINDS: RO1-NS47754 (Moss - PI): Rehabilitation of Neural Spatial Neglect.

The major goal of this project is to study the neurobiology of visual neglect and the possibility of enhancing its rehabilitation by modulating cortical excitability using TMS. The study is conducted in a cat model of neglect combining behavioral measures, optical and neurophysiologic mapping, anatomy, and TMS. Role: PI for subcontract at BIDMC

NIH-NINDS: RO1-NS20068 (G. Schlaug - PI): Facilitators of Motor Recovery Following Stroke

The major goals of this project are: 1. To determine the activation pattern of recovering movements as they emerge in clinically-defined stages of recovery using fMRI; 2. To determine the presence of motor evoked potentials (MEPs) and measures of cortico-cortical excitability using TMS at the same clinically defined stages of recovery; 3. To determine whether temporary inhibition of the ipsilateral primary sensorimotor cortex activation using subthreshold, low frequency repetitive TMS effects motor action in the recovering hand. Role: co-PI

NIH-NCRR: MO1 RR01032 (Flier - PI): Harvard-Thorndike General Clinical Research Center

To provide infrastructure support for clinical investigators at Beth Israel Deaconess Medical Center who have independent funding for their investigations. Role: Associate Director, GCRC

NIH-NINDS: T32NS051151 (Galaburda- PI): Research Training Program in Cognitive Neurology

The goal of this T32 proposal is to support training of fellows in cognitive neuroscience and behavioral neurology. Dr. Pascual-Leone is one of 5 members of the Executive Board, Director of Research for the Behavioral Neurology Division, and Core Faculty Member.

NIH-NEI: R01EY016559 (Kanwisher- PI): Reorganization of visual cortex in macular degeneration

This R01 combines careful psychophysics, fMRI and TMS studies to examine plastic changes in the primary visual cortex in patients with macular degeneration. Role: Principal investigator for BIDMC subcontract

NIH-NIDDK: R03DK071851 (Freedman- PI): TMS treatment for pain in chronic pancreatitis

The purpose of this protocol is to investigate a possible novel treatment – repetitive transcranial magnetic stimulation – for intractable visceral pain in patients with chronic pancreatitis

NIH-NINDS: R01NS051446 (Robertson- PI) : Using TMS to enhance off-line learning

This proposal seeks to determine whether distinct neural circuits support off-line learning of explicit and implicit skills and specifically explore whether non-invasive stimulation with transcranial magnetic stimulation of different brain targets can enhance off-line learning and thus promote skill acquisition. Role: Co-investigator

NIH-NIDCD: R01DC006842 (Caramazza- PI): Cortical organization of noun and verb processing

This study combines careful behavioral and linguistic evaluations with functional magnetic resonance imaging and transcranial magnetic studies of noun and verb processing in normal subjects and patients with focal brain lesions in order to promote understanding of language and grammatical categories organization in the human brain. Role: PI of BIDMC subcontract

Completed Major Research Studies (in the past 3 years)

- 1998 – 2001 Transcranial Magnetic Stimulation in Depression (NIMH, 1R01MH57980, Pascual-Leone – PI)
- 1999 – 2003 Cortical-Subcortical dysfunction in Parkinson's disease (Goldberg Foundation, Pascual-Leone – PI)
- 2001-2003 System for Precise Targeting of Specific Brain Areas with TMS in Stroke (CIMIT, Pascual-Leone – PI).
- 2002-2003 Procedural Learning and Working Memory in Parkinson's Disease (HCNR; Press – PI)
- 2002-2003 Non-invasive *in vivo* Assessment of Cholinergic Cortical Circuitry (HCNR; Pascual-Leone – PI)
- 1999-2004 Cognitive Neuroscience of Visual Imagery (NIMH, RO1-MH60734, Kosslyn – PI)