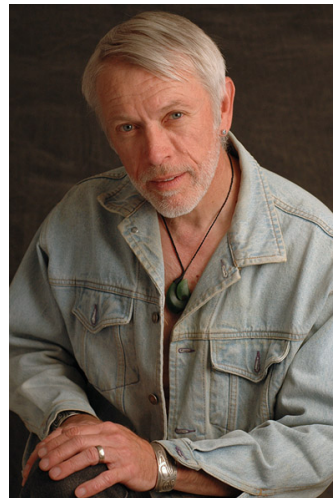


**ROBERT E. MARC, PHD**  
**Mary H. Boesche Professor of Ophthalmology**  
**Director of Research, Moran Eye Center**



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## EDUCATION

**1976...1977** NIH Postdoctoral Fellow, UCLA School of Medicine, Jules Stein Eye Institute  
**1975** PhD, University of Texas Grad School of Biomedical Sciences (UTGSBS), Houston  
**1971** BSc, Honors, University of Texas at El Paso, Biology

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## PROFESSIONAL EXPERIENCE

**1993...2007** Professor of Ophthalmology and Physiology, University Utah School of Medicine  
**1986...1993** Professor of Neural Sciences, UTGSBS, Houston  
**1982...1986** Associate Professor of Neural Sciences, UTGSBS, Houston  
**1978...1982** Assistant Professor of Neural Sciences, UTGSBS, Houston

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## ACTIVE AWARDS

NIH NEI RO1 EY02576-30... 35, Title: *Structural Neurochemistry of Retinal Circuits*, PI: R Marc  
 Period 01 Jan 2006 – 31 Dec 2010  
 Role & Objectives: Robert E. Marc, PI (30%); The aims of this program are to (1) generate a comprehensive retinal map of synaptic connectivity steered by computational classification segmentations; (2) resolve the neurochemical identities of key interneurons; (3) resolve the scaling parameters for glutamatergic drive through the retina.

NIH NEI RO1 EY015128-01 ... 04, Title: *Retinal Remodeling*, PI: R Marc  
 Period: 01 July 2004 – 30 June 2008

Role & Objectives: Robert E. Marc, PI (30%); The aims of this program are to (1) Define the patterns and chronologies of remodeling in RP-like retinal degenerations; (2) Map the anomalous re-wiring patterns of remodeling neurons; (3) Determine the trigger mechanisms and regulation of remodeling.

NIH NEI P30 EY014800, Title: *Core Grant for Vision Research*, PI: R Marc  
 Period: 1 April 2005 – 30 Mar 2010

Role & Objectives: Robert E. Marc, PI and Director; The aims of this program are to develop comprehensive imaging, molecular biology and functional assessment resources for vision research core group of 12 NEI grant holders.

NIH NIBIB, Title: *Large-scale computational reconstruction of three-dimensional neural connectivity from serial-section microscopy*, PI: T Tasdizen, U Utah School of Computing

Period 01 Jul 2005 – 30 Jun 2009

Role & Objectives: Robert E. Marc, co-PI (8%); The goal of this program is the development of high-capacity software tools for precise, non-linear, automated image mosaicking and registration; process segmentation and tracking; texture mapping; and synapse identification using a large (>Tbyte) ultrastructural connectivity dataset from the mammalian retina.

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## EDITORIAL EXPERIENCE

**1997...2002** Associate Editor, Visual Neuroscience  
**1992** Co-editor (Mize, Marc, Sillito) Progress in Brain Research V 90  
**1991...1993** Editorial Board, Visual Neuroscience  
**1985...1992** Executive Editor, *Experimental Eye Research*

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## ACADEMIC HONORS

**2003...** Mary H. Boesche Professorship, University of Utah  
**2003...2005** Research to Prevent Blindness Senior Investigator Award, University of Utah  
**1993...2001** Jules & Doris Stein Research to Prevent Blindness Professorship, University of Utah  
**1986...1993** Robert Greer Professorship, UTGSBS  
**1980, '97, '98** Invited Lecturer 3<sup>rd</sup>, 20<sup>th</sup>, and Final Taniguchi Symposium  
**1976** Glenn Fry Award, American Academy of Optometry  
**1972** Student Fellow, Argonne National Laboratories Conference on Photobiology  
**1967...1971** Stevens Scholar and B.Sc. Honors, University of Texas at El Paso

