March, 2016

Curriculum Vitae

1. **David M. Berson**
   Sidney A. Fox and Dorothea Doctors Fox Professor
   of Ophthalmology and Visual Sciences
   Professor of Neuroscience
   Department of Neuroscience
   Division of Biology and Medicine
   Brown University

2. Home Address: 22 Terrace Avenue
   Newton, MA 02461-1427

3. Education:

   Undergraduate degree:
   A.B., Psychology, Brown University, 1975

   Higher degrees:
   Ph.D., Neuroanatomy, Massachusetts Institute of Technology, 1980
   Dissertation topic: "*Extrageniculate and extrastriate affiliates of the geniculocortical pathway in the cat*."

4. Professional Appointments:

1971	Research Assistant, John B. Pierce Foundation, New Haven, Connecticut
1973	Research Assistant, Montefiore Hospital, Bronx, New York
1976-1977	Teaching Assistant, Department of Psychology, Massachusetts Institute of Technology, Cambridge, Massachusetts
1980-1983	Research Associate, Division of Biology and Medicine, Brown University, Providence, Rhode Island
1983-1985	Assistant Scientist, Eye Research Institute of Retina Foundation, Boston, Massachusetts
1985-1991	Assistant Professor of Medical Science, Brown University, Providence, Rhode Island
1991-	Associate Professor of Medical Science, Brown University, Providence, Rhode Island
1995-98	Director, Neuroscience Graduate Program, Brown University, Providence, Rhode Island

2003- Professor of Neuroscience, Brown University, Providence, RI.

2004- Sidney A. Fox and Dorothea Doctors Fox Professor of Ophthalmology and Visual Sciences

2008- Fellow, American Association for the Advancement of Science

5. Completed Research:

a. Books and monographs:

N/A

b. Chapters in books:

Graybiel, A.M. and Berson, D.M. Families of related cortical areas in the extrastriate visual system: summary of an hypothesis. In: Cortical Sensory Organization. Vol.2. Multiple Visual Areas, Woolsey, C.N. (ed). The Humana Press, Clinton, NJ, 1981, pp. 103-120.

Graybiel, A.M. and Berson, D.M. On the relation between transthalamic and transcortical pathways in the visual system. In: The Organization of the Cerebral Cortex, Schmitt, F.O., Worden, F.G. and Dennis, F. (eds). MIT Press, Cambridge, MA, 1981, pp. 286-319.

Berson, D.M. Retinal ganglion-cell types and their central projections. In: Allan I. Basbaum, Akimichi Kaneko, Gordon M. Shepard and Gerald Westheimer, editors, The Senses: A Comprehensive Reference. Vol. 1. Vision I. R. Masland and T.D. Albright (eds.), San Diego: Academic Press, 2008, p. 491-520.

Wong, K.Y. and Berson, D.M. Ganglion-cell photoreceptors and non-image-forming vision. In: Adler's Physiology of the Eye, 11th edition, Kaufman, P.L., Alm, A., Levin, L.A., Nilsson, S.F.E., Ver Hoeve, J.N. and Wu, S.M. (eds). London, Elsevier. (2010)

Berson, D.M. Intrinsically photosensitive retinal ganglion cells. In: The New Visual Neurosciences, Werner, J.S. and Chalupa, L.M. (eds). The MIT Press, Cambridge, MA (2013)

c. Refereed journal articles:

Berson D.M. and Graybiel, A.M. Parallel thalamic zones in the LP-pulvinar complex of the cat identified by their afferent and efferent connections. Brain Res. 147:139-148, 1978.

Berson, D.M. and Graybiel, A.M. Some cortical and subcortical fiber projections to the accessory optic nuclei in the cat. Neuroscience 5:2203-2217, 1980.

Graybiel, A.M. and Berson, D.M. Autoradiographic evidence for a projection from the pretectal nucleus of the optic tract to the dorsal lateral geniculate complex in the cat. Brain Res. 195:1-12, 1980.

Graybiel, A.M. and Berson, D.M. Histochemical identification and afferent connections of subdivisions in the lateralis posterior-pulvinar complex and related thalamic nuclei in the cat. Neuroscience 5:1175-1238, 1980.

Berson, D.M. and McIlwain, J.T. Retinal Y-cell activation of deep-layer cells in superior colliculus of the cat. J. Neurophysiol. 47:700-714, 1982.

Berson, D.M. and Graybiel, A.M. Organization of the striate-recipient zone of the cat's lateralis posterior-pulvinar complex and its relations with the geniculostriate system. Neuroscience 9:337-372, 1983.

Berson, D.M. and McIlwain, J.T. Visual cortical inputs to the deep layers of the cat's superior colliculus. J. Neurophysiol. 50:1143-1155, 1983.

Berson, D.M. Cat lateral suprasylvian cortex: Y-cell inputs and corticotectal projection. J. Neurophysiol. 53:544-556, 1985.

Berson, D.M. Retinal W-cell input to the upper superficial gray layer of the cat's superior colliculus: a conduction-velocity analysis. J. Neurophysiol. 58:1035-1051, 1987.

Berson, D.M. and Hartline, P.H. A tecto-rotundo-telencephalic pathway in the rattlesnake: evidence for a forebrain representation of the infrared sense. J. Neurosci. 8:1074-1088, 1988.

Berson, D.M. Convergence of retinal W-cell and corticotectal input to cells of the cat superior colliculus. J. Neurophysiol. 60:1861-1873, 1988.

Berson, D.M., Lu, J. and Stein, J.J. Topographic variations in W-cell input to cat superior colliculus. Exp. Brain Res. 79:459-466, 1990.

Berson, D.M. and Graybiel, A.M. Tectorecipient zone of cat lateral posterior nucleus: evidence that collicular afferents contain acetylcholinesterase. Exp. Brain Res. 84: 478-486, 1991.

Berson, D.M., Graybiel, A.M., Bowen, W.D. and Thompson, L.A. Evidence for intrinsic expression of enkephalin-like immunoreactivity and opioid binding sites in cat superior colliculus. Neuroscience 43: 513-530, 1991.

Pu, M. and Berson, D.M. A method for reliable and permanent intracellular staining of retinal ganglion cells. J. Neurosci. Methods 41: 45-51, 1992.

Pu, M., Berson, D.M. and Pan, T. Structure and function of retinal ganglion cells innervating the cat's geniculate wing: an *in vitro* study. J. Neurosci. 14: 4338-4358, 1994.

Berson, D.M. and Stein, J.J. Retinotopic organization of the superior colliculus in relation to the retinal distribution of afferent ganglion cells. Visual Neurosci. 12: 671-686, 1995.

Stein, J.J. and Berson, D.M. On the distribution of gamma cells in the cat retina. Visual Neurosci. 12: 687-700, 1995.

Stein, J.J., Johnson, S.A. and Berson, D.M. Distribution and coverage of beta cells in the cat retina. J. Comp. Neurol. 374: 597-617, 1996.

Berson, D.M., Pu, M., and Famiglietti, E.V. The zeta cell: a new ganglion cell type in cat retina. J. Comp. Neurol. 399: 269-288, 1998.

Berson, D.M., Isayama, T. and Pu, M. The eta ganglion cell type of cat retina. J. Comp. Neurol. 408: 204-219, 1999.

Isayama, T., Berson, D.M. and Pu, M. The theta ganglion cell type of cat retina. J. Comp. Neurol. 417: 32-48, 2000.

O'Brien, B.J., Isayama, T., Richardson, R., and Berson, D.M. Intrinsic physiological properties of cat retinal ganglion cells. J. Physiol. [London] 538.3: 787-802, 2002.

Berson, D.M., Dunn, F., and Takao, M. Phototransduction by retinal ganglion cells that set the circadian clock. Science, 295:1070-1073, 2002.

Hattar, S., Liao, H.-W., Takao, M., Berson, D.M. and K.-W. Yau Melanopsin-containing retinal ganglion cells: architecture, projections and intrinsic photosensitivity. Science, 295:1065-1070, 2002.

