CURRICULUM VITAE March 2, 2015

Franklin R. Amthor

BORN: May 30, 1950; Bridgeport, Connecticut, USA. US Citizen, married, 3 children.

CURRENT ADDRESS:
Department of Psychology
University of Alabama at Birmingham
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CURRENT POSITIONS:
Professor Department of Psychology, UAB
Interim Director, Behavioral Neuroscience Graduate Program, Dept. of Psychology, UAB
Secondary appointments
Dept. of Biomedical Engineering, UAB
Dept. of Vision Science, School of Optometry, UAB
Dept. of Neurobiology, UAB
Scientist-Member, Vision Science Research Center, Civitan International Research Center

NOTABLE PRIOR GRANTS as PI:
NEI Grant EY05070
"Neural Structure Function Relationships in Retina" Role-PI
$525,000 Total Direct Costs, April 1, 2000 - March 31, 2006.
This grant was held continuously without interruption from 1984-2006.

Eyesight Foundation: Eye Movements Mediate High Visual Acuity. Role-PI
$150,000 Total Direct Costs, July 1, 2005 – June 30, 2008.

Office of Naval Research Grant N00014-91-J-1290 Role-PI
"Theoretical and Experimental Determination of the Robust Biological Mechanism of Retinal Directional Selectivity".
$354,621 Total Costs, Dec. 15, 1990 - June 1, 1994.

Sloan Foundation Major Grant ($300,000.) 86-10-7 in Computational Neuroscience Role-PI

PREVIOUS POSITIONS:

Aug. 1996 - Apr. 1999	Director**,** Cognitive Science Program at UAB
Sept. 1991 – June, 2003	Associate Professor, Department of Psychology, UAB
Nov. 1986 - Aug. 1991	Assistant Professor, Department of Psychology, UAB
Oct. 1984 - Nov. 1986	Research Assistant Professor, Dept. of Psychology, UAB
Jan. 1984 - Oct. 1984	Research Assistant Professor, School of Optometry, UAB
May 1981 - Dec. 1983	Research Associate, School of Optometry, UAB

EDUCATION and TRAINING: Franklin R. Amthor

1979 - 1981 NIH Postdoctoral Research Fellow, School of Optometry, UAB

1979 **Ph.D.** Biomedical Engineering; Duke University, Durham, N.C.
Dissertation: *Some Quantitative Characteristics of the Responses of Frog Retinal Ganglion Cells*
Advisor: Myron L. Wolbarsht, Ph.D.
Committee: Drs. Irving Diamond, James McElhaney, Lorne Mendell, Olaf vonRamm, Howard Wachtel
Support: FDA Research Assistantship and NIGMS-NIH

1971 **B.S.** Bioelectronic Engineering; Cornell University, Ithaca, N.Y.

Electrical engineering major with emphasis on applications in neurophysiology and artificial intelligence.

James Vick Scholar (full tuition scholarship)

1967 Graduated Trinity High School; Louisville, Kentucky
National Merit Semifinalist
Kentucky State Debate Champion (National Forensic League)

Patent Applications Sought

1. Multielectrode Array and System for Recording and Analyzing Data from Tissue, or for Stimulating Tissue.
2. Composition and Manufacture Method for Microelectrode Arrays
3. Dye or Pigment Aided Neural Stimulation by Light
4. Neural Stimulation by Light Activated Membrane Diffusion

TEACHING EXPERIENCE

Biological and Artificial Intelligence (graduate level neuroscience, computer science, psychology, biomedical engineering; advanced undergraduate psychology and computer science). Courses on sensory coding and biological information processing in natural and artificial neural networks (such as Perceptrons, Kohonen nets, Grossberg Adaptive Resonant nets, Neocognitron, Edelman's Darwin nets), with particular emphasis on models of visual processing.

Sensation & Perception (upper level undergraduates). Coursemaster for Psychology Dept. course on sensation and perception which is taught at least once a year.

Behavioral Neuroscience (graduate students). Coursemaster and organizer for mandatory entry level course for all entering Behavioral Neuroscience (Psychology) graduate students.

Cognitive Psychology. Basic psychology undergraduate course.

Physiological Optics (Optometry students). Teaching involved basic optic principles, including function of various types of lenses, lens aberrations, physiological optics of the eye, and how patients are refracted and optically corrected with glasses and contact lenses.

Cognitive Neuroscience (Graduate Neuroscience and high level undergraduates). Originated and taught basic course on cognitive neuroscience as part of Cognitive Science and Behavioral Neuroscience Programs at UAB.