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## PROFESSIONAL SOCIETIES

Metabolomics Society  
 Society for Neuroscience  
 Association for Research in Vision and Ophthalmology  
 AAAS

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## ADMINISTRATIVE EXPERIENCE

- 2006 ...** Director of Research, University of Utah Department of Ophthalmology  
**2004...2006** Associate Director of Research, University of Utah Department of Ophthalmology  
**2004...2006** Directorate, University of Utah Neuroscience Program  
**1986...2007** Ad hoc reviewer for NSF and NIH NEI  
**1994...1999** Course Director, Cellular and Molecular Neuroscience Core Course  
**1994...1996** Chair, University of Utah Neuroscience Program Curriculum Committee  
**1992** NSF Committee of Visitors (External Review of NSF Policies)  
**1991...1993** Fellowship Review Board, Fight for Sight (Research to Prevent Blindness, Inc.)  
**1992** U Texas Health Sci Ctr / Hou Planning and Budget Committee  
**1990...1992** Chair, Committee of Professors, UTGSBS UTGSBS  
**1990...1993** Academic Standards Comm (Chair, 1992-1993), UTGSBS  
**1989...1991** Cell Biology Program Planning Comm, ARVO  
**1989** Strategic Planning Committee, U Texas Health Sci Ctr / Hou  
**1988** Federal Demonstration Project Committee, U Texas Health Sci Ctr / Hou  
**1982...1986** NIH NEI Study Section, VIS A2

## TEACHING, SERVICE & STUDENTS

(Conference chairs, Invited lectures etc., not included) 29 y graduate level teaching, 1 MSc, 5 PhDs, 9 post-doctoral fellows, one active PhD student

- 2005** Session Organizer on "Imaging Retinal Function" 9th Vision Research Conf, Ft Lauderdale  
**2002** Session Organizer on "Retinal Remodeling" 6th Vision Research Conf, Ft Lauderdale  
**2000...2002** Lecturer, Physiology 7910, Computational molecular phenotyping  
**1997** Co-Organizer, 3<sup>rd</sup> Great Basin Visual Science Symposium  
**1997** Organizer, Western Eye Research Conference, Snowbird  
**1994...1999** Director, Cellular / Molecular Neuroscience, Neuroscience Program Core Course  
**1994...1999** Cellular / Molecular Neuroscience: Ranked 1<sup>st</sup> lecturer all 6 years.  
**1994...1996** Vision Lectures, 1<sup>st</sup> Y Medical Students, U Utah Med Sch  
**1993...2007** Visual Neuroscience, University of Utah  
**1993...2007** Director: Visual Neuroscience, University of Utah, Lecturer for 3/4 of course  
**1989** The Dean's Teaching Excellence Award, U Texas Grad Sch Biomed Sciences  
**1985...1990** Dean's Teaching Excellence List, U Texas Grad Sch Biomed Sciences  
**1981...1983** Sensory Physiology Lectures, 1<sup>st</sup> Y Medical Students, U Texas Med Sch  
**1981...1991** Director: Visual Neuroscience I & II,  
**1981...1991** Visual Neuroscience II, U Texas Grad Sch Biomed Sciences, 2 lectures  
**1981...1991** Visual Neuroscience I, U Texas Grad Sch Biomed Sciences, 10 Lectures  
**1981...1991** Sensory Neuroethology, Sole lecturer, UT Grad Sch Biomed Sciences  
**1980...1990** Evolution of the Vertebrate Nervous System, Sole lecturer, UT Grad Sch Biomed Sci  
**1978...1980** Sensory Biology, Lecturer for 1/4 of course, U Texas Grad Sch Biomed Sciences  
**1978...2007** Supervisory Committees for 35 doctoral students