Lucas, R.J., Hattar, S., Takao, M., Berson, D.M., Foster, R.G. and Yau, K.-W. Diminished pupillary light reflex at high irradiances in melanopsin-knockout mice. Science, 299: 245-247, 2003.

Rollag, M.D., Berson, D.M., Provencio, I. Melanopsin, ganglion cell photoreceptors, and mammalian photoentrainment. J. Biol. Rhythms 18(3): 227-234, 2003.

Berson, D.M. Strange vision: ganglion cells as circadian photoreceptors. Trends in Neurosci. 26: 314-320, 2003

O'Brien, B.J., Richardson, R., and Berson, D.M. Inhibitory network properties shaping the light evoked responses of cat alpha retinal ganglion cells. Visual Neurosci. 20, 351-361, 2003.

Qiu, X., Kumbalasiri, T., Carlson, S.M., Wong, K.Y., Krishna, V., Provencio, I., and Berson, D.M. Induction of photosensitivity by heterologous expression of melanopsin. Nature 433(7027):745-9, 2005

Wong, K.-Y., Dunn, F.A. and Berson, D.M. Photoreceptor adaptation in intrinsically photosensitive retinal ganglion cells. Neuron 48(6), 873-1068, 2005.

Hattar, S., Kumar, M., Park, A., Tong, P., Tung, J., Yau, K.-W. and Berson, D. M.. Central projections of melanopsin-expressing retinal ganglion cells in the mouse. J. Comp. Neurol. 497:326-349, 2006.

Berson, D.M. Phototransduction in ganglion-cell photoreceptors. Pflugers Arch. 454(5):849-55, 2007. Epub 2007 Mar 10

Wong, K.Y., Graham, D.M. and Berson, D.M. The retina-attached SCN slice preparation: An in vitro mammalian circadian visual system. J. Biol. Rhythms 22(5):400-410, 2007.

Wong, K.Y. Dunn, F.A., Graham, D.M. and Berson, D.M. Synaptic influences on rat ganglion-cell photoreceptors. J. Physiol. (London) 582:279-296, 2007. Epub 2007 May 17.

Graham, D.M., Wong K.Y., Shapiro, P., Frederick, C., Pattabiraman, K., and Berson, D.M. Melanopsin ganglion cells use a membrane-associated rhabdomeric phototransduction cascade J. Neurophysiol. 99, 2522-2532, 2008.

Güler, A.D., Ecker, J.L., Lall, G.S., Haq, S., Altimus, C.M., Liao, H.-W., Barnard, A.R., Cahill, H., Badea, T.C., Hankins, M.W., Berson, D.M., Lucas, R.J., Yau, K.-W., and Hattar, S. Melanopsin ganglion cells are the principal conduits for rod/cone non-image forming vision. Nature 453, 102-105, 2008.

Zhang, D-Q., Wong, K., Sollars, P., Berson, D., Pickard, G. and McMahon, D. Intra-retinal signaling by ganglion cell photoreceptors to dopaminergic amacrine neurons. Proc. Natl. Acad. Sci. USA 105(37), 14181-14186, 2008.

Dumitrescu, O.N., Pucci, F.G., Wong, K.Y. and Berson, D.M. Ectopic ON bipolar cell synapses in the OFF sublamina of the inner plexiform layer: contacts with dopaminergic amacrine cells and melanopsin ganglion cells. J. Comp. Neurol. 517(2), 226-244, 2009.

Weng, S., Wong, K.Y. and Berson, D.M. Circadian modulation of melanopsin-driven light response in rat ganglion-cell photoreceptors. J. Biol. Rhythms. 24: 391-402, 2009.

Isayama, T., O'Brien, B.J., Ugalde, I., Muller, J.F., Frenz, A., Aurora, V., Tsiaras, W. and Berson, D.M. Morphology of retinal ganglion cells in the ferret (*Mustela putorius furo*). J. Comp. Neurol. 517(4), 459-480, 2009.

Berson, D.M., Castrucci, A.M. and Provencio, I. Morphology and mosaics of melanopsin-expressing retinal ganglion cell types in mice. J. Comp. Neurol. 518(13): 2405-2422, 2010.

Ecker, J.L., Dumitrescu, O.N., Wong, K.Y., Alam, N., Chen, S-K, LeGates, T., Renna, J.M., Prusky, G., Berson, D.M. and Hattar, S. Melanopsin-expressing retinal ganglion-cell photoreceptors: cellular diversity and role in pattern vision. Neuron 67(1):49-60, 2010.

Van Hook, M.J. and Berson, D.M. Hyperpolarization- activated current (I_h) in ganglion-cell photoreceptors. PLoS One Dec 20;5(12):e15344, 2010.

Renna, J.M., Weng, S., and Berson, D.M. Light acts through melanopsin to alter retinal waves and segregation of retinogeniculate afferents. Nature Neuroscience. 14(7):827-829, 2011

Osterhout, J., Josten, N, Pan, F., Yamada, J., Wu, C., Nguyen, P., Panagiotakos, G., Inoue, T., Volgyi, B., Bloomfield, S., Barres, B.A., Berson, D.M., Feldheim, D.A., and Huberman, A.D. Cadherin-6 promotes axon-target matching in a non-image-forming visual circuit. Neuron 71(4):632-639, 2011.

Van Hook, M.J., Wong, K.Y. and Berson, D.M. Dopaminergic modulation of ganglion-cell photoreceptors in rat. Eur. J. Neurosci. 35(3-4): 507-518, 2012.

Estevez, M.E., Fogerson, P.M., Ilardi, M.C., Borghuis, B.G., Chan, E., Weng, S., Auferkorte,O.N., Demb, J.B., and Berson, D.M. Form and function of the M4 cell, an intrinsically photosensitive retinal ganglion cell type contributing to geniculocortical vision. J. Neurosci. 32(39):13608-13620, 2012 .

Weng, S., Estevez, M.E. and Berson, D.M. Mouse ganglion-cell photoreceptors are driven by the most sensitive rod pathway and by both types of cones. PLoS One 8(6): e66480, 2013.

Dhande, O. S, . Estevez, M.E., Quattrochi, L.E., El-Danaf, R.N., Nguyen, P.L., Berson, D.M., and Huberman, A.D. Genetic dissection of retinal inputs to brainstem nuclei controlling image stabilization. J. Neurosci. 33(45):17797-813, 2013

Lucas, R.J., Peirson, S.N., Berson, D.M., Brown, T.M., Cooper, H.M., Czeisler, C.A., Figueiro, M.G., Gamlin, P.D., Lockley, S.W., O'Hagan, J.B., Price, L.L., Provencio, I., Skene, D.J., and Brainard,G.C.. Measuring and using light in the melanopsin age. Trends in Neurosciences 37(1):1-9, 2014.

Renna, J.M., Chellappa, D.K., Ross, C.L., Stabio, M.E., and Berson DM. Melanopsin ganglion cells extend dendrites into the outer retina during early postnatal development. (in press) Dev Neurobiol. Sep;75(9):935-46, 2015.

Walker, MT, Rupp, A., Elsaesser, R., Güler, A.D., Sheng, W., Weng, S, Berson, D.M., Hattar, S. and Montell, C. RdgB2 required for dim light input into intrinsically photosensitive retinal ganglion cells. Molec. Biol. of the Cell Oct 15;26(20):3671-8, 2015.

d. Non-refereed journal articles:

Berson, D.M. and Graybiel, A.M. Subsystems within the visual association cortex as revealed by their thalamic and transcortical affiliations. In: Molecular and Cellular Interactions Underlying Higher Brain Functions. Prog. Brain Res. 58:229-238, 1983.

