BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Carl Hirschie Johnson	Professor
eRA COMMONS USER NAME (credential, e.g., agency login) CJOHNSON04	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Texas, Austin, TX	BA	1976	Liberal Arts
Stanford University, Stanford, CA	PhD	1982	Biology
Harvard University, Cambridge, MA	Post Doc	1982-1987	Cell & Developmental Biology

A. Personal Statement

My lab studies daily biological clocks in a variety of organisms, and we use luminescence as a tool to monitor these clocks. In mammals, our lab uses transgenic mice and mammalian fibroblasts expressing different kinds of light-emitting enzymes ("luciferases") to monitor rhythms of gene expression and calcium levels by the rhythmic glow of the reporter luciferase. Therefore, our lab uses luminescence as a tool to monitor circadian rhythms in the brain and in cell cultures. These studies are directed towards understanding the calcium signal transduction pathway to the core clock and the role of clock genes in the fundamental mammalian clockwork. We have recently extended our studies to the genetics of the human biological clock. We are examining clock gene polymorphisms in human populations to determine how the neurogenetics of the biological clock affects our ability to adapt to shiftwork cycles and how it can influence mental health (esp. depression). I have been a professor at Vanderbilt University for 22 years. During those twenty-two years, I have mentored the research projects in my laboratory of 22 postdoctoral fellows (6 currently), 8 Ph.D. students (2 currently), 5 Master's students (none currently), and 64 undergraduates (7 currently). My students have been successful in their professional careers, that include (1) being professors at University of Texas Southwestern Medical Center, Central Missouri State University, Western Kentucky University, Kenyon College, and Hebei Normal University (China), (2) postdoctoral fellowships at prestigious universities in the USA and Japan, and (3) in the case of my undergraduate students becoming physicians, graduate students, pharmacists, and businesspersons. I have also regularly organized and run journal clubs. I have organized symposia at annual meetings of the American Society of Microbiology and the Society for Research on Biological Rhythms and have participated in graduate/postdoctoral training sessions at those meetings. I have served on the committees of numerous graduate students at Vanderbilt other than my own students. I participate in the journal club organized in conjunction with the Neurosciences Training Grant and related training of students at Vanderbilt. I am therefore well acquainted and experienced in the challenges and issues of graduate/postdoctoral mentoring.

B. Positions and Honors

1987-1994 Assistant Professor, Department of Biology, Vanderbilt University
1994-1999 Associate Professor, Department of Biology, Vanderbilt University
1999-Pres Professor, Department of Biological Sciences, Vanderbilt University

Awards and Other Professional Activities

1975 Phi Beta Kappa, University of Texas at Austin
1976 Ettlinger Award for Outstanding Plan II student (University of Texas)

1976-1979 National Science Foundation Graduate Fellowship
1979 MBL Physiology Course
1982-1985 National Institutes of Health Postdoctoral Fellowship (NRSA F32 GM08288)
1983 MBL Analytical and Quantitative Light Microscopy Course, MBL, Woods Hole, MA
1986 Jean and Katsuma Dan Fellow (for 3 months research in Japan)
1988 Visiting Lecturer, University of Tsukuba, Japan
1992 Ampere Fellowship, Ibaraki University, Japan
1994-2004 Research Scientist Development Award from the NIMH (K02 MH01179)
2005 Chancellor's Research Award, Vanderbilt University

C. Selected peer-reviewed publications (in chronological order)

Johnson, C. H., J. F. Roeber, and J. W. Hastings. 1984. Circadian changes of enzyme concentration account for rhythm of enzyme activity in Gonyaulax. *Science 223*: 1428-1430.

Dube, F., T. Schmidt, C. H. Johnson, and D. Epel. 1985. The hierarchy of requirements for an elevated intracellular pH during early development of sea urchin embryos. *CELL 40*: 657-666.

Johnson, C. H. 1990. An Atlas of Phase Response Curves for Circadian and Circatidal Rhythms. Dept. of Biology, Vanderbilt University, 715 pp.

Kondo, T., C. A. Strayer, R. D. Kulkarni, W. Taylor, M. Ishiura, S. S. Golden, and C. H. Johnson. 1993. Circadian rhythms in prokaryotes: luciferase as a reporter of circadian gene expression in cyanobacteria. *Proc. Natl. Acad. Sci. USA 90*: 5672-5676.