## CURRENT RESEARCH

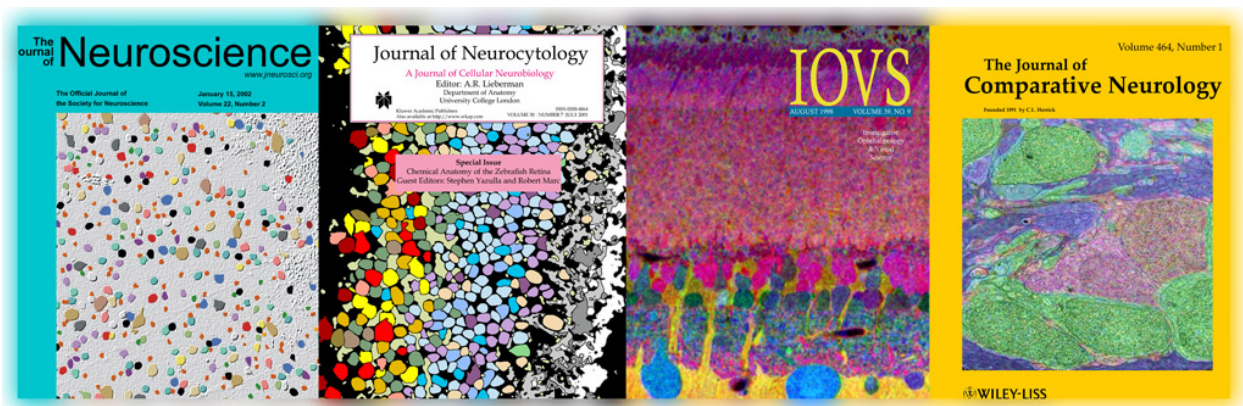
My global objectives are the development of imaging strategies and molecular probes designed to reveal cellular physiological states and large-scale neural systems reconstruction. The current focus is computational molecular phenotyping: a system of analysis based on anti-hapten molecular detection, high-density sample array fabrication, multidimensional image processing and computational pattern recognition analyses for image segmentation. I have developed a library of >60

small-molecule probes (including probes to the free states of 20 natural amino acids as well as glutathione, taurine, etc; and a set of exogenous probe molecules) to map cellular metabolic signatures, transport and channel permeation. The latter employs organic cation probes and detection to map functional glutamate signaling in the retina and brain. Applications of this technology include high-throughput phenotyping, pharmacological response assays, and cellular metabolic profiling. We have also discovered unprecedented plasticity and rewiring in the neural retina in advanced degenerative diseases; phenomena that change strategies for retinal rescue via genetic, molecular, cellular or bionic means. I have also founded a startup company, Signature Immunologics Inc, that provides a library of small molecule probes and continues to explore strategies for commercialization of anti-hapten methods. Finally, we are undertaking the largest ultrastructural neural systems reconstruction yet attempted.

## CAREER RESEARCH HIGHLIGHTS

- 2003** Characterization of neural remodeling processes in retinal degenerations
- 2002** First comprehensive mapping of ganglion cells published
- 2000** Computational fusion of EM ultrastructure-LM molecular mapping published
- 2000** New metabolic activity mapping probes developed
- 1999** Novel channel permeation activity mapping published
- 1998** Computational molecular phenotyping of a disease process published
- 1996** Signature Immunologics Inc established
- 1995** Channel permeation activity probes developed
- 1995** First computational molecular phenotyping published
- 1990...2004** Library of >50 molecular probes developed
- 1990** Quantitative mapping of cellular glutamic acid distributions published
- 1978...1981** EM microscopic mappings of retinal inhibitory transmitter circuits published
- 1975...1977** First functional mapping of vertebrate cone mosaics published

**PUBLICATIONS** (see [http://prometheus.med.utah.edu/~marclab/pubx\\_pdf.html](http://prometheus.med.utah.edu/~marclab/pubx_pdf.html))



- 2007** Marc RE. Functional Anatomy of the Retina. Duane's Foundations of Clinical Ophthalmology (Tasman and Jaeger), in preparation.
- 2007** Marc RE, BW Jones, JR Anderson, K Kinard, DW Marshak, JH Wilson, TG Wensel, RJ Lucas. Neural reprogramming in retinal degenerations. Invest Ophthalmol Vis Sci, in press.