Berson, D.M. Retinal and cortical inputs to cat superior colliculus: composition, convergence and laminar specificity. Prog. Brain Res. 75:17-26, 1988.

f. Abstracts:

1978: Berson, D.M. and Graybiel, A.M. Thalamo-cortical projections and histochemical identification of subdivisions of the LP-pulvinar complex in the cat. Society for Neuroscience

1979: Graybiel, A.M., Berson, D.M., Langer, T.P. and Colby, C.L. A pretectal projection to the dorsal lateral geniculate complex in the cat. Society for Neuroscience

1981: Berson, D.M. and McIlwain, J.T. Retinal Y-cell inputs to the deep layers of the cat's superior colliculus. Society for Neuroscience.

1982: Berson, D.M. Inputs from visual cortex to deep layers of the cat's superior colliculus: the Y-indirect pathway. Society for Neuroscience.

1983: Berson, D.M. Y-cell inputs to the lateral suprasylvian area: a substrate for Y-indirect influence on the deep superior colliculus. Society for Neuroscience.

1984: Berson, D.M., Newman, E.A., Gruberg, E.R. and Hartline, P.H. A tecto-thalamo-telencephalic pathway in the rattlesnake: evidence for transmission of infrared and visual signals to the forebrain. Society for Neuroscience.

1986: Berson, D.M. A slowly conducting subclass of W-cells innervates the upper superficial gray of cat superior colliculus. Society for Neuroscience.

1987: Berson, D.M. Convergence of cortical and retinal W-cell input to cells of cat superior colliculus. Society for Neuroscience.

1988: Hartline, P.H., Stirling, R.V. and Berson, D. Intracellular HRP study of visual and infrared terminal and postsynaptic cells in the optic tectum of the rattlesnake Crotalus viridis. Society for Neuroscience.

1989: Berson, D.M., Lu, J. and Stein, J.J. The retinotectal W-cell projection in the cat: evidence for topographic variations in density. Society for Neuroscience.

1990: Berson, D.M. and Stein, J.J. Collicular magnification is not scaled to the intraretinal density of afferent ganglion cells. Society for Neuroscience.

1991: Pu, M. and Berson, D.M. Morphology of retinal W-cells innervating the cat's superior colliculus. Association for Research in Vision and Ophthalmology.

1991: Pu, M. and Berson, D.M. Morphology of ganglion cells innervating the medial interlaminar nucleus of the lateral geniculate body. Society for Neuroscience.

1992: Pu, M, Pan, T. and Berson, D.M. Structure and function of ganglion cells projecting to the cat's geniculate wing: an in vitro study. Society for Neuroscience.

1993: Stein, J.J. and Berson, D.M. Is geniculate magnification scaled to ganglion-cell density in the cat? Society for Neuroscience.

1994: Stein, J.J., Johnson, S.A. and Berson, D.M. Distribution and coverage of beta cells in the cat retina. Society for Neuroscience.

1996: Berson, D.M., Pu, M. and Famiglietti, E.V. The zeta cell: A new ganglion cell type in cat retina. Association for Research in Vision and Ophthalmology.

1997: Berson, D.M., Pu, M. and Isayama, T. The eta cell: a new ganglion cell type in cat retina. Association for Research in Vision and Ophthalmology.

1997: Isayama, T., Berson, D.M., and Pu, M. The theta cell: a bistratified ganglion cell type in cat retina. Association for Research in Vision and Ophthalmology.

1997: Berson, D.M., Isayama, T., and Pu, M. Morphology of presumed ON-OFF direction selective ganglion cell of cat retina. Society for Neuroscience.

1998: Isayama, T., O'Brien, B., Ugalde, I., Frenz, A., Aurora, V., Tsiaras, W., Muller, J. and Berson, D. Morphology of ferret retinal ganglion cells. Association for Research in Vision and Ophthalmology.

1998: O'Brien, B.J., Isayama, T. and Berson, D.M. Intrinsic membrane characteristics of morphologically identified cat retinal ganglion cells. Society for Neuroscience.

1999: O'Brien, B.J., Isayama, T. and Berson, D.M. Light responses of morphologically identified cat ganglion cells. Association for Research in Vision and Ophthalmology.

1999: Berson, D.M., Isayama, T., O'Brien, B.J., and Pu, M. The kappa ganglion cell type of cat and ferret retina. Association for Research in Vision and Ophthalmology.

1999: Isayama, T., Berson, D.M., O'Brien, B.J., and Pu, M. The lambda ganglion cell type of cat and ferret retina. Association for Research in Vision and Ophthalmology.

2000: O'Brien, B., Richardson, R. and Berson, D. Cat retinal alpha cell responses to non-preferred luminance steps. Society for Neuroscience .

2001: Berson, D.M., Dunn, F.A. and Takao, M. Phototransduction by ganglion cells innervating the circadian pacemaker. Association for Research in Vision and Ophthalmology.

2002: Dunn, F.A. and Berson, D.M. Are intrinsically photosensitive retinal ganglion cells influenced by rods or cones? Association for Research in Vision and Ophthalmology.

2002: Provencio, I., Berson, D., Rollag, M., Castrucci, A. and Richardson, R. Melanopsin immunoreactivity in retinal ganglion cells. Association for Research in Vision and Ophthalmology.

2002: Hattar, S., Liao, H., Takao,M, Carlson, S., Richardson, R., Berson, D. and Yau, K.-W. Possible role for melanopsin in photoentrainment of the circadian clock in rodents. Association for Research in Vision and Ophthalmology.

2002: Dunn, F.A. and Berson, D.M. Influences of rods and cones on intrinsically photosensitive retinal ganglion cells. Retinal Neurobiology and Visual Processing, FASEB Summer Research Conference.

2003: Carlson, S., Takao, M., Sherer, I., Dunn, F., and Berson, D., Phototransduction cascade in intrinsically photosensitive ganglion cells. Association for Research in Vision and Ophthalmology.

2003: Hattar, S., Lucas, R.J., Takao, M., Berson, D.M., Foster, R.G. and Yau, K.-W., Diminished pupillary light reflex at high irradiances in melanopsin-knockout mice. Association for Research in Vision and Ophthalmology.

2003: Carlson, S., Takao, M., Sherer, I.,, Dunn, F. and Berson, D. Phototransduction cascade in intrinsically photosensitive ganglion cells. Soc.for Neuroscience

2004: Hattar, S. Kumar, M., Tung, J., Park, A., Tong, P., Berson, D.M., and Yau, K.-W. Diverse brain targets of melanopsin-expressing retinal ganglion cells. Association for Research in Vision and Ophthalmology.

2004: Berson, D., Dunn, F., Carlson, S. , Wong, K. , Kumar, M., Yau, K.-W. and Hattar, S. Ganglion cell photoreceptors: Phototransduction, adaptation, synaptic modulation and outputs. American Society of Photobiology, Seattle, WA.

2004: Wong, K.Y. , Dunn, F.A., and Berson, D.M. Adaptation in ganglion-cell photoreceptors: Soc.for Neuroscience.

2005: Kumbalasiri, T., Carlson, S.M., Qiu, X., Krishna, V., Wong, K.Y., Provencio, I. and Berson, D. Heterologous expression of melanopsin. I. Induced photosensitivity. Association for Research in Vision and Ophthalmology

2005: Qiu, X., Carlson, S.M., Wong, K.Y., Kumbalasiri, T., Provencio, I. and Berson, D. Heterologous expression of melanopsin. II. Spectral sensitivity and phototransduction cascade. Association for Research in Vision and Ophthalmology

2005: Wong, K.Y. and Berson, D.M. Bipolar and amacrine inputs modulating ganglion-cell photoreceptors. Association for Research in Vision and Ophthalmology

2005: Qiu, X. and Berson, D.M. Melanopsin's chromophore: Spectral consequences of reconstitution with various retinaldehyde isomers. Soc. for Neuroscience

2005: Carlson, S. and Berson, D.M. TRPC channels may carry the light-evoked current in the intrinsically photosensitive retinal ganglion cells. Soc. for Neuroscience

2006: Wong, K.Y., Graham, D. and Berson, D.M. The eye-attached SCN slice preparation: An in vitro mammalian circadian visual system Soc. Res. Biol. Rhythms.

