

EDUCATION

2000-2008	Northwestern University Northwestern University Institute for Neuroscience Ph.D.	Evanston, IL
1996-2000	University of St. Thomas B.A. Biology (<i>Magna Cum Laude</i>) Minor: Chemistry	St. Paul, MN

POSTGRADUATE TRAINING

2009-2015	University of Washington Department of Ophthalmology Senior Fellow Dr. Russell Van Gelder, research advisor	Seattle, WA
2009	ReSet Therapeutics Biotechnology consultant	Evanston, IL

FACULTY POSITIONS HELD

2015-present	University of Washington Research Assistant Professor Department of Ophthalmology Vision Science Center	Seattle, WA
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HONORS & AWARDS

2011	Ruth L. Kirschstein National Research Service Award for Postdoctoral Fellows- F32 (NEI) #EY021104-01A1
2010	Postdoctoral Award Fight for Sight FFS-PD-10-041
2008	Research Merit Award Society for Research on Biological Rhythms (SRBR)

PROFESSIONAL ORGANIZATIONS

2013-present	ARVO
2015-present	Optical Society of America
2012-present	Society for Research on Biological Rhythms

TEACHING EXPERIENCE

- Spring 2010- 2012 Guest Lecturer
University of Washington Seattle, WA
Undergraduate course Biology of Biological Clocks
Course Instructor: Dr. Horacio de la Iglesia
- Fall 2004, 2005, 2006 Tutor
Northwestern University Evanston, IL
SERTS biology tutorial section of Biology in the Information Age
Course Instructor: Dr. Teresa Horton
- I taught groups of four to five non-science major undergraduate students about laboratory research. I then designed short lab research experiments for them to perform under my supervision.
- Spring 2002 Teacher's Assistant
Northwestern University Evanston, IL
Cell Biology and Physiology
Course Instructors: Dr. Linda Hicke and Dr. Tracy Hodgson
- Fall 2001 Teacher's Assistant
Northwestern University Evanston, IL
Biology in the Information Age
Course Instructor: Dr. Teresa Horton

RESEARCH FUNDING

- 2012-2014 Principal Investigator: Identity and functional properties of the retinal circadian clock.
- Project includes the analysis of retinal clocks in "blind" mice, characterization of the entrainment properties, and ontogeny of retinal circadian clocks. Mentor: Russell Van Gelder
- 2010 Recipient of the Fight for Sight Postdoctoral Award
- This award allowed for molecular characterization of mouse retinas under controlled lighting paradigms. Mentor: Russell Van Gelder
- 2003 Multidisciplinary Visual Sciences Training Grant
- 2001 Predoctoral Training Grant: Neuroscience in the Early Years

BIBLIOGRAPHY

Research articles:

