CURRICULUM VITAE:

Robert Shapley
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born: Oct. 7, 1944
married: Laurie Sigal
children: Nina Shapley A.B. (1993), Ph.D. (2000) and Alice Shapley, A.B. (1997), Ph.D. (2003)

Education:

Harvard College, Cambridge MA, A.B. 1965 Chemistry and Physics
Rockefeller University, New York NY, Ph. D. 1970 Biophysics

Positions Currently Held:

Natalie Clews Spencer Professor of the Sciences, New York University, 1992-
Professor, Neural Science, Psychology and Biology, New York University, 1987-
Associate Member, Courant Institute, New York University 2000-
Adjunct Professor, Rockefeller University, 1987-
Director, Program for Theoretical Visual Neuroscience, New York University, 1994-

Previous Professional Experience:

Helen Hay Whitney Foundation Postdoctoral Fellowship
Northwestern University, Evanston Illinois 1970-71
Cambridge University, Cambridge England, 1971-72
Assistant Professor, Rockefeller University, 1972-76
Investigator, Marine Biological Laboratory, Woods Hole, Mass. summer, 1974, 1976
Associate Professor, Rockefeller University, 1976-87
Investigator, Marine Laboratory, Plymouth UK, summer, 1977
Committee on Vision, US National Research Council, 1986-90
Visual Sciences B Study Section, NIH, 1988-92
Chairman, Visual Sciences B Study Section, NIH, 1990-92
Director, NYU Center for Neural Science, 1991-93
Associate Editor, *Journal of General Physiology*, 1983-95
Associate Editor, *Visual Neuroscience*, 1988-1991
Sensory Physiology Editor, *Experimental Brain Research*, 1990-97
Director, Visual Neuroscience Training Program, Center for Neural Science, 1993-2001

Fellowships, Honors:

National Science Foundation Graduate Fellowship 1965-1970
Woodrow Wilson Fellowship 1965 (honorary)
Helen Hay Whitney Postdoctoral Fellowship 1970-73
National Institutes of Health, Research Career Development Award, 1977-82
MacArthur Fellow 1986
Astor Lecturer, Oxford University, U.K. 1996
NYU Sokol award, 1997

Selected Invited Lectures

Netherlands Academy of Sciences, Amsterdam, 1977, 1986
Japan Society for the Promotion of Science, Tokyo 1979
Society for Neuroscience, Los Angeles 1981; New Orleans 1988; San Diego 2008
Bat-Sheva Seminar, Hebrew University of Jerusalem, Israel 1984
National Institute of Biology Symposium, Okazaki, Japan 1984
American Philosophical Society, Philadelphia, Penn. 1985
Illusory Contours Conference, Adelphi University, Long Island, NY 1985
Badenweiler Conference, West Germany 1987
Association for Research in Vision and Ophthalmology, Sarasota 1988
International Conference on Eye Research, Helsinki, Finland 1990
NATO Workshop, Roros, Norway 1990
Taniguchi Symposium, Katata, Japan, 1990
Retina Research Foundation Symposium, Houston, 1992
FASEB Retinal Pathways Conference, Vermont 1992
European Conference on Visual Perception, Pisa, Italy, 1992
McDonnell-Pew Cognitive Neuroscience Workshop, Lake Tahoe, 1993, 1998
Ciba Workshop on "Higher Order Processes in Vision", London, U.K. 1993
US-Israel BiNational Science Foundation Workshop, Jerusalem, Israel 1994
Astor Lecturer, Oxford University, U.K. 1996
Computational Neuroscience Summer Course, Woods Hole, Mass. 1996
Teuber Symposium, MIT, Cambridge Mass. 1996
Workshop on Color Vision, Tuebingen Germany, 1996
Institute for Mathematics and Applications, University of Minnesota, Minneapolis 1998
Courant Institute, Christmas Lecture, New York City 1998
Cold Spring Harbor Laboratory, Workshop on Thalamus-Cortex, 1999
Gatsby Center Workshop on Cortical Dynamics, London UK, 2000
CNRS Workshop on Cerebral Cortex, University of Paris, Paris France, 2000
Rockefeller University Reunion, New York City, 2001
Optical Society of America Workshop on Color Vision, Irvine California 2001
Institute of Theoretical Physics, University of California, Santa Barbara, 2001
Dynamical Neuroscience IX, NIMH workshop, San Diego California, 2001
Helmholtz Club, Irvine California 2002
Workshop on Cortical Dynamics, Institut Henri Poincare, Paris France, 2002
Moran Eye Center, University of Utah, Salt Lake City, 2003
Reganfest, York University, Toronto Canada 2003
NYU Color Workshop, New York City, 2003
McLaughlinFest, University of North Carolina, Chapel Hill 2004
"Cortical Dynamics" course, Karolinska Institute, Stockholm Sweden 2005
AIC Colour 2005, Granada Spain 2005
Lundfest for Jennifer Lund, Salt Lake City Utah 2005
Killam Lecture, McGill University, Montreal Canada, 2005
University of Paris V, Paris France 2006
Mind and Brain Institute, University of New Mexico, Albuquerque New Mexico 2006
German Neuroscience Society, Goettingen Germany 2007
Institute for Advanced Study, Hebrew University, Jerusalem Israel 2007; 2008
Visual Sciences Society, Naples Florida 2008
Workshop, Bernstein Center for Computational Neuroscience, Berlin Germany, 2008
Cosyne Workshops, Snowbird Utah, 2010
CNTRICS, Washington University, St. Louis, 2010
Duke University Institute of Brain Sciences, Durham NC 2011
UCLA Physics Department Colloquium, Los Angeles CA 2011
Heller Lecture in Computational Neuroscience, Hebrew University, Jerusalem 2012