Kondo, T., N. F. Tsinoremas, S. S. Golden, C. H. Johnson, S. Kutsuna, and M. Ishiura..1994. Circadian clock mutants of cyanobacteria. *Science 266*: 1233-1236.

Johnson, C. H., M. R. Knight, T. Kondo, P. Masson, J. Sedbrook, A. Haley, and A. Trewavas. 1995. Circadian oscillations of cytosolic and chloroplastidic free calcium in plants. *Science 269*: 1863-1865.

Liu, Y, N.F. Tsinoremas, C.H. Johnson, N.V. Lebedeva, S.S. Golden, M. Ishiura, and T. Kondo. 1995. Circadian orchestration of gene expression in cyanobacteria. *Genes & Develop*. *9*: 1469-1478.

Mori, T., B. Binder, and C.H. Johnson. 1996. Circadian gating of cell division in cyanobacteria growing with average doubling times of less than 24 hours. *Proc. Natl. Acad. Sci. USA 93*: 10183-10188.

Johnson, Golden, Ishiura, and Kondo. 1996. Circadian clocks in prokaryotes. *Mole. Micro*. *21*: 5-11.

Ishiura, M., S. Kutsuna, S. Aoki, H. Iwasaki, C. R. Andersson, A. Tanabe, S. S. Golden, C. H. Johnson, and T. Kondo. 1998. Expression of a gene cluster *kaiABC* as a circadian feedback process in cyanobacteria. *Science 281*: 1519-1523.

Ouyang, Y., C.R. Andersson, T. Kondo, S.S. Golden, and C.H. Johnson. 1998. Resonating circadian clocks enhance fitness in cyanobacteria. *Proc. Natl. Acad. Sci*. USA *95*: 8660-8664.

Xu, Y., D. Piston, and C.H. Johnson. 1999. A bioluminescence resonance energy transfer (BRET) system: Application to interacting circadian clock proteins. *Proc. Natl. Acad. Sci. USA 96*: 151-156.

Sai, J., and C.H. Johnson. 1999. Different circadian oscillators control Ca^{++} fluxes and *Lhcb* gene expression. *Proc. Natl. Acad. Sci. USA 96*: 11659-11663.

Johnson, C.H. Forty years of PRCs–what have we learned? 1999. *Chronobiol. Int*. *16*: 711-743.

Nikaido, S.S., and C.H. Johnson. 2000. Daily and circadian variation in survival from ultraviolet radiation in Chlamydomonas reinhardtii. *Photochem. Photobiol*. *71*: 758-765.

Wood, N.T., A. Haley, M. Viry-Moussaïd, C. H. Johnson, A.H. van der Luit, and A.J.Trewavas. 2001. The calcium rhythms of different cell types oscillate with different circadian phases. *Plant Physiol*. *125*: 787-796.

Johnson, C.H. 2001. Endogenous timekeepers in photosynthetic organisms. *Annu. Rev. Physiol*. 63: 695-728.

Xu, Y., and C.H. Johnson. 2001. A clock- and light-regulated gene that links the circadian oscillator to *LHCB* gene expression. *PLANT CELL 13*: 1411-1425.

Mori, and Johnson. 2001. Circadian programming in cyanobacteria. *Sem. Cell Devel. Biol*. 12: 271-278.

Schoenhard, J.A., M. Eren, C.H. Johnson, and D.E. Vaughan. 2002. Alternative splicing yields novel BMAL2 variants: tissue distribution and functional characterization. *Am. J. Physiol. 283*: C103-C114.

Sai, J., and C.H. Johnson. 2002. Dark-stimulated calcium ion fluxes in the chloroplast stroma and cytosol. *PLANT CELL 14*: 1279–1291.

Suzuki, L., and C.H. Johnson. 2002. Photoperiodic Control of Germination in the Unicell *Chlamydomonas*. *Naturwissenschaften 8*9:214–220.

Mori, T., S. V. Saveliev, Y. Xu, W. F. Stafford, M. M. Cox, R. B. Inman, and C. H. Johnson. 2002. Circadian Clock Protein KaiC forms ATP-dependent Hexameric Rings & Binds DNA. *PNAS USA 99*: 17203–17208.

Schoenhard, J.A., Smith, L.H., Painter, C.A., Eren, M., Johnson, C.H., and Vaughan, D.E. 2003. Regulation of the PAI-1 promoter by circadian clock components: differential activation by BMAL1 and BMAL2. *Journal of Molecular and Cellular Cardiology 35*: 473-481.