1. **Buhr ED**, Yue WW, Ren X, Jiang Z, Liao HW, Mei X, Vemaraju S, Nguyen MT, Reed RR, Lang RA, Yau KW, Van Gelder RN (2015) Neuropsin (OPN5)-mediated photoentrainment of local circadian oscillators in mammalian retina and cornea. *Proc Natl Acad Sci USA* 112(42): 13093-8.
2. **Buhr ED** and Van Gelder RN. (2014) Local photic entrainment of the retinal circadian oscillator in the absence of rods, cones, and melanopsin. *Proc Natl Acad Sci USA* 111(23): 8625-30.
3. Shimomura K, Kumar V, Koike N, Kim TK, Chong J, **Buhr ED**, Whiteley AR, Low SS, Omura C, Fenner D, Owens JR, Richards M, Yoo SH, Hong HK, Vitaterna MH, Bass J, Pletcher MT, Wiltshire T, Hogenesch J, Lowrey PL, Takahashi JS. (2013) *Usp1*, a suppressor of the circadian *Clock* mutant, reveals the nature of the DNA-binding of the CLOCK:BMAL1 complex in mice. *Elife* Apr9;2:e00426.
4. Chen Z, Yoo SH, Park YS, Kim KH, Wei S, **Buhr E**, Ye ZY, Pan HL, Takahashi JS. (2012) Identification of diverse modulators of central and peripheral circadian clocks by high-throughput chemical screening. *Proc Natl Acad Sci USA* 109(1): 101-6.
5. Owens L, **Buhr E**, Tu DC, Lamprecht TL, Lee J, Van Gelder RN. (2012) Effect of circadian clock gene mutations on nonvisual photoreception in the mouse. *Invest Ophthalmol Vis Sci* 53(1): 454-60.
6. **Buhr ED**, Yoo SY, and Takahashi JS. (2010) Temperature as a universal resetting cue for mammalian circadian oscillators. *Science* 330(6002): 379-85.
7. Ko CH, Yamada YR, Welsh DK, **Buhr ED**, Liu AC, Zhang EE, Ralph MR, Kay SA, Forger DB, Takahashi JS. (2010) Emergence of noise-induced oscillations in the central circadian pacemaker. *PLoS Biol* 8(10): e1000513.
8. Marcheva B, Ramsey KM, **Buhr ED**, Kobayashi Y, Su H, Ko CH, Ivanova G, Omura C, Mo S, Vitaterna MH, Lopez JP, Philipson LH, Bradfield CA, Crosby SD, JeBailey L, Wang X, Takahashi JS, Bass J. (2010) Disruption of the clock components CLOCK and BMAL1 leads to hypoinsulinaemia and diabetes. *Nature* 466(7306): 627-31.
9. Shimomura K, Lowrey PL, Vitaterna MH, **Buhr ED**, Kumar V, Hanna P, Omura C, Izumo M, Low SS, Barrett RK, La Rue SI, Green CB, Takahashi JS. (2010) Genetic suppression of the circadian *Clock* mutation by the melatonin biosynthesis pathway. *Proc Natl Acad Sci USA* 107(18): 8399-403.
10. Ramsey KM, Yoshino J, Brace CS, Abrassart D, Kobayashi Y, Marcheva B, Hong HK, Chong JL, **Buhr ED**, Lee C, Takahashi JS, Imai S, Bass J. (2009) Circadian clock feedback cycle through NAMPT-mediated NAD⁺ biosynthesis. *Science* 324(5927): 651- 4.
11. Liu AC, Welsh DK, Ko CH, Tran HG, Zhang EE, Priest AA, **Buhr ED**, Singer O, Meeker K, Verma IM, Doyle FJ 3rd, Takahashi JS, and Kay SA. (2007) Intercellular coupling confers robustness against mutations in the SCN circadian clock network. *Cell* 129(3): 605-616.
12. Vitaterna MH, Ko C, Chang AM, **Buhr ED**, Fruechte EM, Schook A, Turek FW. (2006) The mouse *Clock* mutation reduces circadian pacemaker amplitude and enhances efficacy of resetting stimuli and phase-response curve amplitude. *Proc Natl Acad Sci USA* 103(24): 9327-9332.

Research articles (cont.):

13. Yoo SH, Ko C, Lowrey PL, **Buhr ED**, Song EJ, Chang S, Yoo OJ, Yamazaki S, Lee C, and Takahashi JS. (2005) A noncanonical E-box enhancer drives mouse Period2 circadian oscillations in vivo. *Proc Natl Acad Sci USA* 102(7): 2608-2613.
14. Yoo SH, Yamazaki S, Lowrey PL, Shimomura K, Ko C, **Buhr ED**, Siepka SM, Hong HK, Oh WJ, Yoo OJ, Menaker M, and Takahashi JS. (2004) PERIOD2::LUCIFERASE real-time reporting of circadian dynamics reveals persistent circadian oscillations in mouse peripheral tissues. *Proc Natl Acad Sci USA* 101(16): 5339-5346.

Book Chapters:

Buhr ED & Takahashi JS. (2013) Genetic control of the circadian pacemaker. *The Genetic Basis of Sleep and Sleep Disorders. Cambridge University Press: 119-126.*

Buhr ED & Takahashi JS. (2013) Molecular components of the mammalian circadian clock. *Handbook of Experimental Pharmacology. (217): 3-27.*

Review Articles:

Van Gelder RN & **Buhr ED** (2016) Ocular Photoreception for Circadian Rhythm Entrainment in Mammals. *Annu Rev Vis Sci* 2:12.1-12.17

Buhr E & Van Gelder RN. (2014) The Making of the Master Clock. *Elife* Aug20;3:e04014.