- 2005 Jones BW, RE Marc, CB Watt, DK Vaughan, DT Organisciak 2005 Neural plasticity revealed by light-induced photoreceptor lesions. *Retinal Degenerative Diseases*, Springer, (New York), pp. 405-410. 2005.
- 2005 Marc RE, M Kalloniatis and BW Jones. Excitation Mapping with the Organic Cation  $AGB^{2+}$  (Agmatine). *Vision Research* 45: 3454-3468,
- 2005 Marc RE, BW Jones and CB Watt. Retinal remodeling: Circuitry revisions triggered by photoreceptor degeneration. In *Plasticity in the Visual system: from Genes to Circuits*. Eds, Pinaud et al., in press.
- 2005 Jones BW and RE Marc. Invited Review: Retinal remodeling in retinal degenerations. *Clinical and Experimental Optometry*, 88: 282-291.
- 2005 Jones BW and RE Marc. Invited Review: Retinal remodeling during retinal degeneration. *Experimental Eye Research*, 81: 121-244.
- 2005 Rohrer B, R Blanco, RE Marc, MB Lloyd, D Bok, DM Schneeweis, LF Reichardt. Functionally intact glutamate-mediated signaling in bipolar-cells of the Trkb knockout mouse retina. *Visual Neurosci* 21: 703-714.
- 2005 Sarthy VP, L Pignataro, T Pannicke, M Weick, A Reichenbach, T Harada, K Tanaka and RE Marc. Glutamate Transport by Retinal Müller Cells in Glutamate /Aspartate Transporter -knockout mice. *Glia* 49:184-196
- 2004 Sarthy VP, RE Marc, L Pignataro and K Tanaka 2004 Contribution of a glial glutamate transporter to GABA synthesis in the retina. *Neuroreport* 15: 1895-1898
- 2004 Marc RE "Retinal Neurotransmitters" in *The Visual Neurosciences* (Chalupa and Werner, Eds.). MIT Press, pp 315-330.
- 2003 Marc RE, BW Jones. Retinal remodeling in inherited photoreceptor degenerations. *Molecular Neurobiology* 28: 139-147.
- 2003 Marc RE, BW Jones, CB Watt, E Strettoi. Retinal remodeling in photoreceptor degenerations. In *Progress in Retinal and Eye Research*. 22: 607-655.
- 2003 B.W. Jones, C.B. Watt, J.M. Frederick, W. Baehr, C.K. Chen, E.M. Levine, A.H. Milam, M.M. LaVail, R.E. Marc. Retinal remodeling triggered by photoreceptor degenerations. *J Comp Neurol*. 464:1-16.
- 2003 Marc RE, BW Jones. Phenotyping neurons with pattern recognition of molecular mixtures. *IEEE International Symposium on Signal Processing and its Applications*, S1571.
- 2002 Marc RE A review of: Retinal Cell Rescue - The Sixth Annual Vision Research Conference. *Investigational Drugs: Weekly Highlights June 2002*: 53-60.
- 2002 Joyce-Brady M, RE Marc, JC Jean 2002 The importance of gamma-glutamyl transferase in lung glutathione homeostasis and antioxidant defense in Thiol Metabolism and Redox Regulation of Cellular Functions (Pompella et al. Eds) IOS Press, 182-196.
- 2002 Jean JC, Y Liu, LA Brown, RE Marc, E Klings, M Joyce-Brady (2002) Gamma-glutamyltransferase deficiency results in lung oxidant stress in normoxia. *Am J Physiol Lung Cell Mol Physiol* 283: 766-776.
- 2002 Marc RE, D Cameron. A molecular phenotype atlas of the zebrafish retina. *J Neurocytol*. 30: 593-654.