Bernstein Center for Computational Neuroscience, Berlin, Germany 2013
Max Planck Institut für Dynamik und Selbstorganisation, Goettingen, Germany 2013
Asian-Pacific Conference on Vision, Suzhou China 2013
Fall Vision Meeting, OSA, Houston Texas, 2013
Art, Vision & the Brain Workshop, Duke University, Durham North Carolina, 2014
University College London UK, 2015
Seeing Color: Art, Vision & the Brain, Duke University, Durham North Carolina, 2015
From structure to computation, ELSC and ICNS Workshop, Hebrew University, Jerusalem, 2015
International Color Vision Society, Erlangen Germany, 2017

ROBERT SHAPLEY: COMPLETE PUBLICATIONS

Papers

Shapley, R. (1969) Fluctuations in the response to light of visual neurones in Limulus, *Nature*, 221, 437-440.

Dodge, F.A., Shapley, R. and Knight, B.W.(1970) Linear systems analysis of the Limulus retina, *Behav.Sci.*, 15, 24-36.

Shapley, R.(1971) Fluctuations of the impulse rate in Limulus eccentric cells, *J.Gen.Physiol.*, 57, 539-556.

Shapley, R.(1971) Effects of lateral inhibition on fluctuations of the impulse rate, *J.Gen.Physiol.*, 57, 557-575.

Shapley, R, Enroth-Cugell, C., Bonds, A.B. and Kirby, A.(1972) Gain control of the retina and retinal dynamics. *Nature*, 236, 352-353.

Shapley, R. and Tolhurst, D.J. (1973) Edge detectors in human vision, *J.Physiol.*, 229, 165-183.

Enroth-Cugell, C. and Shapley, R. (1973) Adaptation and dynamics of cat retinal ganglion cells. *J.Physiol.*, 233, 271-309.

Enroth-Cugell, C. and Shapley, R.(1973) Flux, not retinal illumination, is what cat retinal ganglion cells really care about, *J.Physiol.*, 233, 311-326.

Shapley, R. (1974) Gaussian bars and rectangular bars: the influence of width and gradient on visibility, *Vision Res.*, 14, 1457-1462.

Shapley, R. and Hochstein, S. (1975) Visual spatial summation in two classes of geniculate cells. *Nature,* 256, 411-413.

Enroth-Cugell, C., Lennie, P. and Shapley, R.(1975) Surround contribution to light adaptation in cat retinal ganglion cells *J.Physiol.*, 247, 579-588.

Shapley, R. and Rossetto, M.(1976) An electronic visual stimulator, *Behav. Res. Meth. Instrum.*, 8, 15-20.

Hochstein, S. and Shapley, R. (1976) Quantitative analysis of retinal ganglion cell classifications. *J.Physiol.*, 262, 237-264.