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2007: Graham, D., Wong, K.Y., Pattabiraman, K. and Berson, D.M. A bit of fly in the mammalian eye. Association for Research in Vision and Ophthalmology

2007: Qiu, X. and Berson, D.M. Melanopsin bistability in ganglion-cell photoreceptors. Association for Research in Vision and Ophthalmology

2007: Wong, K.Y., Graham, D.M., Pattabiraman, K. and Berson, D.M. A bit of fly in the mammalian eye. Gordon Conference on Chronobiology.

2008: Dumitrescu, O.N. and Berson D.M. A new ganglion-cell photoreceptor in the rodent retina. Association for Research in Vision and Ophthalmology.

2008: Zhang, D.-Q., Wong, K.Y., Berson, D.M., Sollars, P.J., McMahon, D.G. Pickard, G.E. Sustained dopaminergic amacrine cells: Evidence for inputs from melanopsin ganglion-cell photoreceptors. Association for Research in Vision and Ophthalmology

2008: Wong, K.Y., Ecker, J.L., Dumitrescu, O.N., Berson, D.M., Hattar, S.. Multiple morphological types of melanopsin ganglion cells with distinct light responses and axonal targets. Association for Research in Vision and Ophthalmology.

2008: S. Weng, K.Y. Wong, D.M. Berson. Circadian modulation of ganglion-cell phototransduction. Association for Research in Vision and Ophthalmology

2008: Dumitrescu, O. and Berson, D. M. Intrinsically photosensitive retinal ganglion cells receive ON bipolar cell input in the OFF sublamina of the inner plexiform layer. FASEB Summer Research Conference.

2008: Hattar, S., Ecker, J., Dumitrescu, O.N., Wong, K.Y. and Berson, D.M. Melanopsin cells comprise an anatomically and functionally diverse population of retinal ganglion cells in the mouse. Soc. for Neuroscience.

2008: Wong, K.Y. Dumitrescu, O.N. Pucci, F.G. and Berson, D.M.. Paradoxical ON bipolar cell input to the OFF sublamina of the inner plexiform layer provides a substrate for ON channel input to ganglion-cell photoreceptors. Soc. for Neuroscience.

2009: Hattar, S., Ecker, J.L., Dumitrescu, O.N., Chen, S.-K., Wong, K.Y., Alam, N.M., Prusky, G.T. and Berson, D.M. Functions and target innervations of distinct subtypes of melanopsin cells. Association for Research in Vision and Ophthalmology

2009: Van Hook, M.J. and Berson, D.M.. Dopaminergic modulation of ipRGC photoreception. Association for Research in Vision and Ophthalmology

2009: Weng, S. and Berson, D. Ganglion-cell photoreceptors are driven by the most sensitive rod pathway and by cones. Association for Research in Vision and Ophthalmology

2009: Dumitrescu, O.N., Pucci, F.G., Wong, K.Y. and Berson, D.M. ON bipolar cell output to the OFF sublamina of the inner plexiform layer: contacts with melanopsin ganglion cells and dopaminergic amacrine cells. Association for Research in Vision and Ophthalmology

2009: Frederick, C.E., Weng, S. and Berson, D.M. Arrestin and response termination in ganglion-cell photoreceptors. Association for Research in Vision and Ophthalmology

2009: Wong, K.Y., Garcia-Jimenez, M., Berson, D.M., and Zimmerman, A.L. With a little help from their friends: rods show partial recovery from a full bleach without pigment epithelium. FASEB Summer Research Conference on Biology and Chemistry of Vision.

2009: Wong, K.Y., Garcia-Jimenez, M., Berson, D.M., and Zimmerman, A.L. With a little help from their friends: rods show partial recovery from a full bleach without pigment epithelium. Soc. for Neurosci.

2010: Van Hook, M.J. and Berson, D.M. Hyperpolarization-activated cation current *(I_h)* in ipRGCs. Association for Research in Vision and Ophthalmology

2010: Renna, J.M., Weng, S. and Berson, D.M. Bidirectional interactions between ganglion-cell photoreceptors and retinal waves. Association for Research in Vision and Ophthalmology

2010: Van Hook, M. and Berson, D. Bidirectional interactions of ganglion-cell photoreceptors and dopamine cells in the mammalian retina. 35th meeting of American Society for Photobiology.

2010: Berson, D. Ganglion-cell photoreceptors: What are they good for? 35th meeting of American Society for Photobiology.

2010: Renna, J.M., Weng, S. and Berson, D.M. Bidirectional interactions between ganglion-cell photoreceptors and retinal waves. FASEB Summer Research Conference.

2011: Van Hook, M. and Berson, D. Paired recordings of dopaminergic amacrines and ipRGCs. Association for Research in Vision and Ophthalmology

2011: Renna, J.M and Berson, D.M. Exposure to light alters the segregation of retinogeniculate projections to the dLGN. Association for Research in Vision and Ophthalmology

2011: Estevez, M.E., Weng, S., Chang, E.C., and Berson, D.M. Form and function of M4 and M5 intrinsically photosensitive retinal ganglion cells. Association for Research in Vision and Ophthalmology

2011: Renna, J. and Berson, D.M. Light acts through melanopsin to alter retinal waves and segregation of retinogeniculate afferents. Soc. for Neuroscience.

2012: Estevez, M.E., Fogerson, P.M., Ilardi, M.C. and Berson, D.M. Identity and receptive field properties of melanopsin ganglion cells innervating the mouse dLGN. Association for Research in Vision and Ophthalmology

2012: Quattrochi, L.E., Estevez, M.E. and Berson, D.M. Assessment of two cre-lox reporters of melanopsin expression. Association for Research in Vision and Ophthalmology

2012: Fogerson, P.M. and Berson, D.M. Outputs of the olivary pretectal nucleus in relation to photic blink, pain and tears. Association for Research in Vision and Ophthalmology

2012: Renna, J.M., Chew, K., Loevinsohn, G., Weng, S., Hattar, S. and Berson, D.M. Melanopsin ganglion cells are critical for the proper development of the visual system. FASEB Summer Research Conference, Steamboat Springs, CO.

2012: Renna, J.M., Chew, K., Loevinsohn, G., Weng, S., Hattar, S. and Berson, D.M. Melanopsin ganglion cells are critical for the proper development of the visual system. Soc. for Neuroscience.

2013: Renna, J.; Chellappa, D.; Estevez, M; Berson, D Dendrites of melanopsin ganglion cells transiently extend into the outer retina in early postnatal development. Association for Research in Vision and Ophthalmology

2013: Estevez, M; Quattrochi, L, Dhande, O, Kim, I, Firman, T, Eldanaf, R, Huberman, A, and Berson, D Form and function of the three ON-type direction-selective retinal ganglion cells in the Hoxd10 mouse Association for Research in Vision and Ophthalmology

2013: Chew, K, Renna, J, McNeill, D, Chen, S-K, Zhao, H, Berson, D, and Hattar, S. ipRGCs regulate the development of the circadian pacemaker and vision Association for Research in Vision and Ophthalmology

2013: Quattrochi, L.E., Estevez, M., Kim, I., and Berson, D.M. Structure, function and outputs of a novel type of ganglion-cell photoreceptor Soc. for Neuroscience.

2013: . Fogerson, P.M. and Berson, D.M. Two genetically defined luminance pathways linking pretectum to visual thalamus in the mouse. Soc. for Neuroscience.

2013: Berg. D.J and Berson, D.M. RNA-seq sheds light on molecular diversity in intrinsically photosensitive retinal ganglion cells (ipRGCs) Soc. for Neuroscience.