- 2002 Marc RE, BW Jones Molecular phenotyping of retinal ganglion cells. *J Neurosci.* 22: 413-427.
- 2000 Marc RE, WL Liu. Fundamental GABAergic amacrine cell circuitries in the retina: Nested feedback, concatenated inhibition, and axosomatic synapses. *J Comp Neurol* 425: 560-582.
- 1999 Marc RE. "The Structure of Vertebrate Retinas" in *The Retinal Basis of Vision* (Toyoda et al, Eds) Elsevier, Amsterdam, p 3-19.
- 1999 Marc RE. Mapping glutamatergic drive in the vertebrate retina with a channel permeant organic cation. *J Comp Neurol* 407:47-64.
- 1999 Marc RE. Kainate activation of horizontal, bipolar, amacrine and ganglion cells in the rabbit retina. *J Comp Neurol* 407:65-76.
- 1998 Gaal L, B Roska, SA Picaud, SM Wu, RE Marc, FS Werblin. Postsynaptic response kinetics are controlled by a glutamate transporter at cone photoreceptors. *J Neurophysiol* 79: 190-196.
- 1998 Marc RE, RF Murry, SK Fisher, KA Linberg, GP Lewis. Amino acid signatures in the detached cat retina. *Invest Ophthalmol Vis Sci* 39: 1694-1702.
- 1998 Marc RE, RF Murry, SK Fisher, KA Linberg, GP Lewis, M Kalloniatis. Amino acid signatures in the normal cat retina. *Invest Ophthalmol Vis Sci* 39: 1685-1693.
- 1996 Kalloniatis M, Marc RE, RF Murry. Amino signatures in the primate retina. *J Neuroscience* 16: 6807-6829.
- 1995 Marc RE, RF Murry, SF Basinger. Pattern recognition of amino acid signatures in retinal neurons. *J Neuroscience* 15: 5106-5129.
- 1995 Marc RE. Interplexiform cell connectivity in the outer retina. In *Neurobiology of the Vertebrate Outer Retina* (eds S. Archer, M.B.A. Djamgoz, S. Vallergera). Chapman and Hall, London). Chapman and Hall, London, pp 369-393.
- 1994 Kalloniatis MK, G Tomisch, RE Marc. Neurochemical signatures revealed by glutamine labeling in the chicken retina. *Visual Neurosci* 11: 793-804.
- 1994 Marc RE. Visualizing amino acids in the retina. In *The First Great Basin Symposium on Visual Science*, U Utah Press, Vol. 1: 58-68.
- 1993 Van Haesendonck E, RE Marc, L Missotten. New aspects of dopaminergic interplexiform cell organization in goldfish retina. *J Comp Neurol* 333: 503-518.
- 1992 Massey SC, SL Mills, RE Marc. Indoleamine accumulating amacrine cells in the rabbit retina contain GABA. *J Comp Neurol* 322: 275-291.
- 1992 Critz S, RE Marc. Glutamate antagonists that block hyperpolarizing bipolar cells increase the release of dopamine from turtle retina. *Visual Neurosci* 9: 271-278.
- 1992 Marc RE. The structure of GABAergic circuits in ectotherm retinas. In Mize R, Marc RE, Sillito A (Eds.), *GABA in the Retina and Central Visual System*, Elsevier, Amsterdam, pp 61-92.
- 1990 Marc RE, W-LS Liu, M Kalloniatis, S Raiguel E Van Haesendonck. Patterns of glutamate immunoreactivity in the goldfish retina. *J Neuroscience* 10: 4006-4034.
- 1990 Kalloniatis M, RE Marc. Interplexiform cells of the goldfish retina. *J Comp Neurol* 297: 340-358.

