

Biomedical Engineering

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Core Faculty Profile

Robert A. Linsenmeier

Professor, Biomedical Engineering and Neurobiology & Physiology (WCAS)
Member, Northwestern University Interdepartmental Neuroscience Program (NUIN)

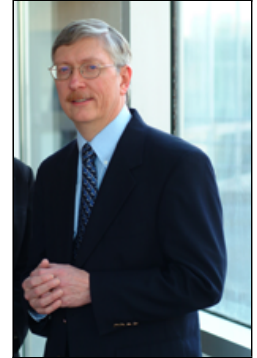
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Robert A. Linsenmeier

Research Interests

We are interested in the microenvironment in which the neurons of the retina work. Studying the distribution and regulation of ions, substrates and metabolites allows us to understand aspects of cell biology, physiology and energy metabolism in the intact retina. Also, many blinding diseases are caused by problems with the vasculature and its ability to supply nutrients to the tissue. Our work, funded by the National Eye Institute since 1983, provides insight into these diseases.

Our recent work has been on the oxygenation of the cat retina, a good model for the human retina in many respects. We use oxygen-sensitive microelectrodes that measure oxygen levels with excellent spatial resolution. Simultaneously we measure local neural activity to provide an index of retinal function. The oxygen distribution in the retina of higher mammals is particularly interesting; oxygen is a critical nutrient, and it is supplied to the retina by two independent circulations, the retinal and choroidal, which have very different properties. The focus of our current work is to understand the relationships between oxidative and glycolytic metabolism in the retina, and to work on animal model for diseases such as retinal vascular occlusion, diabetic retinopathy, and retinal detachment.

Another area of interest is in engineering education. Through the VaNTH Engineering Research Center in Bioengineering Educational Technologies (www.vanth.org), and now through the Northwestern Center for Engineering Education Research, we study ways in which bioengineers learn, how to improve their education, and what the curriculum is at present and what it should be in the future (www.vanth.org/curriculum).

Research and Professional Activities

- Principal Investigator, Microenvironment of the Retina, NIH/National Eye Institute
- Associate Director, Multidisciplinary Visual Sciences Training Program, NIH/NEI
- Associate Director and Site Leader, VaNTH Engineering Research Center in Bioengineering Educational Technologies
- Co-Director, Northwestern Center for Engineering Education Research (NCEER)
- Vice President, American Institute of Medical and Biological Engineering, 2005-2007
- Conference Chair, Biomedical Engineering Society Annual Meeting, Chicago, IL, October, 2006
- Chair, Academic Council, American Institute of Medical and Biological Engineering, 2002
- Project Director, Development of Undergraduate and Graduate Programs in Medical Imaging, Whitaker Foundation Special Opportunity Award, 1999-2005

Selected Publications

1. Padnick-Silver, L and Linsenmeier, R.A. (2002) Quantification of in vivo anaerobic metabolism in the normal cat retina through pH measurements. Visual Neuroscience, 19: 793-806.
2. Wangsa-Wirawan, N. and Linsenmeier, R.A. (2003) Retinal oxygen: fundamental and clinical aspects. Archives of Ophthalmology, 121: 547-557.
3. Linsenmeier, R.A.. (2003) Defining the undergraduate biomedical engineering curriculum. IEEE Engineering in Medicine and Biology Magazine, in press.
4. Birol, G., Budzynski, E., Wangsa-Wirawan, N., and Linsenmeier, R.A. (2004) Hyperoxia promotes electroretinogram recovery following retinal artery occlusion in cat. Invest. Ophthalmol. Visual Sci. 45: 3690-3696
5. Birol, G.B., Budzynski, E., Wangsa-Wirawan, N.D., and Linsenmeier, R.A. (2005) Retinal arterial occlusion leads to acidosis in the cat. Exp. Eye Res. 80 (4): 527-533 2005
6. Budzynski, E., Padnick-Silver, L., Wangsa-Wirawan, N.D., Hatchell, D.L., and Linsenmeier, R.A. (2005) Intraretinal pH distribution in diabetic cats, Current Eye Research 30: 229-240.
7. Padnick-Silver, L and Linsenmeier, R.A. (2005) Effect of hypoxemia and hyperglycemia on pH and anaerobic metabolism in the intact cat retina. Archives of Ophthalmology 123:1684-1690.
8. Kolikant, Y.B-D., Gatchell, D.W., Hirsch, P.L. and Linsenmeier, R.A. (2006) A Cognitive-Apprenticeship-Inspired Instructional Approach for Teaching Scientific Writing and Reading, J College Science Teaching, in press.
9. Kang Derwent, J.J., Padnick-Silver, L., McRipley, M., Giuliano, E., Linsenmeier, R.A. and Narfstrom, K. (2006). The electroretinogram (ERG) components in Abyssinian cats with hereditary retinal degeneration, Invest. Ophthalmol. Visual Sci., 47: 3673-3682.
10. Padnick-Silver, L., Kang Derwent, J.J., Giuliano, E.Narfstrom, K.N., and Linsenmeier, R.A. (2006) Retinal oxygenation and oxygen metabolism in Abyssinian cats with a hereditary retinal degeneration, Invest. Ophthalmol. Visual Sci., 47: 3683-3689.
11. Wang, S. and Linsenmeier, R.A. (2007) Hyperoxia improves oxidative metabolism in the detached feline retina. Invest. Ophthalmol. Visual Sci. 48: 1335-1341.
12. Budzynski E, Smith JH, Bryar P, Birol G, Linsenmeier RA. (2008). Effects of photocoagulation on intraretinal PO₂ in cat. Invest Ophthalmol Vis Sci. 49(1):380-9.
13. Crosson LA, Kroes RA, Moskal JR, Linsenmeier RA. (2009). Gene expression patterns in hypoxic and post-hypoxic adult rat retina with special reference to the NMDA receptor and its interactome. Mol Vis. 15:296-311. Epub 2009 Feb 9.

[Link to Full List of Publications](#)

Honors & Awards

- Fellow, American Institute of Medical and Biological Engineering, 1999
- Fellow, Biomedical Engineering Society, 2005
- Bette and Neison Harris Professor of Teaching Excellence, Northwestern University 2003 - 2006

Personal

I am married to Joan A. W. Linsenmeier, who divides her working time between the Psychology Department and the Dean's office in the Weinberg College of Arts and Sciences at Northwestern. We have three children, all of whom will soon have Northwestern degrees, David, Katherine, and Jeremy. At present I teach Animal Physiology in the Biology Program, and a part of Human Systems Physiology (renal, digestive, endocrine, metabolic) and Introduction to BME for Biomedical Engineering.