Electronics for neuroscientists and basic electronic circuits. (Graduate Neuroscience). Responsible for teaching basic electronic principles necessary for understanding activity in neural dendrites and axons. Taught basic electronic device and circuit principles as needed to understand operation of equipment used by electrophysiologists and other neuroscientists.

PH.D. STUDENTS MENTORED

Ming-Liang Pu (Vision Science) 1990 “The dendritic characteristics of ganglion cells projecting to the nucleus of the optic tract and dorsal lateral geniculate nucleus of the rabbit"

David Merwine (Vision Science) 1997 "Analysis of the center-surround interaction of rabbit retinal ganglion cells: physiology and pharmacology.

Darrel Tjepkes (Behavioral Neuroscience) 1999 "A role of NMDA channels in rabbit retinal directional selectivity.

Christianne Strang (Behavioral Neuroscience) 2004 "The expression and function of neuronal nicotinic receptors in rabbit retina." (co-mentored with Dr. Kent Keyser)

Brian Reed (Vision Science) 2004 "Neuronal nicotinic receptor subtypes that modulate the responses of directionally selective ganglion cells in rabbit retina." (co-mentored with Dr. Kent Keyser)

INVITED SYMPOSIA and COLLOQUIA, HONORS

Morphological substrates of receptive field properties of rabbit retinal ganglion cells. Dept. of Anatomy, Wayne State University. Nov., 1984.

Direction selective cells in rabbit retina. The Neuroscience Institute of the Rockefeller University. May 21, 1985.

Morphological substrates of receptive field properties of rabbit retinal ganglion cells. Southeastern Regional Neuroscience Meeting, Univ. of Alabama at Birmingham. May 25, 1985.

Morphology of rabbit retinal ganglion cells. Invited presentation at 7th International Congress of the International Society for Eye Research, Japan. Fall, 1986.

Retinal Topography and Transmitters, co-Chairman, Anatomy and Pathology Section of Association for Research in Vision and Ophthalmology Annual Spring Meeting, May 2, 1986.

Principles of Distributed and Parallel Processing in Neural and Biological Models: Introduction and Tutorial. Invited presentation to Association for Computing Machinery 25th Southeast Regional Conference, April 2, 1987.

Invited Chairman, Retina IV Section, Society for Neuroscience Meeting, Toronto, 1988.

Robust Detection of Motion by On-Off Directionally Selective Ganglion Cells in Rabbit Retina. Invited colloquia Univ. of Delaware School of Life Sciences, Oct 10, 1990.

Structure Function Relationships in the Visual System. Invited presented to Sigma Xi, January, 1992

Anatomical substrates of complex information processing in retina. Invited presentation to the Dept. of Anatomy, St. Louis University, Jan., 1996.

Structure function relationships in retinal ganglion cells. Invited presentation to the Smith-Kettlewell Eye Research Institute, Dec. 10, 1997.

Invited Chairman, Section on Inner Retina, Fundamental Properties of Amacrine and Ganglion Cells, ARVO, 1999.

The Brain and Artificial Intelligence. Invited platform presentation, Alabama Academy of Science, Samford Univeristy, March 22, 2013

CURRENT and Past PROFESSIONAL AFFILIATIONS:

Association for Research in Vision and Ophthalmology
Society for Neuroscience

PROFESSIONAL ACTIVITIES:

ad hoc reviewer for: Vis-C study section, NIH., National Science Foundation
J. Comp. Neurol., IEEE Transactions on Biomedical Engineering, Visual Neuroscience,

J. Neurophysiology, Vision Research

PUBLICATIONS in peer-reviewed journals

Ringo J, Wolbarsht ML, Wagner HG, Crocker R and **Amthor** F. (1977) Trichromatic vision in the cat. *Science* **198**:753-755.

Amthor FR, Wolbarsht ML and Ringo J. (1983) Functional implications of ON-OFF response variation in frog retinal ganglion cells. *Vis. Res.* **23**:21-32.

Amthor FR, Oyster CW, and Takahashi ES. (1983) Quantitative morphology of rabbit retinal ganglion cells. *Proc. Roy. Soc. B.* **217**:341-355.

Amthor FR. (1984) A modified slurry beveler for HRP-filled intracellular micropipettes. *J. Electrophysiol. Tech.* **11**:79-86.