- 1990 Muller JF, RE Marc. GABA-ergic and glycinergic pathways in the inner plexiform layer of the goldfish retina. *J Comp Neurol.* 291: 281-304.
- 1989 Marc RE. The role of glycine in the mammalian retina in *Progress in Retinal Research*, 8: 67-107.
- 1989 Marc RE. The anatomy of multiple GABAergic and glycinergic pathways in the inner plexiform layer of the goldfish retina. In R. Weiler and N.N. Osborne (Eds.), *Neurobiology of the Inner Retina*, NATO ASI Series, Vol. H31a, Springer-Verlag, Berlin, pp 53-64.
- 1989 Marc RE. Evolution of retinal circuits. In J. Erber, R. Menzel, H.-J. Pflugger, D. Todt (Eds.), *Neural Mechanisms of Behavior, Proceedings of the 2nd International Congress of Neuroethology*, Thieme Medical Publishers, Inc., N.Y., pp. 146-147.
- 1988 Marc RE, W-LS Liu, K Scholz, JF Muller. Serotonergic pathways in the goldfish retina. *J Neuroscience.* 8: 3427-3450.
- 1988 Marc RE, WLS Liu, JF Muller. Gap junctions in the inner plexiform layer of the goldfish retina. *Vision Res* 28:9-24.
- 1988 Elberger A, RE Marc. Norepinephrine is a pre-synaptic input to visual corpus callosum cells. *Neurosci Ltrrs* 84:167-172.
- 1986 Marc RE. Neurochemical stratification in the inner plexiform layer of the vertebrate retina. *Vision Research* 26: 223-238.
- 1986 Marc RE. The development of retinal networks in *Cell Biology of the Retina*, R Adler and D Farber, Eds., Academic Press, pp. 17-65.
- 1985 Marc RE, W-LS Liu. Glycine-accumulating neurons in the human retina. *J Comp Neurol* 232: 241-260.
- 1985 Marc RE. The role of glycine in retinal circuitry in *Retinal Transmitters and Modulators: Models for the Brain Vol. 1*, Wm Morgan, Ed, CRC Press, Boca Raton, FL, pp. 119-158.
- 1984 Muller JF, RE Marc. Three distinct morphological classes of receptors in fish olfactory organs. *J Comp Neurol* 222:482-495.
- 1984 Marc RE, WLS Liu. Horizontal cell synapses onto glycine-accumulating interplexiform cells. *Nature* 311:266-269.
- 1982 Marc RE. Spatial organization of neurochemically classified interneurons in the goldfish retina. I. Local patterns. *Vision Res* 22:589-608.
- 1982 Marc RE. Retinal neurotransmitters, morphology and color coding. *Taniguchi Foundation Symposium. Color research and Application* 7:155-158.
- 1982 Marc RE. Chromatic organization of the retina in *Cellular Aspects of the Eye*, D McDevitt, Ed., Academic Press, NY, pp. 435-473.
- 1982 Lam DMK, J Fredericks, JG Hollyfield, PV Sarthy, RE Marc. Identification of neurotransmitter candidates in the invertebrate and vertebrate photoreceptor. In *The Evolution of Photoreceptors*, J Westphall Ed., Raven Pres, NY, pp. 65-80.
- 1981 Marc RE, DMK Lam. Glycinergic pathways in the goldfish retina. *J Neurosci* 1: 152-165
- 1981 Marc RE, DMK Lam. Uptake of aspartic and glutamic acid by goldfish photoreceptors. *Proc Natl Acad Sci USA* 78:7185-7189.
- 1980 Marc RE. Retinal colour channels and their neurotransmitters in *Colour Deficiencies V*, Adam Hilger Ltd, London, pp. 15-29.

- 1980 Lam DMK, RE Marc, PV Sarthy, CA Chin, YYT Su, C Brandon & JY Wu. Retinal organization: Neurotransmitters as physiological probes. *Neurochemistry* 1:183-190.
- 1980 Lam DMK, YYT Su, CA Chin, C Brandon, RE Marc, RM Lasater. GABAergic horizontal cells in the teleost retina. *Brain Res Bull.* 5:137-140
- 1979 Lam DMK, YYT Su, L Swain, RE Marc, C Brandon, JY Wu. Immunocytochemical localization of glutamic acid decarboxylase in the goldfish retina. *Nature* 278:565-567.
- 1978 Marc RE, WK Stell, D Bok, DMK Lam. GABAergic pathways in the goldfish retina. *J Comp Neurol* 182:221-246.
- 1977 Marc RE, HG Sperling. The chromatic organization of primate cones. *Science* 196:454-456.
- 1977 Marc RE. Glenn Fry Award Lecture: Chromatic patterns of cone photoreceptors. *Am. J. Optometry and Physiological Optics* 54:212-225.
- 1976 Crawford MLJ, RE Marc. Light transmission of cat and monkey eyelids. *Vision Res* 16:323-324.
- 1976 Marc RE, HG Sperling. The chromatic organization of the goldfish cone mosaic. *Vision Res* 16:1211-1224.
- 1976 Marc RE, HG Sperling. The color receptor identities of goldfish cones. *Science* 191:487-489.