Sexton T, **Buhr E**, and Van Gelder RN. (2012) Melanopsin and mechanisms of non-visual ocular photoreception. *J Biol Chem* 287(3): 1649-56.

Abstracts:

Buhr E.D. & Van Gelder R.N. (2016) Opn5-mediated regulation of clock genes in the mouse retina. *Association for Research and Vision Ophthalmologists.* (Poster)

Buhr E.D. & Van Gelder R.N. (2015) The influence of spectral cues on behavioral entrainment and circadian period in constant light. *Gordon Research Conference: Chronobiology.* (Poster)

Buhr E.D. & Van Gelder R.N. (2013) Short wavelength light entrains local circadian clocks in the retina. *Gordon Research Conference: Chronobiology.* (Poster)

Buhr E.D. & Van Gelder R.N. (2012) Melanopsin is required for rapid entrainment to shifted cycles of light and dark. *Society for Research on Biological Rhythms.* (Poster)

Buhr E.D. & Van Gelder R.N. (2011) Light sensitivity of the retinal circadian clock in mice. *Gordon Research Conference: Chronobiology.* (Poster)

Buhr E.D., Yoo S.Y., and Takahashi J.S. (2008) Organotypic cultures of mouse peripheral tissues display strong phase resetting in response to temperature pulses within the physiological core body temperature range. *Society for Research on Biological Rhythms* 204. (Poster)

Abstracts (cont.):

Buhr E.D., Wilsbacher L.D., Antoch M.P., and Takahashi J.S. (2006) BAC transgenes over-expressing *Clock* and *Bmal-1* reveal that *Clock* is rate-limiting in the control of circadian periodicity. *Society for Research on Biological Rhythms* 255. (Poster)

Ko C., **Buhr E.D.**, Liu A.C., Zhang E., Ralph M.R., Kay S.A., and Takahashi J.S. (2006) Differential effects of Cryptochrome mutations on central and peripheral circadian expression of PERIOD2::LUCIFERASE in mice. *Society for Research on Biological Rhythms* 103.

Brown D.A., **Buhr E.**, Schmit B., and Brooke J.D. (2001) Soleus H reflex depression can be overridden with high background soleus muscle activity during the flexion phase of cycling. *Society for Neuroscience Abstracts* 936.5.

Buhr E.D., Laliberte M.A., Lutterman A.A., and Nelson D.E. (1999) Sensitivity of the mouse circadian system to photic stimulus duration and intensity. *Society for Neuroscience Abstracts* 140.11. (Poster)

INVITED LECTURES

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| 2016 | Society for Research on Biological Rhythms
Biannual meeting
“OPN5-mediated photoentrainment of retinal circadian clocks” | Palm Harbor, FL |
| 2016 | Gordon Research Conference:
Photosensory receptors and Signal Transduction meeting
“OPN5-mediated photoentrainment of retinal circadian clocks” | Galveston, TX |
| 2015 | European Biological Rhythms Society
Annual meeting
“Photic entrainment of local circadian clocks in the mouse retina by non-canonical photoreceptors” | Manchester, UK |
| 2014 | Society for Research on Biological Rhythms
Biannual meeting
“The retinal circadian clock entrains to light: dark cycles in the absence of rods, cones, and melanopsin” Buhr E.D. & Van Gelder R.N. | Big Sky, MT |
| 2014 | Center for Integrative Neuroscience Symposium
“Light sensitive circadian clocks in the retina” | Seattle, WA |
| 2013 | Association for Research and Vision Ophthalmologists
Annual Meeting
“The photoentrainment of circadian clocks in the mammalian retina”
Buhr E.D. & Van Gelder R.N. | Seattle, WA |

EDITORIAL RESPONSIBILITIES

Journals Refereed (ad hoc):

Investigative Ophthalmology and Visual Sciences, Neurology, PLoS One