Hochstein, S. and Shapley, R. (1976) Linear and nonlinear spatial subunits in Y cat retinal ganglion cells. *J.Physiol.,* 262, 265-284.

Jakiela, H.G., Enroth-Cugell, C. and Shapley, R. (1976) Adaptation and dynamics in X-cells and Y-cells of the cat retina, *Exp.Brain Res.*, 24, 335-342.

Victor, J.D., Shapley, R. and Knight, B.W.(1977) Nonlinear analysis of cat retinal ganglion cells in the frequency domain. *Proc. NAS US* , 74, 3068-3072.

Milkman, N., Shapley, R. and Schick, G.(1978) A microcomputer-based visual stimulator, *Behav.Res.Meth.&Instrum.*, 10, 539-545.

Gordon, J., Shapley, R. and Kaplan, E.(1978): The eel retina. Receptor classes and spectral mechanisms, *J.Gen.Physiol.*, 71, 123-138.

Shapley, R. and Gordon, J. (1978) The eel retina: Ganglion cell classes and spatial mechanisms. *J.Gen.Physiol.,* 71, 139-155.

Shapley, R. and Victor, J.D. (1978) The effect of contrast on the transfer properties of cat retinal ganglion cells, *J.Physiol.*, 285, 275-298.

Shapley, R. and Victor, J.D.(1979):The contrast gain control of the cat retina. *Vision Res.*, 19, 431-434.

So, Y.T. and Shapley, R. (1979) Spatial properties of X and Y cells in the lateral geniculate nucleus of the cat and conduction velocities of their inputs, *Exp.Brain Res.*, 36, 533-550.

Victor, J.D. and Shapley, R.(1979) Receptive field mechanisms of cat X and Y retinal ganglion cells, *J.Gen.Physiol.*, 74, 275-298.

Shapley, R. and Victor, J.D.(1979) Nonlinear spatial summation and the contrast gain control of cat retinal ganglion cells, *J.Physiol.* 290, 141-161.

Snyder, A. and Shapley, R. (1979) Deficits in the visual evoked potentials of cats as a result of visual deprivation, *Exp.Brain Res.*37, 73-86.

Victor, J.D. and Shapley, R. (1979) The nonlinear pathway of Y ganglion cells in the cat retina, *J.Gen.Physiol.*74, 671-689.

Milkman, N., Schick, G., Rossetto, M., Ratliff, F., Shapley, R. and Victor, J.D. (1980) A two-dimensional computer-controlled visual stimulator, *Behav.Res.Meth.&Instrum.*,12, 283-292.

Shapley, R. and So, Y.T. (1980) Is there an effect of monocular deprivation on the proportions of X and Y cells in the cat lateral geniculate nucleus? *Exp.Brain Res.*, 1980, 39, 41-48.

Victor JD Shapley R(1980) A method of nonlinear analysis in the frequency domain *Biophys.J* 29, 459-483

Shapley R Gordon,J (1980) The visual sensitivity of the retina of the Conger eel *Proc.Roy.Soc.Lond.B.* 209, 317-330.

Shapley RVictor JD (1980) The effect of contrast on the non-linear response of the Y cell *J.Physiol.*302, 535-547.

So YT Shapley R(1981) Spatial tuning of cells in and around lateral geniculate nucleus of the cat: X and Y relay cells and perigeniculate interneurons. *J.Neurophysiol* 45, 107-120.

Shapley R Kaplan E Soodak R. (1981) Spatial summation and contrast sensitivity of X and Y cells in the lateral geniculate nucleus of the macaque *Nature* 292, 543-545

Tranchina D Gordon J Shapley R Toyoda J-I (1981) Linear information processing in the retina: A study of horizontal cell responses. *Proc.Nat.Acad.Sci US*,78, 6540-6542

Shapley RM Victor JD (1981) How the contrast gain control modifies the frequency responses of cat retinal ganglion cells *J.Physiol* 318, 161-179

Winterkorn, J.M.S., Shapley, R, and Kaplan E. (1981) The effect of monocular paralysis on the lateral geniculate nucleus of the cat, *Exp. Brain Res*.42, 117-121.

Kaplan E Shapley, R (1982) X and Y cells in the lateral geniculate nucleus of the macaque monkey. *J.Physiol*.330, 125-143.