2014: Quattrochi, L.E., Kim, I., Estevez, M., and Berson, D.M. The M6 cell: a novel bistratified ganglion-cell photoreceptor in the mouse. FASEB Scientific Research Conference

2014: Berg, D. and Berson, D. Molecular diversity of ipRGCs: Implications for specialized Ras signaling. FASEB Scientific Research Conference

2014: Sabbah, S., Gemmer, J.A., Siegel, J.K., Castro, G., and Berson, D.M. Topographic variation in directional tuning of ON-DS retinal ganglion cells: implications for image stabilization. FASEB Scientific Research Conference

2014: Fogerson, P.M and Berson, D.M. Untangling visual circuits in the olivary pretectal nucleus. Janelia Conference: Signal Transforms in the Early Visual System

2014: Maloney, R and Berson, D.M. A Viral Method for Optogenetic Control of Intrinsically Photosensitive Retinal Ganglion Cells. ARVO Annual Meeting (submitted)

2014: Sabbah, S., Gemmer, J.A., Castro, G., Siegel, J., Jeffery, N. and Berson, D.M. ON-DS retinal ganglion cells encode global motion in vestibular coordinates ARVO Annual Meeting (submitted)

2015: European Retina Meeting

g. <u>Invited lectures</u>:

1981: "Subsystems within the visual association cortex as delineated by their thalamic and transcortical affiliations"
Ninth Meeting, International Neurobiology Society
Abbaye Royale de Fontevraud, France

"Anatomical organization of the extrageniculate visual thalamus in the cat"
Section of Neurobiology
Brown University

1982: "Visual inputs to the deep layers of the cat's superior colliculus"
Department of Psychology
University of Connecticut
Storrs, Connecticut

1983: "Subsystems within the visual association cortex as delineated by their thalamic and transcortical affiliations"
Symposium on Vision, Brain, and Cooperative Computation
University of Massachusetts, Amherst, Massachusetts

"Visual inputs to the deep layers of the cat's superior colliculus"
Department of Neurobiology
Harvard University School of Medicine
Boston, Massachusetts

"Retinal and non-retinal visual input to the deep layers of the superior colliculus"
Biological Laboratories
Harvard University
Cambridge, Massachusetts

1984: "Retinal and cortical influences on deep tectal neurons in the cat"
NATO Workshop: Functional Mechanisms of the Optic Tectum
University of St. Andrews
St. Andrews, Scotland

1985: "Infrared vision in the rattlesnake"
Department of Psychology and Section of Neurobiology
Brown University

1986: "Visual inputs to an oculomotor center of the midbrain"
Section of Physiology and Biophysics
Brown University

1987: "W-cell input to the cat superior colliculus"
Section of Neurobiology
Brown University

"W-cell input to the cat's superior colliculus: functional specificity and corticotectal convergence"
Symposium on Extrageniculo-striate Visual Mechanisms
Szeged, Hungary

1989: "Physiology of the visual cortex"
Department of Clinical Neurosciences
Brown University

1990: "Sensorimotor transformations in the superior colliculus: maps, magnification, and movement"
Department of Cognitive and Linguistic Sciences
Brown University

1993: "The W-cell conundrum: clues from the retinocollicular pathway"
Department of Anatomy and Neurobiology
Boston University

1998: “What to expect from a graduate program in neuroscience”,
69th Annual Meeting of the Eastern Psychological Association, Boston, MA.

2000: "Progress toward a comprehensive taxonomy of mammalian ganglion cells"
FASEB Summer Research Conference " Retinal Neurobiology and Visual Processing", Copper Mountain, CO.

2000: "What the mammalian retina tells the brain: ganglion cell diversity and parallel visual processing"
University of Texas, Houston, Department of Neurobiology and Anatomy.

2001: "Retinal output channels: a new look at ganglion cell diversity" Brown University, Department of Neuroscience

"Intrinsic photosensitivity of retinal ganglion cells setting the circadian clock"
Department of Neurology, Thomas Jefferson University

"What the eye tells the brain: specializations of retinal output signals"
Department of Biology, Boston University

2002: "Strange vision: how the retina sets the circadian clock"
Boston University, Department of Anatomy and Neurobiology, Boston University

"Phototransduction by ganglion cells of the retinohypothalamic tract,"
Gordon Research Conference, Pineal Cell Biology, Ventura, CA.

"Strange vision: how the retina sets the circadian clock""
Department of Neurobiology and Behavior, SUNY Stony Brook

"Phototransduction by retinal ganglion cells innervating the circadian clock."
Sleep Grand Rounds, Brigham and Women's Hospital, Harvard Medical School

"Strange vision: How the retina sets the circadian clock"
Society for Research in Biological Rhythms, Amelia Island, FL

"Strange vision: phototransduction by ganglion cells that set the circadian clock"
FASEB Summer Research Conference "Retinal Neurobiology and Visual Processing", Saxton's River, VT

" Retinal ganglion cells as circadian photoreceptors "
International Congress of Eye Research (ICER), Geneva, Switzerland

" Melanopsin and phototransduction by retinal ganglion cells. "
5th International Symposium of the Lighting Research Organization, "Light and Human Health", Orlando, FL

"What the eye tells the brain's clock"
Special Lecture, Society for Neuroscience annual meeting, Orlando, FL

"Strange vision: ganglion cells as circadian photoreceptors"
Departments of Ophthalmology & Visual Sciences and of Anatomy & Neurobiology, Washington University, St. Louis, MO

2003: "Strange vision: ganglion cells as circadian photoreceptors"
Department of Biology, Northeastern University (Feb., 2003)

" Ganglion cells as photoreceptors for circadian entrainment,"
Department of Physiology, University of Minnesota (April, 2003)

" Ganglion cells as photoreceptors for circadian entrainment,"
Gordon Research Conference, Chronobiology, Il Ciocco, Barga, Italy (May 2003).

"Retinal ganglion cells as circadian photoreceptors"
Program in Neuroscience, University of Massachusetts Medical Center, Worcester, MA (May, 2003).

"Ganglion cells as circadian photoreceptors"
World Congress of Chronobiology, Sapporo, Japan (Sept., 2003).

"Strange vision: what the eye tells the brain's clock"
Neuroscience Program, University of California, San Francisco, CA (October, 2003).

" Ganglion cell photoreceptors: you can set your clock by them "
Biological Laboratories, Harvard University (October, 2003).

" Ganglion cells as circadian photoreceptors "
Guest lecture in course “Circadian Biology: From Cellular Oscillators to Sleep Regulation”, Department of Biology, Harvard University (October, 2003).

“Ganglion cells as circadian photoreceptors "
Massachusetts Eye and Ear Infirmary (Dec., 2003).

2004: "Strange vision: What the eye tells the brain's clock"
Neuroscience Program, University of Chicago, Chicago, IL (Feb., 2004).

"Strange vision: What the eye tells the brain's clock"
Program in Neurobiology and Behavior, University of Washington, Seattle, WA (March, 2004).

"Strange vision: What the eye tells the brain's clock"
Vision Lecture Series, Tufts University School of Medicine, Boston, MA (March, 2004).

"Strange vision: What the eye tells the brain's clock"
Neuroscience Program, University of Massachusetts, Amherst, MA (April, 2004).

"Ganglion-cell photoreceptors: Phototransduction, adaptation, synaptic modulation and outputs"
Annual meeting, American Society of Photobiology, Seattle, WA (July, 2004).

"Strange vision: What the eye tells the brain's clock"
Keynote Address, Summer Research Symposium, Sciences, Social Sciences, and Humanities, Division of Biology and Medicine and Howard Hughes Medical Institute, Brown University (August, 2004).

2005: "Ganglion cell photoreceptors"
Winter Conference on Brain Research (Feb. 2, 2005).

"What the eye tells the brain's clock "
Neuroscience Seminar Series, University of California, San Diego (April 26, 2005).

"What the eye tells the brain's clock"
Center for Neuroscience, University of California, Davis (April 27, 2005).

"What the eye tells the brain's clock "
PSRIG Seminar Series, Bradley Hospital, Providence, RI (May 17, 2005).

"Intrinsic photosensitivity of retinal ganglion cells"
FASEB Summer Research Conference, Tucson, AZ (June 22, 2005).