Amthor FR, Oyster CW and Takahashi ES. (1984) Morphology of ON-OFF direction-selective ganglion cells in the rabbit retina. *Brain Res.* **298**:187-190.

Amthor FR and Jackson CA. (1986) Staining of retinal neurons in the isolated eyecup by extracellular horseradish peroxidase injection. *Vision Res.* **26(2)**:269-274.

Amthor FR, Takahashi ES and Oyster CW. (1989) Morphologies of rabbit retinal ganglion cells with concentric receptive fields. *J. Comp. Neurol.* **280(1)**:72-96.

Amthor FR, Takahashi ES and Oyster CW. (1989) Morphologies of rabbit retinal ganglion cells with complex receptive fields. *J. Comp. Neurol.* **280(1)**:97-121.

Grzywacz NM, **Amthor** FR and Mistler LA (1990) Applicability of quadratic and threshold models to motion discrimination in the rabbit retina. *Biol. Cyber*. **64:**41-49.

Pu M-L and **Amthor** FR. (1990) Dendritic morphologies of retinal ganglion cells projecting to the Nucleus of the Optic Tract in rabbit. *J. Comp. Neurol*. **302:**657-674.

Pu M-L and **Amthor** FR. (1990) Dendritic morphologies of retinal ganglion cells projecting to the Lateral Geniculate Nucleus in rabbit. *J. Comp. Neurol*. **302:**675-693.

Amthor, FR and Grzywacz NM. (1991) The nonlinearity of the inhibition underlying retinal directional selectivity. *Vis Neurosci*. **6**:197-206.

Grzywacz NM, **Amthor** FR and Borg-Graham LJ. (1993) Does synaptic facilitation mediate motion facilitation in the retina. *Computation and Neural Systems, 1992*. F. Eeckman and J. Bower eds. Chapter 24. Kluwer, New York.

Oyster CW, **Amthor** FR and Takahashi ES. (1993) Dendritic architecture of ON-OFF direction-selective ganglion cells in rabbit retina. *Vision Research* **33**: 579-608.

Amthor FR and Grzywacz NM. (1993) Inhibition in On-Off directionally selective ganglion cells in the rabbit retina. *J. Neurophysiol*. **69**(6):2174-2187.

Grzywacz NM and **Amthor** FR. (1993) Facilitation in On-Off directionally selective ganglion cells in the rabbit retina. *J. Neurophysiol*. **69**(6):2188-2199.

Grzywacz NM, **Amthor** FR and Merwine DK. (1994) Directional hyperacuity in ganglion cells of the rabbit retina. *Visual Neuroscience* **11**: 1019-1025.

Villa MF and **Amthor** FR. (1995) Automating the quantitative analysis of 2-D neural dendritic trees. *Neuroscience Methods* **56**: 77-88.

Amthor FR and Oyster CW. (1995) Spatial organization of retinal information about movement detection. *Proc. Natl. Acad. Sci. USA*. **92(9)**: 4002-4005.

Merwine DK, **Amthor** FR and Grzywacz NM. (1995) The interaction between center and surround of rabbit retinal ganglion cells. *J. Neurophysiol.* **73(4)**: 1547-1567.

Amthor FR, Grzywacz NM and Merwine DK. (1996) Extra-receptive field facilitation in On-Off DS ganglion cells of the rabbit retina. *Visual Neuroscience* **13(2)**: 303-310.

Grzywacz NM, Tootle JS and **Amthor** FR (1997) Is the input to a GABAergic or cholinergic synapse the sole asymmetry in rabbit's retinal directional selectivity? *Visual Neurosci*. **14**: 39-54.

Grzywacz NM, Merwine DK and **Amthor** FR. (1998). Complementary roles of two excitatory pathways in retinal directional selectivity. *Visual Neuroscience* **15(6)**: 1119-1128

Merwine DK, Grzywacz NM, Tjepkes DS and **Amthor** FR. (1998). Non-monotonic contrast behavior in directionally selective ganglion cells and evidence for its dependence on their GABAergic input. *Visual Neuroscience* **15(6)**: 1129-1136.

Grzywacz NM, **Amthor** FR and Merwine DK (1998) Necessity of acetylcholine for retinal directionally selective responses to drifting gratings in rabbit. *J. Physiol*. **512.2**: 575-581.

Tjepkes, DS and **Amthor** FR. (2000) The role of NMDA channels in rabbit retinal directional selectivity. *Visual Neuroscience* **17(2)**: 291-302.