Tranchina,D., Gordon, J. and Shapley, R. (1983) Spatial and temporal properties of luminosity horizontal cells in the turtle retina. *J.Gen.Physiol*. 82, 573-598

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Tranchina, D., Gordon, J. and Shapley, R. (1984) Retinal light adaptation - evidence for a feedback mechanism. *Nature*310, 314-316.

Shapley, R. and Gordon, J. (1985) Nonlinearity in the perception of form. *Percept. and Psychophys*., 37, 84-88.

Shapley, R. and Reid, R.C. (1985) Contrast and assimilation in the perception of brightness. *Proc.Nat. Acad. Sci. US*, 82, 5983-5986.

Shapley, R. and Victor, J.D. (1986) Hyperacuity in cat retinal ganglion cells. *Science* 231, 999-1002

Shapley, R. (1986) The importance of contrast in the responses of single units, the VEP, and perception. *Vision Res*. 26, 45-61

Kaplan E, Shapley R. (1986) The primate retina contains two types of ganglion cells, with high and low contrast sensitivity.*Proc.Nat.Acad.Sci. USA* 83: 2755-2757 PMCID:PMC323379

Shapley, R. and Perry, V.H. (1986) Cat and monkey retinal ganglion cells and their visual functional roles. *Trends in Neurosciences* 9, 229-235

Reid, R.C., Soodak, R.E., and Shapley, R.M.(1987) Linear mechanisms of directional selectivity in simple cells of cat striate cortex. *Proc Nat. Acad. Sci. USA* 84, 8740-8744

Kaplan, E., Purpura, K. and Shapley, R.M. (1987) Contrast affects the transmission of visual information through the mammalian lateral geniculate nucleus. *J. Physiol*. 391, 267-288

Reid, R.C. and Shapley, R.M. (1988) Brightness induction by local contrast and the spatial dependence of assimilation. *Vis. Res.* 1988, 28, 115-132.

Purpura, K., Kaplan, E. and Shapley, R.M. (1988) Background light and the contrast gain of primate P and M retinal ganglion cells *Proc. Nat. Acad. Sci.USA*, 85, 4534-4537.

Victor, J., Maiese, K, Shapley, R. Sidtis, J., and Gazzaniga, M. (1989) Acquired central dyschromatopsia. *Clin. Vis. Sci.* 4, 183-196

Purpura, K., Tranchina, D.,Kaplan, E. and Shapley, R.M. (1990) Light adaptation in the primate retina: analysis of changes in gain and dynamics of monkey retinal ganglion cells. *Visual Neuroscience*, 4, 75-93

Soodak, R.E., Shapley, R.M., and Kaplan, E. (1991) Fine structure of receptive field centers of X and Y cells of the cat. *Visual Neuroscience* 6, 621-628

Reid, R.C., Soodak, R.E., and Shapley, R.M. (1991) Directional selectivity and spatiotemporal structure of receptive fields of simple cells in cat striate cortex. *J. Neurophysiol.*, 66, 505-529

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Reid, R.C. and Shapley, R. (1992) Spatial structure of cone inputs to receptive fields in primate lateral geniculate nucleus, *Nature*, 356, 716-718.

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Grosof, D.H., Shapley, R.M., and Hawken, MJ (1993) Macaque V1 neurons can signal "illusory" contours. *Nature*, 365: 550-552

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Ringach, D., Hawken, M. and Shapley, R. (1996) Binocular eye movements caused by the perception of three-dimensional structure from motion. *Vision Research*, 36,1479-92

Ringach, D. and Shapley, R. (1996) Spatial and temporal properties of illusory contours and amodal boundary completion. *Vision Research*, 36, 3037-3050

Ringach, D., Hawken, M. and Shapley, R. (1997) The dynamics of orientation tuning in the macaque monkey striate cortex, *Nature*, 387, 281-284

Rubin, N., Nakayama, K., and Shapley, R. (1997) Abrupt learning and retinal size specificity in illusory contour perception, *Current Biology* 7, 461-467

Ringach, D., Carandini, M, Sapiro, G. and Shapley, R. (1997) A subspace reverse correlation method for the study of visual neurons. *Vision Research* 37, 2455-2464