2006: "Ganglion-cell photoreceptors: Modulating melanopsin's message"
Gordon Conference, Pineal Cell Biology, Santa Ynez, CA (Jan. 15, 2006).

"Strange vision: ganglion cell photoreceptors, melanopsin and the fly in your eye" Dept. of Molecular, Cellular and Developmental Biology, Univ. of Michigan (March 15, 2006).

"Strange vision: ganglion cell photoreceptors, melanopsin and the fly in your eye" Washington University, St. Louis. Neuroscience Institute Seminar Series (April 7, 2006).

"Strange vision: ganglion cell photoreceptors, melanopsin and the fly in your eye" Society for Research on Biological Rhythms, Sandestin, FL (May 25, 2006).

"Strange vision: ganglion cell photoreceptors, melanopsin and the fly in your eye" Society for Light Treatment and Biological Rhythms (SLTBR), Quebec, Canada (July 14, 2006).

"Ganglion cell photoreceptors" Workshop, National Institute of Environmental Health Sciences, Washington, DC (Sept. 14, 2006).

2007: "Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Univ. of Alabama, Birmingham, Dept. of Vision Sciences (Jan 12, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Harvard Univ. School of Medicine, Dept. of Neurobiology (March 6, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Univ. of Maryland, Baltimore County, Baltimore, MD, Dept. of Biology (March 15, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Boston University, Boston, MA, Program in Neuroscience (March 21, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Ohio State Univ. (April 24, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" University of Louisville (April 26, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" University of California, Los Angeles (May 29, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Northwestern University (June 6, 2007).

"Ganglion cell photoreceptors: a bit of fly in the mammalian eye" University of Pennsylvania (October, 2007)

2008: "Ganglion cell photoreceptors: a bit of fly in the mammalian eye" Case Western Reserve University (March 4, 2008).

"Strange vision: a new retinal photoreceptor and its functional roles" Neurology Grand Rounds, Rhode Island Hospital, Providence, RI (Sept. 24, 2008)

2009: "Ganglion-cell photoreceptors: new types, new circuits" FASEB Summer Research Conference: The Biology and Chemistry of Vision (June 17, 2009).

Structure, Function and Development of the Visual System Course, Cold Spring Harbor Laboratory (July 2, 2009).

"Electrophysiology of circadian photoreception" American Society for Photobiology, (July 10, 2009)

"Ganglion-cell photoreceptors: curiouser and curiouser" Fall Vision Meeting, Optical Society of America (OSA), Seattle WA. (Sept. 24-27, 2009)

SUNY Upstate Medical University, Syracuse, NY. (Nov. 2, 2009).

2010: “Strange vision: the peculiar biology of ganglion-cell photoreceptors” University of Manchester, UK. (March 10, 2010).

“Strange vision: the peculiar biology of ganglion-cell photoreceptors” Institute of Ophthalmology, University College London, UK. (March 12, 2010)

“TRP-channels in melanopsin ganglion cells” Invited talk for mini-symposium *TRP-channel function and their role in vision*, ARVO annual meeting, Ft. Lauderdale, FL. (May 5, 2010).

“Ganglion-cell photoreceptors: what are they good for?” American Society for Photobiology, (June 12, 2010)

2011: “What do ganglion-cell photoreceptors tell the clock?” UCSD Center for Chronobiology Symposium - “From Cells to the Clinic” Feb. 11, 2011

"Ganglion-cell photoreceptors: The architecture of a unique visual channel" Virginia Commonwealth University, “ October 7, 2011.

“Ganglion-cell photoreceptors: The architecture of a unique visual channel". Boston University Dept. of Physiology and Biophysics, November 8, 2011

“The peculiar biology of ganglion-cell photoreceptors” “VisioNYC” (Columbia-NYU-Cornell joint vision seminar series); December 12, 2011.

“The peculiar biology of ganglion-cell photoreceptors” Gordon Research Conference, Photosensory Receptors and Signal Transduction, Galveston TX, 1/22 – 1/27/2012

2012: “The peculiar biology of ganglion-cell photoreceptors” Dept. of Physiology, Yale University, May 31, 2012

“A vestibulocentric visual channel for image stabilization” FASEB Summer Research Conference, "Retinal Neurobiology and Visual Processing," Steamboat Springs, CO, July-Aug., 2012

George Washington University Institute for Neuroscience/Children's National Medical Center-Center for Neuroscience Research Seminar Series, Dec. 13, 2012

2013: International Workshop on Circadian and Neurophysiological Photometry, Manchester, UK., Jan. 10, 2013

“Ganglion-cell photoreceptors: New types, new functions” SUNY Stony Brook, Neuroscience Seminar Series, Dept. of Neurobiology and Behavior, Feb. 14, 2013

“Ganglion-cell photoreceptors: New types, new functions” Colorado State University, Molecular, Cellular and Integrative Neurosciences Seminar Series, Feb. 19, 2013

"*Sensory Signaling in Model Organisms*", HHMI/Janelia Farm Research Campus, April, 2013

Cold Spring Harbor Course: "Vision: a platform for linking, circuits, perception and behavior", June 13, 2013.

2014: 'Retinal output channels: distinct networks for synching the clock and stabilizing the visual world' Univ. of California, Berkeley, March 17, 2014

'Retinal output channels: distinct networks for synching the clock and stabilizing the visual world' Univ. of Southern California, March 19, 2014

'Diversity of ganglion cells: distinct networks for synching the clock and stabilizing the visual world' Johns Hopkins University, Department of Neuroscience, Oct. 2014

Presidential Faculty Award Lecture, Brown University, November 5, 2014

2015: Panelist, Day of Biology, Brown University 250th Anniversary event

Light InSight Lecture Series, New England College of Optometry, Boston, MA, April 7, 2015

'The Brain in Your Eye', 250th Anniversary Symposium, *The Next 250 Years,* Brown University, May 15, 2015.

"The architecture of visual reflex circuits" Kroon Lecture (keynote address), Dept. of Ophthalmology and Visual Sciences, University of Nebraska Medical Center, Omaha, NE. May 28, 2015

"Bipolar inputs to intrinsically photosensitive retinal ganglion cells: A serial electron-microscopice analysis". Invited platform talk, European Retina Meeting, Brighton, UK.

"Ultrastructural labeling of neuronal types defined by gene expression or axonal projection", Special Symposium "Advanced Microscopy Techniques in Biomedical Research", Brown Institute for Brain Science, Brown University, Sept. 14, 2015

"Ways of Seeing: The Eye's Diverse Output Channels" Keynote Address, Upstate Medical University Annual Research Day, SUNY Upstate, Syracuse, NY, Sept. 17, 2015

<u>Planned</u>:

Harvard University, Dept. of Molecular and Cellular Biology, Spring 2016

Distinguished Scientist lecture, Dept. of Ophthalmology, Medical College of Wisconsin; April 4, 2016

Neurobiology Seminar Series, University of Chicago, May 19, 2016

h. Papers read:

See abstracts

i. Work in review:

Chew, KS, Renna, JM, McNeill,DS, Van Dunk, C, Gray, P, Herzog, E, Zhao, H, Berson, DM, and Hattar, S. M1 ipRGCs regulate the development of the circadian pacemaker and vision. Submitted to Science

Walker, MT, Rupp, A., Elsaesser, R., Güler, A.D., Sheng, W., Weng, S, Berson, D.M., Hattar, S. and Montell, C. Rod-driven light input into retinal ganglion cells depends on a mouse homolog of *Drosophila* RDGB. Submitted to J. Neurosci.