Amthor FR, Keyser KT and Dmitrieva NA. (2002) Effects of the destruction of starburst-cholinergic amacrine cells by the toxin AF64A on rabbit retinal directional selectivity. Visual Neuroscience **19**: 495-509.

Reed BT, **Amthor** FR, and Keyser KT. (2002) Rabbit retinal ganglion cell responses mediated by ∀-bungarotoxin-sensitive nicotinic acetylcholine receptors. Visual Neuroscience **19**:427-438.

Dacheux RF, Chimento M. and **Amthor** FR. (2003) Synaptic input to the direction selective ganglion cell in the rabbit retina. J. Comparative Neurology **456**: 267-278.

Amthor FR, Tootle JS and Yildirim A. (2003) A new transparent multi-unit recording array system fabricated by in-house laboratory technology. J. Neuroscience Methods, 126(2): 209 - 219.

Strang, CE, **Amthor** FR and Keyser, KT (2003) Rabbit retinal ganglion cell responses to nicotine can be mediated by b2-containing nicotinic acetylcholine receptors *Visual Neuroscience* **20**, 651–662.
Reed, B.T., **Amthor**, F.R., and Keyser, K. T. (2005) MLA-Sensitive Cholinergic Receptors Involved in the Detection of Complex Moving Stimuli in Retina. *Visual Neuroscience,* **21(6)**: 861-872.

Strang CE, Andison M E, **Amthor** F R, and Keyser KT (2004) Rabbit retinal ganglion cells express functional alpha7 nicotinic acetylcholine receptors. *Am J Physiol Cell Physiol*, **289**(3): C644 - C655.

Amthor FR, Tootle JS and Grzywacz NM. (2005) Stimulus-Dependent correlated firing in directionally selective retinal ganglion cells. *Visual Neuroscience* **22**: 769-787.

Amthor FR, Tootle JS and T. J. Gawne. (2005) Retinal ganglion cell coding in simulated active vision. *Visual Neuroscience* **22**: 789-806.

Renna, JM, Strang, CE, **Amthor** FR and Keyser KT. (2007) Strychnine, but not PMBA, inhibits neuronal nicotinic acetylcholine receptors expressed by rabbit retinal ganglion cells. *Visual Neuroscience* 24(04): 503-511. doi: 10.1017/S0952523807070241

Strang, CE, Renna, JM, **Amthor** FR and Keyser KT. (2007) Nicotinic acetylcholine receptor expression by directionally selective ganglion cells. *Visual Neuroscience* 24(04): 523-533. doi: 10.1017/S0952523807070435,

Grzywacz NM and **Amthor** FR. (2007) Robust directional computation in on-off directionally selective ganglion cells of rabbit retina. *Visual Neuroscience* 24(04): 647-661. doi: 10.1017/S0952523807070666

Chatterjee, S., D.K. Merwine, F.R. **Amthor**, and N.M. Grzywacz (2007) Properties of Stimulus-dependent Synchrony in Retinal Ganglion Cells. *Visual Neuroscience* **24**: 827-843.

Li Y, Liu L, **Amthor F** and Yao XC. (2010) High speed line-scan confocal imaging of stimulus-evoked intrinsic optical signals in the retina*, Optics letters* 35(3): 426-428.

Risner M, **Amthor FR** and Gawne T. (2010) The response dynamics of rabbit brisk-transient and -sustained retinal ganglion cells to simulated optical blur Visual Neuroscience 27: 1-13, doi:10.1017/S0952523810000064

Li YG, Qiu-Xiang Zhang, Liu L and **Amthor FR** and Yao XC. (2010) High spatiotemporal resolution imaging of fast intrinsic optical signals in the retina activated by frequency flicker stimulation. Optics Express of JOSA 18(7): 7210-7218.

Strang CE, Renna JM, **Amthor FR** and Keyser KT (2010) Muscarinic Acetylcholine Receptor Localization and Activation Effects on Ganglion Response Properties. Invest*. Ophthal. Vis. Sci*. **51(5)**: 2778-2789. doi:10.1167.

Xin-Cheng Yao, Yichao Li, Christianne Strang, Franklin Amthor, Lei Liu, Yangguo Li, Qiuxiang Zhang, and Kent Keyser (2010) Parallel optical monitoring of visual signal propagation from the photoreceptors to inner retina layers. Optics Letters Accepted: 23 April 2010 Posted: 6 May 2010 Doc. ID: 125382

Yi-Chao Li,5, Wan-Xing Cui, Xu-Jing Wang, Franklin Amthor, Rong-Wen Lu, Anthony Thompson, and Xin-Cheng Yao (2010) Intrinsic optical signal imaging of glucose-stimulated insulin secreting β-cells Optics Express, J. Opt. Soc. Amer.Vol. 19, Issue 1, pp. 99-106 (2011).