Reid, R.C., Victor, J. and Shapley,R. (1997) The use of m-sequences in the analysis of visual neurons. *Visual Neurosci*., 14, 1015-1027

O'Keefe LP, Levitt JB, Kiper DC, Shapley RM, Movshon JA (1998) Functional Organization of Owl Monkey Lateral Geniculate Nucleus and Visual Cortex. *J Neurophysiol* 80(2):594-609

Mechler F, Victor JD, Purpura KP, Shapley R (1998) Robust temporal coding of contrast by V1 neurons for transient but not for steady-state stimuli *J Neurosci* 18: 6583-6598

Sceniak MP, Ringach DL, Hawken MJ, and Shapley R (1999) Contrast's effect on spatial summation by macaque V1 neurons. *Nature Neuroscience* 2: 733-739

Corballis PM, Fendrich R, Shapley RM, Gazzaniga MS (1999)Illusory contour perception and amodal boundary completion: evidence of a dissociation following callosotomy. *J Cogn Neurosci* 11:459-66

M. C. Pugh, D. L. Ringach, R. Shapley, M. J. Shelley (2000) Computational Modeling of Orientation Tuning Dynamics in Monkey Primary Visual Cortex, *J Computational Neurosci*. 8:143-159

Victor JD, Apkarian P, Hirsch J, Conte MM, Packard M, Relkin NR, Kim KH, Shapley RM (2000) Visual function and brain organization in non-decussating retinal-fugal fibre syndrome. *Cereb Cortex* 10 :2-22

McLaughlin,D, Shapley,R, Shelley,M, Wielaard, J (2000). A Neuronal Network Model of Sharpening and Dynamics of Orientation Tuning in an Input Layer of Macaque Primary Visual Cortex, *Proc. Nat. Acad. Sci. USA*, 97:8087-8092

Johnson EA Hawken MJ and Shapley RM (2001) The Spatial Transformation of Color in the Primary Visual Cortex of the Macaque Monkey, *Nature Neuroscience* 4: 409-16.

Sceniak MP, Hawken MJ, and Shapley RM (2001) Spatial Characterization of Receptive Fields in Macaque V1 Neurons, *J. Neurophysiol*. 85:1873-87.

Henrie JA, Shapley RM.(2001) The relatively small decline in orientation acuity as stimulus size decreases. *Vision Res* 41:1723-33.

Mareschal IM, Sceniak MP and Shapley RM (2001) Contextual influences on orientation judgments *Vision Res*. 41:1915-1930.

Wielaard, J Shelley M Mclaughlin DM and Shapley RM (2001) How Simple Cells Are Made in a Nonlinear Network Model of the Visual Cortex *J Neurosci*. 21:5203-5211.

Ringach, D Hawken, M. and Shapley, R. (2001) Receptive field structure of neurons in monkey primary visual cortex revealed by stimulation with natural image sequences *J. of Vision* 2, 12-24

Ringach, D Bredfeldt CE Hawken, M. and Shapley, R. (2002) Suppression of neural responses to non-optimal stimuli correlates with tuning selectivity in macaque V1, *J Neurophysiol* 87, 1018-1027.

Ringach, D Shapley, RM and Hawken, MJ. (2002) Orientation selectivity in macaque V1: diversity and laminar dependence. *J. Neurosci*. 22:5639-5651

Reid RC and Shapley RM (2002) Space and time maps of cone photoreceptor signals in macaque lateral geniculate nucleus. *J. Neurosci*. 22:6158-6175

Mareschal I, Andrew Henrie J, Shapley RM.(2002) A psychophysical correlate of contrast dependent changes in receptive field properties. *Vision Res*. 42:1879-1887.

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Sceniak MP, Hawken MJ, Shapley R. (2002) Contrast-dependent changes in spatial frequency tuning of macaque V1 neurons: effects of a changing receptive field size. *J Neurophysiol*. 88:1363-1373.