Gallagher, S.K., Renna, J.M., Berg, D., Hartwick, A.T., Berson, D.M., and Vigh, J. μ-opioid receptors directly modulate intrinsically photosensitive retinal ganglion cells. Submitted to J. Physiol.

j. Work in progress:

My research concerns the structural and functional organization of retinal ganglion cells, the output cells of the retina whose axons make up the optic nerve. Ganglion cells exhibit great diversity both in their morphology and in their responses to light stimuli. On this basis, they are divisible into a large number of types (>20). Each ganglion-cell type appears to send its outputs to a specific set of central visual nuclei. This suggests that ganglion-cell heterogeneity has evolved to provide each visual center in the brain with pre-processed representations of the visual scene tailored to its specific functional requirements. Though the outline of this story has been appreciated for some time, it has received little systematic exploration. My laboratory is addressing three sets of related questions: 1) How many types of ganglion cells are there in a typical mammalian retina and what are their structural and functional characteristics? 2) What combination of synaptic networks and intrinsic membrane properties are responsible for the characteristic light responses of individual types? 3) What do the functional specializations of individual classes contribute to perceptual function or to visually mediated behavior? To pursue these questions, we use mouse genetics, viral methods, or axon-transport tracing to label specific populations of ganglion cells with fluorescent dyes or indicators for intracellular calcium or extracellular glutamate. Such cell-type-specific labeling allows us to trace the axonal projections specific ganglion-cell types to the brain. It lets us target these cells for high-resolution intracellular recording, for assessing the synaptic networks and cell types that affect them. Dye-filling during recording reveals cell morphology in great detail. Multiphoton imaging of the calcium or glutamate indicators provides an alternative window on how cell activity is affected by other cells or visual stimuli. We also isolate thousands of ganglion cells of a specific type from the rest of the retina by cell dispersion, then conduct

differential transcriptional profiling by high-throughput sequencing (RNAseq) to probe the molecular basis of ganglion-cell identity and function.

Just over a decade ago, we discovered a novel ganglion cell that is intrinsically photosensitive. These ganglion cells exhibit robust light responses even when all influences from classical photoreceptors (rods and cones) are eliminated. We now know that they use a novel photopigment called melanopsin to generate their intrinsic light responses and they are a universal feature of the vertebrate visual system. It is now clear that that they are essential for a variety of reflexive or homeostatic responses to environmental illumination, including photic synchronization of circadian rhythms, constriction of the pupil or modulation of hormones by light, photic pain, and modulation of sleep and mood. These findings help to explain why various physiological responses to light responses appear in young animals before rods and cones are functional and why they persist in mammals, including humans, with retinal blindness resulting from loss of rods and cones. We are pursuing many new lines of inquiry about these cells, including their unexpected diversity (there appear to be at least five types), their diverse functional roles in visually driven behavior, and their surprising ability to distribute their output signals within the retina itself. We are particularly interested in the capacity of such intraretinal feedback to affect retinal circadian rhythms and sensitivity. Such 'centrifugal' signals from these cells also appear to modulate spontaneous waves of activity that sweep across the developing retina and, through this, to help to establish normal connections in the developing visual regions of the brain.

7. Research Grants:

a: Current grants

NIH RO1 EY12793
National Eye Institute, National Institutes of Health
"Structure and function of mammalian ganglion cells"
02/07/2000 – 01/31/2019
Role: principal investigator
$1,500,000 total direct costs over 5 years

NIH 1 R01 EY017137
National Eye Institute, National Institutes of Health
"Biology of photosensitive ganglion cells"
9/1/2011-8/31/2015
Role: Principal investigator
$900,000 direct costs over 4 years

b: Completed grants

NSF BNS 841156
National Science Foundation
"Infrared vision in snakes"
1984-1985
$151,800
Role: co-principal investigator

PHS 1 S15 DK39381-01
National Institutes of Health
"Biomedical Research Support Grant"
1986
$4,222
Role: principal investigator

NIH RO1 EY06108
National Eye Institute, National Institutes of Health
"Visual circuitry of the superior colliculus"
1986-1990
$169,289
Role: principal investigator

NIH RO1 EY06108
National Eye Institute, National Institutes of Health
"Visual circuitry of the superior colliculus"
1990-1994
$253,453
Role: principal investigator

PHS 1 S15 CA53754-01 -
National Institutes of Health
" Biomedical Research Support Grant "
1990
$8,972
Role: principal investigator

NIH RO1 EY06108
National Eye Institute, National Institutes of Health
"Visual circuitry of the superior colliculus"
1995-1999
$540,682
Role: principal investigator

NIH RO1 EY12793
National Eye Institute, National Institutes of Health
"Structure and function of mammalian ganglion cells"
2/1/2000-1/31/2004
$791,922 (direct + indirect)
Role: principal investigator

c: Proposals submitted

7. Service:

i. To the University:

1986 Search Committee, Faculty Appointment, Section of Neurobiology

1987	Organizing Committee, Symposium on Neuroscience at Brown
1987-91 & '95-98	Training Committee, Graduate Program in Neural Science
1988	Interviewer for Premedical Advisory Committee
1988-93	Program Committee, Physiology and Neurobiology Graduate Progam
1988-92 & '94-5	Program Committee, Neural Science Graduate Program Seminar Series, Chair (1991-92)
1990-	Ad Hoc Proposal Reviewer, Institutional Animal Care and Use Committee
1992	Ad Hoc Member of Program in Biology Executive Committee, search for Dean of Medicine and Biological Sciences
1992-97	Space Committee, Department of Neuroscience.
1993 -	Coordinator, Instructional Computing, Department of Neuroscience
1994	Search Committee; Lab Preceptor position; Dept. of Neuroscience
1994-95	Chair, Comprehensive Examining Committee, Graduate Program in Neuroscience.
1995-8	Program Director, Graduate Program in Neuroscience
1995-6	Undergraduate Awards Committee; Division of Biology and Medicine
1997-8	Protocol reviewer, Institutional Animal Care and Use Committee
1998	Faculty Marshal, Graduate School Commencement Exercises
1998	Whalen Award Committee
1998-9	Institutional Animal Care and Use Committee (IACUC)
1999-2004	Chair, Institutional Animal Care and Use Committee (IACUC)
2000	Panelist, Management Development Program, Office of Training and Development
2000	Admissions Committee, MD/PhD program
2001	Neuroscience Department Prize Committee
2002	Organizer, Oral Presentation Workshop, Neuroscience Graduate Program
2002	Fox Postdoctoral Fellowship Committee
2002	Search Committee, Associate University Veterinarian

2003	Whalen Award Committee
2003-04	Chair, Neuroscience Undergraduate Curriculum Committee
2003-04	Chair, Search Committee, Assistant/Associate Professor of Neuroscience
2004-	Information Technology Advisory Committee, Div. of Biology and Medicine
2005-	Acting Director, Neuroscience Postdoctoral Training Grant
2005-6	Action Group/Search Committee, Associate Dean of Research, Div. of Biol. & Medicine
2006-7	Action Group; Policy on Faculty Reappointment and Tenure, Div. of Biol. & Medicine
2006-7	Chair, Search Committee, Senior Associate Dean for the Program in Biology, Div. of Biol. & Medicine
2007	Salomon Awards Review Committee
2008-09	Committee on Medical Faculty Affairs
2008	Admissions Committee, Neuroscience Graduate Program
2008	Ad hoc committee on evaluation of teaching mission, Dept. of Neuroscience
2008	Selections Committee, Undergraduate Teaching and Research Awards (UTRA)
2009-12	Academic Priorities Committee
2009-10	Chair, Search committee, faculty, Dept. of Neuroscience
2010	Admissions Committee, Neuroscience Graduate Program
2010	Internal review committee, departmental review, Dept. of Ecology and Evolutionary Biology
2011	Reviewer for internal (Brown Univ.) evaluation, IGERT proposals for NSF graduate training
2011-13	Salomon Awards Review Committee
2012	Strategic Planning Committee; Division of Biology and Medicine
2012	Admissions Committee, Neuroscience Graduate Program
2013	Ad hoc committee, Brown Institute for Brain Science, Multiphoton Microscopy for the Leduc Imaging Facility.
2014	Conflict of Interest Review Board, Office of the Vice President for Research

ii. To the Profession:

Field Referee:
- Nature
- Science
- Neuron
- Proceedings of the National Academy of Sciences (USA)
- PLoS Biology
- Journal of Neuroscience
- Science Translational Medicine
- Journal of Comparative Neurology
- Journal of Neurophysiology
- Visual Neuroscience
- Vision Research
- Synapse
- Journal of Biological Rhythms
- Experimental Brain Research
- Neuroscience
- NeuroReport
- American Journal of Anatomy
- Experimental Neurology
- Journal of Experimental Zoology
- Journal of Neuroscience Methods
- Journal of Chemical Neuroanatomy
- Journal of Clinical Endocrinology and Metabolism
- Brain Research

Ad Hoc grant proposal referee (since 1982)
- National Science Foundation (U.S.A.)
- National Sciences and Engineering Research Council (Canada)
- Biotechnology and Biological Sciences Research Council (UK)
- Wellcome Trust (UK)
- Israel Science Foundation
- Aard- en Levenswetenschappen (Netherlands)
- March of Dimes

External referee, faculty promotions
- Yale University
- Harvard University
- Stanford University
- Johns Hopkins University
- Washington University
- The Salk Institute
- Northwestern University
- University of California, Los Angeles
- University of California, Santa Cruz
- Oregon Health and Sciences University
- Friedrich Miescher Institute for Biomedical Research, Basel, Switzerland
- Weitzmann Institute
- Technion
- Ben Gurion University
- University of Utah

- University of Virginia
- University of Maryland
- UT Houston
- University of Southern California
- York University, Ontario, Canada
- Louisiana State University Medical Center
- Boston University
- Rensselaer Polytechnic Institute
- Center of Advanced European Studies and Research (CAESAR); Bonn, Germany
- Wayne State University

Member, Educational Outreach Committee, Association of Neuroscience Departments and Programs (1997-99)

Session chair, Society for Neuroscience Annual Meeting (1998)

Session chair, Association for Research and Ophthalmology Annual Meeting (2000, 2005)

Member, Editorial Board, Visual Neuroscience (2000-2005)

Member, Biology and Diseases of the Posterior Eye (BDPE) Study Section, NIH (ad hoc: 2003-2005; regular member: 2005-2009; chair 2006-2009).

Participant, Neuroscience Open House, Center for Scientific Review, NIH. (March, 2007)

Session Chair; Non-Rod/Non-Cone Photoreceptors; FASEB Summer Research Conference; Biology and Chemistry of Vision; Snowmass, CO (2009)

Reviewer NIH CSR ZRG1 MDCN-N 02 (M) Special Emphasis Panel, Neuronal Development, Synaptic Transmission and Neuropathy, 2009.

Reviewer NIH CSR ZRG1 CB-N (58) R Challenge Grants Panel # 3, June, 2009.

Grant referee, Jeffress Memorial Trust (2010).

Session Chair: “Photosensitive ganglion cells” Thirteenth Annual Vision Research Conference on Retinal Ganglion Cells: Development, Function, and Disease, Ft. Lauderdale, FL, April 30 - May 1, 2010.

Moderator, Poster session, “Everything you want to know about ipRGCs”, Association for Research in Vision and Ophthalmology, 2010.

Member, Annual Meeting Program Committee, Association for Research in Vision and Ophthalmology (ARVO; elected 2011)

Biology and Diseases of the Posterior Eye (BDPE) Study Section, CSR-NIH, ad hoc member, Sept. 2011.

Session Chair, “Developments in Optical Switches” Optogenetic Therapies for Vision, Massachusetts Eye and Ear Infirmary, Boston, MA, May, 2012

Member, Neurotransporters, Receptors and Calcium Signaling Study Section (NTRC), NIH (July 2012 – June 2014).

Board of Scientific Counselors, National Eye Institute, National Institutes of Health (ad hoc member, 2013)

Member, Scientific Advisory Board, Center for Vision Research, Upstate Medical University, Syracuse, NY (2014)

Ad hoc reviewer NIH CSR ZRG1 CB-G 02 M Special Emphasis Panel, Member Conflict, Developmental Cell Biology, 2015.

Ad hoc reviewer NIH CSR ZRG1 MDCN-R (04) M Transporters & Receptors (Teleconference) Special Emphasis Panel, 2015

8. Academic Honors:

1975 Graduation Magna Cum Laude, with Honors, Brown University

2004- Sidney A. Fox and Dorothea Doctors Fox Professor of Ophthalmology and Visual Sciences

2008- Fellow, American Association for the Advancement of Science (AAAS)

2013 Finalist, Alcon Research Award

2014 Finalist, Alcon Research Award

2014 Boycott Prize, FASEB Scientific Research Conference

2014 Presidential Faculty Award, Brown University

2015 Friedenwald Award, Association for Research in Vision and Ophthalmology

2015 Dean's Excellence in Teaching Award, Alpert Medical School

Fellowships:

1975-1978 National Science Foundation
Individual Predoctoral Fellowship

1980-1983 National Institutes of Health
Individual Postdoctoral Fellowship

1984 National Science Foundation Travel Awardee

1988-1992 Alfred P. Sloan Research Fellowship

Honorary Societies:

Phi Beta Kappa

Sigma Xi

Professional Societies:

Society for Neuroscience
American Association for the Advancement of Science
Association for Research in Vision and Ophthalmology
Society for Research on Biological Rhythms

9. Teaching (past 10 years; course director*):

2003-2004	I.	BN 165* (29 students) BN 195 (2 students) Bio 195 (1 student)
	II.	BN 296 (3 students) BN 196 (2 students) BI 196 (1 student)
2004-2005	I.	BN 165* (41 students) BN 195 (1 students) BN 296 (2 students)
	II.	BN 296 (1 student) BN 196 (1 student) BN 260 (2 lectures; 2 labs)
2005-2006	I.	BN 165* (55 students) BN 195 (2 student) BN 203 (1 guest lecture; 1 discussion section) BN 205 (1 guest lecture; 1 discussion section) BN 296 (2 students) BN 294 (guest lecture)
	II.	BN 194 (12 students) BN 296 (2 students) BN 196 (3 students) BN 260 (2 lectures; 2 labs)
2006-2007	I.	BN 165* (48 students) BN 195 (3 students) BN 205 (1 guest lecture)
	II.	BI 365 (3 guest lectures)
2007-2008	I.	<sabbatical>
	II.	BN212 (7 students)

BI 365 (2 guest lectures)

2008-2009 I. BN 165* (56 students)

II. BI 365 (1 guest lecture)

2009-2010 I. Neur 1650* (58 students)

II. BI 365 (1 guest lecture)
Neur 2120* (12 students)

2010-2011 I. Neur 1650* (51 students)

II. BI 365 (2 guest lectures)
Neur 1020* (2 guest lectures)

2011-2012 I. <sabbatical>

II. BI 365 (2 guest lectures)
Neur 2120* (10 students)

2012-2013 I. Neur 1650* (55 students)

II. BI 365 (2 guest lectures)

2013-2014 I. Neur 1650* (47 students)

II. Neur 2120* (12 students)

2014-2015 I. BI 3650 Medical Brain Sciences

Faculty Advising:

Undergraduate:

Concentration advising
Sc.B. in Biology, Classes of '89, '90, and '92
A.B in Human Biology (Brain and Behavior); Classes of '95 - '00
Sc.B in Neuroscience; Classes of '96-present

Freshman advising
2001-2002 (6 students)

Sophomore advising
1995-6 (1 student)
2002-3 (2 students)
2004-5 (1 student)

2008-9 (2 students)
2013-14 (1 student)

Undergraduate research projects supervised
43 students since 1988

Undergraduate honors theses (second reader)
>20 since 1988

Graduate:

Master's research projects supervised
2 since 1992

Graduate student advisory committees/ first year advisor
>30 since 1988

Graduate student first year faculty advisor
9 since 1988

Doctoral comprehensive examination committees
>23 since 1988

Doctoral thesis committees
30 since 1989