Hopkins IM, Gower MW, Perez TA, Smith DS, Amthor FR, Wimsatt C, and Biasini FJ. (2011) Avatar Assistant: Improving Social Skills in Students with an ASD Through a Computer-Based Intervention.
J Autism Dev Disord. in press DOI: 10.1007/s10803-011-1179-z

Nowak PN, Dobbins AC, Gawne TJ, Grzywacz NM and Amthor FR (2011) Separability of stimulus parameter encoding by on-off directionally selective rabbit retinal ganglion cells. J. Neurophysiol. 105(5):2083-99.

Hopkins, IM; Gower, MW; Perez, TA; Smith, DS; Amthor, FR; Casey Wimsatt, F; Biasini, FJ
(2011) Avatar Assistant: Improving Social Skills in Students with an ASD Through a Computer-Based Intervention. J Autism Dev Disord 41, 15430.

Y.C. Li, W.X. Cui, X.J. Wang, F. Amthor, R.W. Lu, A. Thompson, and X.C. Yao. Intrinsic optical signal imaging of glucose-stimulated insulin secreting β-cells, Optics Express 19: 99-106 (2011)

Li YC, Cui WX, Wang XJ, Amthor F, Lu RW, Thompson A, Yao XC. (2011) Intrinsic optical signal imaging of glucose-stimulated insulin secreting ß-cells. Optics Express 01/2011; 19(1):99-106.

X. C. Yao, W.X. Cui, Y. C. Li, W. Zhang, R. W. Lu, A. Thompson, F. Amthor, X.J. Wang (2012) Functional imaging of glucose-evoked rat islet activities using transient intrinsic optical signals. Journal of Modern Optics 01/2012; 59(7):843-847. DOI:230459 .

Burge WK, Ross LA, Amthor FR, Mitchell WG, Zotov A and Visscher, KM (2013) Processing speed training increases the efficiency of attentional resource allocation in young adults. Front. Hum. Neurosci., 7:684. doi: 10.3389/fnhum.2013.00684.

Layfield S1, Burge W2, Mitchell W3, Ross L4, Denning C5, Amthor F2, Visscher K (2014) The effect of speed of processing training on microsaccade amplitude. PLoS One. Sep 23;9(9): e107808. doi: 10.1371/journal.pone.0107808.

Strang CE, Long Y, Gavrikov KE , Amthor FR and Keyser KT (2015) Nicotinic and muscarinic acetylcholine receptors shape ganglion cell response properties. J. Neurophysiol 113:203-217; doi:10.1152/jn.00405.2014

Manuscripts in press or submitted.

Timothy J. Gawne ,Allan C. Dobbins, Carl E. Stevens, Jr. and Franklin R. Amthor (2015) The Responses of On-Off Directionally Selective Retinal Ganglion Cells to Sudden Motion-Onset (rejected by Visual Neuroscience for significance, to be resubmitted to J. Neurophysiol)

Manuscripts being revised or in final stages of preparation:

Timothy J. Gawne ,Allan C. Dobbins, Carl E. Stevens, Jr. and Franklin R. Amthor (2015) On-Off Directionally Selective Retinal Ganglion Cells' Responses to Speed Variation at Motion-Onset

BOOKS

Neuroscience for Dummies. Wiley. (2011)
The Phoenix War. Sam's Dot Publications 2012 (science fiction novel)
Neurobiology for Dummies (2014)

Book Chapters and non-peer reviewed PUBLICATIONS

Amthor FR. (1980) Multiplier increases resolution of standard shaft encoders. *Electronics* 53(20):139.

Amthor FR (1985) Quantitative analysis and three dimensional color reconstruction of retinal ganglion cells, Chapter in: *The Microcomputer in Cell and Neurobiology Research*, R. Ranney Mize, ed., pp. 135-153, Elsevier Press, New York.

Grzywacz NM, and **Amthor** FR (1989) A computationally robust anatomical model for retinal directional selectivity. Advances in Neural Information Processing Systems I. David S. Touretzky, ed. pp. 477-484, Morgan Kaufman, San Mateo,CA.