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Tao L, Shelley M, McLaughlin D, Shapley R (2004) An Egalitarian Network Model for the Emergence of Simple and Complex Cells in Visual Cortex *Proc. Nat. Acad. Sci. USA* 101:366-71

Mareschal I Shapley RM (2004) Effects of contrast and size on orientation discrimination *Vision Res*. 44:57-67

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Kang K, Shapley RM, Sompolinsky H. (2004) Information tuning of populations of neurons in primary visual cortex. *J Neurosci*. 24:3726-35

Xing D, Ringach DL, Shapley RM, Hawken MJ (2004) Correlation of Local and Global Orientation and Spatial Frequency tuning in Macaque V1 *J Physiol* 557:923-33

Williams PE, Mechler F, Gordon J, Shapley R, Hawken MJ. (2004) Entrainment to video displays in primary visual cortex of macaque and humans. *J Neurosci*. 24:8278-88.

Imber ML, Shapley RM, Rubin N (2005) Differences in real and illusory shape perception revealed by backward masking. *Vision Res*. 45:91-102

Henrie JA, Shapley R. (2005) LFP power spectra in V1 cortex: the graded effect of stimulus contrast. *J Neurophysiol* 94:479-90

Xing D Shapley RM, Hawken MJ. Ringach DL (2005) The effect of stimulus size on the dynamics of orientation selectivity in Macaque V1 *J Neurophysiol* 94:799-812

Gordon J Shapley R (2006) Brightness contrast inhibits color induction: evidence for a new kind of color theory *Spatial Vision*, 19, No. 2-4:133–146

Tao L Cai D McLaughlin DW Shelley MJ Shapley R (2006) Orientation selectivity in visual cortex by fluctuation-controlled criticality. *Proc Natl Acad Sci U S A*. 103:12911-6

Williams PE Shapley RM (2007) A Dynamic Nonlinearity and Spatial Phase Specificity in Macaque V1 Neurons *J. Neurosci* 27: 5706-5718

Shapley R Maertens M (2008) Angle Alignment Evokes Perceived Depth and Illusory Surfaces *Perception* 37:1471-1487

Maertens M Shapley R (2008) Local determinants of contour interpolation *J. of Vision* 8(7):3, 1-11

Johnson EN, Hawken MJ, Shapley R. (2008) The orientation selectivity of color-responsive neurons in macaque V1. *J Neurosci*. 28:8096-8106.

Koelling M, Shapley R, Shelley M. (2008) Retinal and cortical nonlinearities combine to produce masking in V1 responses to plaids. *J Comput Neurosci*. 25:390-400

Zhu W, Shelley M, Shapley R. (2009) A neuronal network model of primary visual cortex explains spatial frequency selectivity. *J Comput Neurosci*. 26:271-87

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Xing D, Yeh CI, Shapley RM. (2009) Spatial spread of the local field potential and its laminar variation in visual cortex. *J Neurosci*. 29:11540-9.

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Burns SP, Xing D, Shelley MJ, Shapley RM (2010) Searching for autocoherence in the cortical network with a time-frequency analysis of the local field potential. *J Neurosci*. 30:4033-47

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Burns SP, Xing D, Shapley RM (2010) Comparisons of the Dynamics of LFP and MUA signals in Macaque Visual Cortex. *J. Neurosci*. 30:13739-49

Burns SP, Xing D, Shapley RM. (2011) Is gamma-band activity in the local field potential of V1 cortex a "clock" or filtered noise? *J Neurosci*. 31:9658-64

Xing D, Ringach DL, Hawken MJ, Shapley RM. (2011) Untuned suppression makes a major contribution to the enhancement of orientation selectivity in macaque v1 *J Neurosci*. 31:15972-82.

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Lin IC, Xing D, Shapley R. (2012) Integrate-and-fire vs Poisson models of LGN input to V1 cortex: noisier inputs reduce orientation selectivity. *J Comput Neurosci*. 33(3):559-72

Xing D, Yeh CI, Burns S, Shapley RM. (2012) Laminar analysis of visually evoked activity in the primary visual cortex. *Proc Natl Acad Sci U S A*. 109:13871-6.

Xing D, Shen Y, Burns S, Yeh CI, Shapley R, Li W (2012) Stochastic generation of gamma-band activity in primary visual cortex of awake and anesthetized monkeys. *J Neurosci*. 32:13873-80

Shapley RM, Xing D. (2013) Local circuit inhibition in the cerebral cortex as the source of gain control and untuned suppression. *Neural Netw*. 37:172-81.

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Maertens M, Shapley R. (2013) Linking appearance to neural activity through the study of the perception of lightness in naturalistic contexts . *Vis Neurosci*. 24:1-10.

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