Amthor FR and Grzywacz NM (1993) Directional Selectivity in Vertebrate Retinal Ganglion Cells. Visual Motion and its Role in the Stabilization of Gaze, FA Miles, ed., Elsevier Press, The Netherlands.

Grzywacz NM, Harris JM and **Amthor** FR (1994) Computational and neural constraints for the measurement of local visual motion. Visual Detection of Motion., Snowdon, ed., Academic Press, Ltd.

Grzywacz NM, Sernagor E and **Amthor** FR (1995) Function, mechanism and development of retinal directional selectivity. Handbook of Brain Theory and Neural Networks, MA Arbib, ed. Bradford Books, MIT Press, Cambridge.

Amthor F, Dobbins A and Gawne T (2014) The Responses of On-Off Directionally Selective Retinal Ganglion Cells to Sudden Motion-Onset Journal of Vision August 22, 2014 vol. 14 no. 10 article 284 doi: 10.1167/14.10.284

Media (Podcasts)

"Neurobiology for Dummies" (BSP 110) http://brainsciencepodcast.com/bsp/2014/110-amthor

peer-reviewed ABSTRACTS

Amthor FR (1980) Some quantitative characteristics of the responses of frog retinal ganglion cells. *Dissert. Abstra. Int*. 40(8): 3840B.

Amthor FR, Wolbarsht ML and Ringo J (1980) Functional implications of ON-OFF response variation in frog retina. *Invest. Ophthal. Vis. Sci. Suppl.* p.277.

Amthor FR, Oyster CW and Takahashi ES (1980) Morphological classification of rabbit retinal ganglion cells. *Soc. Neurosci. Abstr*. 6:213.

Amthor FR, Oyster CW and Takahashi ES (1981) Quantitative classification of retinal ganglion cell morphology. *Invest. Ophthal. Vis. Sci. Suppl*. 20(3):204.

Amthor FR, Oyster CW and Takahashi ES (1982) Structure/function correlations of rabbit retinal ganglion cells. *Invest. Ophthal. Vis. Sci. Suppl.* **22(3)**:279.

Amthor FR, Oyster CW and Takahashi ES (1982) Morphology of physiologically identified retinal ganglion cells. *Neurosci Abstr.* **8**:133.

Amthor FR, Oyster CW and Takahashi ES (1983) Morphology of direction selective ganglion cells in rabbit retina. *Invest. Ophthal. and Vis. Sci. Suppl.* 24(3):204.

Amthor FR, Oyster CW and Takahashi ES (1983) Do major physiological retinal ganglion cell classes have distinct morphologies? *Neurosci. Abstr.* 9:896.

Jackson, CA and **Amthor**, FR. (1984) Morphology of retinal ganglion cells in the ferret. *Invest. Ophthal. Vis. Sci. Suppl*. **25(3)**:204.

Amthor FR (1984) Computer morphometric analysis of neuronal dendritic branching. *Neurosci Abstr.* 10(1):426.

Amthor FR, Oyster CW and Takahashi ES (1984) Morphological substrates of receptive field properties of rabbit retinal ganglion cells. *Invest. Ophthal. Vis. Sci. Suppl.* **25(3)**:204.

Mistler LA, **Amthor** FR and Koch C. (1985) Modeling HRP-injected, physiologically identified direction-selective ganglion cells in rabbit retina. *Invest. Ophthal. Vis. Sci. Suppl.* **26(3)**:165.

Amthor FR, Oyster CW and Takahashi ES (1986) Quantitative morphometric characteristics of physiologically identified rabbit retinal ganglion cells. *Invest. Ophthal. Vis. Sci. Suppl.* **27(3)**:332.

Godwin DW and **Amthor** FR (1986) Use of Asymmetric Contrast Microscopy for Intracellular Injection of Retinal Ganglion Cells. *Invest. Ophthal. Vis. Sci. Suppl.* **27(3)**:332.

Amthor FR, Mistler LA and Grzywacz NM. (1987) Experimental analysis of the nonlinear mechanism of direction selectivity in rabbit retinal ganglion cells. *Invest. Ophthal. and Visual Sci.* **28(3)**:405

Amthor FR, Grzywacz NM and Mistler LA. (1987) The mechanism of direction selectivity in rabbit retinal ganglion cells. *Neurosci. Abst.* **13(2)**:1052.

Amthor FR and Grzywacz NM (1988) The time course of inhibition and the velocity independence of direction selectivity in the rabbit retina. *Invest. Ophthal. Vis. Sci. Suppl.* **29**:225.

Grzywacz NM, **Amthor** FR and Borg-Graham L (1988) The inhibition of direction selective ganglion cells in the rabbit retina has both hyperpolarizing and shunting components. *Invest. Ophthal. and Vis. Sci. Suppl.* **29**:294

Amthor FR. (1988) Quantitative/fractal analysis of dendritic trees of identified rabbit retinal ganglion cells. *Neurosci. Abst.* **14(1)**:603.

Pu ML and **Amthor** FR. (1988) Identities of LGN projecting rabbit retinal ganglion cells. *Neurosci. Abst.* **14(1)**:603.

Grzywacz NM and **Amthor** FR. (1988) What are the directionally selective subunits of rabbit retinal ganglion cells? *Neurosci. Abst.* **14(1)**:603.

Grzywacz NM, and **Amthor** FR (1988) A model for neural directional selectivity that exhibits robust direction of motion computation. IEEE conference on Neural Information Processing Systems - Natural and Synthetic. Proceedings published as <u>Advances in Neural Information Processing Systems</u> I. David S. Touretzky, ed. pp. 477-484, Morgan Kaufman, San Mateo,CA.

Grzywacz NM and **Amthor** FR. (1989) Facilitation in On-Off directionally selective ganglion cells of the rabbit retina. *Neurosci. Abstr*. **15(1)**:969

Pu ML and **Amthor** FR. (1989) Central projections of rabbit retinal ganglion cells. *Neurosci. Abstr*. **15(1)**:969.

Amthor FR and Grzywacz NM (1990) On-Off directionally selective ganglion cells are inhibited by two distinct mechanisms in rabbit retina. *Invest. Ophthal. Vis Sci.* 31(5):115.

Merwine DK, **Amthor** FR and Grzywacz NM (1990) Ganglion cell surround inhibition is divisive, not linear, in rabbit retina. *Invest. Ophthal. Vis Sci.* 31(5):115.

Merwine DK and **Amthor** FR (1990) Ganglion cell surround inhibition is divisive, not linear, in rabbit retina. *Neurosci. Abstr.* 16(1):466.

Merwine DK, **Amthor** FR and Grzywacz NM (1991) Characteristics of divisive ganglion cell surround inhibition in the rabbit retina. *Invest. Ophthal. Vis Sci.* 32(4):1132.

Grzywacz NM and **Amthor** FR (1991) Independent On and Off computations of retinal directional selectivity in rabbit. *Neurosci. Abstr.* 17(1):344.

Amthor FR and Grzywacz NM (1992) Response of rabbit directionally selective ganglion cells to moving gratings and plaids. *Invest. Ophthal. Vis Sci.* 33(4):907.

Grzywacz NM and **Amthor** FR (1992) Quantitative fits of an amacrine model of directional selectivity to rabbit data. *Neurosci. Abstr.* 18(1):393.

Merwine DK and **Amthor** FR (1992) Rabbit retinal ganglion cell surround mechanisms: physiology and pharmacology. *Neurosci. Abstr.* 18(1):394.

Amthor FR, Tootle JS and Oyster CW (1993) Dendritic morphologies and sublamination pattern of physiologically identified rabbit retinal ganglion cells. *Invest. Ophthal. Vis Sci.* **34(4)**:985.

Grzywacz NM and **Amthor** FR (1993) Tests of an asymmetric amacrine cell model for retinal directional selectivity. *Invest. Ophthal. Vis Sci.* **34(4)**:1292.

Merwine DK, **Amthor** FR and Grzywacz NM (1993) A pharmacological analysis of rabbit retinal ganglion cell surround inhibition. *Invest. Ophthal. Vis Sci.* **34(4)**:1332.

Amthor FR and Oyster CW (1993) Relation between preferred direction and dendritic organization of identified, contacting on-off ds ganglion cells and ach. Amacrine cells in rabbit retina. *Neurosci. Abstr.* 19(2):1258.

Grzywacz NM, **Amthor** RF and Merwine DK. (1993) Extra receptive field facilitation in rabbit's retinal directional selectivity. *Neurosci. Abstr.* 19(2):1258.

Tjepkes DS, **Amthor** FR and Tucker DC. (1993) Morphological and physiological identification of the rabbit retinal ganglion cell that projects to the suprachiasmatic nucleus. *Neurosci. Abstr.* 19(2):1417.

Tjepkes DS, **Amthor** FR (1993) The role of NMDA channel blockade by magnesium channel ions on the responses of On-Off directionally selective rabbit retinal ganglion cells. *Invest. Ophthal. Vis Sci.* **39(4)**: S433.

Amthor FR, Oyster CW and Grzywacz NM (1994) Retinal coverage and physiological inputs to directionally selective rabbit retinal ganglion cells. *Invest. Ophthal. Vis Sci.* **35(4)**:2065.

Amthor FR and Grzywacz NM. (1994) Morphogical and physiological basis of starburst-ach Amacrine input to directionally selective (DS) ganglion cells in rabbit retina. *Neurosci. Abstr*. **20**: 217.

Grzywacz NM, **Amthor** FR and Dacheux RF (1995) Are cholinergic synapses to directionally selective ganglion cells spatially asymmetric? *Invest. Ophthal. Vis Sci Suppl*. **36(4)**: S865.

Amthor FR and Grzywacz NM (1995) Morphological and physiological basis of starburst-Ach amacrine input to directionally selective (DS) ganglion cells in rabbit retina. *Neurosci. Abstr*. **21**: 508.

Grzywacz NM, **Amthor** FR and Merwine DK (1996) Pharmacological evidence for two asymmetric pathways in rabbit retinal directional selectivity. *Invest. Ophthal. Vis Sci.* **37(3)**:S689.

Amthor FR, Grzywacz NM, Keyser KT and Dacheux RF(1997) Contribution of cholinergic amacrine cells to directional selectivity in rabbit retinal ganglion cells. *Invest. Ophthal. Vis Sci.* **38(4)**:S949.

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RESEARCH INTERESTS AND GOALS

My career has been devoted to understanding neural computation, both for its own sake, and for the sake of making neural prosthesis that restore and augment human function. My specific research has been to investigate complex neural computations in retinal ganglion cells, the first locus in the visual system of highly specific and nonlinear analyses such as motion and directional selectivity.

The response properties of retinal ganglion cells arise from bipolar and amacrine cell inputs interacting with mechanisms exhibited by ganglion cells' dendritic trees. The first task I took on as a retinal researcher was to identify, by intracellular recording and staining, all the major ganglion cell classes in a mammalian retina (rabbit), including directionally selective, orientation-selective and edge-detecting ganglion cells. My colleagues and I have shown that the morphologies of at least 20 different physiological classes of rabbit retinal ganglion cells are distinct, and typically associated with important physiological properties of each class. Most of these classes are likely to be highly conserved across mammals, including primates.

Following this necessary, pioneering, and now "classic" work, I have investigated the retinal circuitry and mechanisms underlying complex receptive field properties such as directional selectivity, including the receptor types exhibited by various ganglion cell classes, and their projection targets in the brain in order to understand the role of different ganglion cell classes in various aspects of visual acuity and perception.   These investigations have used virtually the entire suite of single cell neurophysiological techniques, including single cell extracellular recording, sharp electrode intracellular recording and staining, patch clamp recording, optical imaging with both calcium and potentiometric dyes, dual electrode recording, and, most recently, microelectrode array recording. This research has been supported by the NEI over a continuous, 20 year period of support. Some computational aspects were also supported by the Sloan Foundation and the Office of Naval Research, while the EyeSight Foundation of Alabama has supported some efforts having clinical implications.

Most recently I have sought to determine how this entire ensemble of mammalian retinal ganglion cells apportions and codes information about the visual environment for transmission to the brain. I am particularly interested in how the temporal coherence of firing among nearby ganglion cells may help "bind" or code aspects of the visual input beyond the firing rate of any one cell by itself. Some have argued that such coherent firing underlies not only attention, but consciousness itself. In order to do this I have developed a unique microelectrode array for recording from retinal ganglion cells. This array has properties that may be optimal for also stimulating neurons in a neural prosthesis that could be used in the retina or other regions of the CNS. UAB has sought patent protection for some of the intellectual property stemming from this research.

My current interests involve further translating my basic research on the retina to the development of neural prostheses both for the visual system and for other disabilities. The penetrating microelectrode arrays I have developed have the capabilities of high bio-compatibility in terms of materials and mechanical flexibility, as well as very large size electrode counts. I also have two other active projects involving haptic (skin) stimulation to improve mobility in blind and low vision patients. I believe that combining a variety of interfaces between humans and computational machinery is the most promising approach for replacing functions lost, such as vision or paralysis.

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