Kolar, J., C.H. Johnson, and I. Machackova. 2003. Exogenously applied melatonin (N-acetyl-5-methoxytryptamine) affects flowering of the short-day plant *Chenopodium rubrum*. *Physiologia Plantarum 118*: 605-612.

Xu, Y., T. Mori, and C.H. Johnson. 2003. Cyanobacterial circadian clockwork: roles of KaiA, KaiB, and the *kaiBC* promoter in regulating KaiC. *EMBO Journal 22*: 2117-2126.

Izumo, M., C.H. Johnson, and S. Yamazaki. 2003. Circadian gene expression in mammalian fibroblasts revealed by real-time luminescence reporting. Proc. Natl. Acad. Sci. USA 100: 16089–16094.

Subramanian, C., B.-H. Kim, N.N. Lyssenko, X. Xu, C.H. Johnson, and A.G. von Arnim. 2004. Mutational & BRET analysis of the *Arabidopsis* repressor of light signaling. *Proc. Natl. Acad. Sci. USA* 101: 6798-6802.

Woelfle, M.A., Y. Ouyang, K. Phanvijhitsiri, and C.H. Johnson. 2004. The adaptive value of circadian clocks: An experimental assessment in cyanobacteria. *Current Biol. 14*: 1481–1486.

Pattanayek, R., J. Wang, T. Mori, Y. Xu, C.H. Johnson, and M. Egli. 2004. Visualizing a circadian clock protein: crystal structure of KaiC and functional insights. *Molecular Cell 15*: 375–388.

Xu, Y., T. Mori, R. Pattanayek, S. Pattanayek, M. Egli, and C.H. Johnson. 2004. Identification of Key Phosphorylation Sites in the Circadian Clock Protein KaiC by Crystallographic and Mutagenetic Analyses. *Proc. Natl. Acad. Sci. USA* 101: 13933-13938.

Johnson, C.H. and M. Egli. 2004. Visualizing a biological clockwork's cogs. *Nature Struct. & Mole. Biol. 11*: 584-585.

Johnson, C.H. 2004. As time glows by in bacteria. *Nature 430*: 23-24.

Johnson, C.H. and C.P. Kyriacou. 2005. Clock evolution and adaptation: whence and whither? *Endogenous Plant Rhythms* (eds. A.J.W. Hall and H. McWatters), Blackwell Publishing Ltd, Oxford, Ch. 10, pp. 237-260.

Johnson, C.H. Testing the adaptive value of circadian systems. 2005. *Methods in Enzymology 393*: 818-837 (M.W. Young, ed.).

Pattanayek, R., D.R. Williams, S. Pattanayek, Y. Xu, T. Mori, C.H. Johnson, P.L. Stewart, and M. Egli. 2006. Analysis of KaiA-KaiC protein interactions in the cyano-bacterial circadian clock using hybrid structural methods. *EMBO Journal 25*: 2017-2028.

Johnson, C.H., R. Shingles, and W.F. Ettinger. 2006. Regulation and role of Ca^{++} fluxes in the chloroplast. In: R.R. Wise and J.K. Hoober (eds). Chapter 20 in *The Structure and Function of Plastids*. Vol. 23. In Govindjee (series ed) *Advances in Photosynthesis and Respiration*, Kluwer Academic Press, pp. 403-416.

Johnson, C.H. 2006. Reminiscences from Pittendrigh's last Ph.D. student. *Resonance 11*: 22-31.

Izumo, M., T.R. Sato, M. Straume, and C.H. Johnson. 2006. Quantitative analyses of circadian gene expression in mammalian cell cultures. *PLoS Computational Biology 2*: e136.

Xu, X., M. Soutto, Q. Xie, S. Servick, C. Subramanian, A. von Arnim, and C.H. Johnson. 2007. Imaging Protein Interactions with BRET in Mammalian Cells and Tissues. *Proc. Natl. Acad. Sci. USA 104*: 10264-10269.

Mori, T., D. Williams, M. Byrne, X. Qin, M. Egli, P. Stewart, and C.H. Johnson. 2007. Visualizing the Ticking of an *in vitro* Circadian Clockwork. *PLoS Biology 5*: e93.

Fan, Y., A. Hida, D.A. Anderson, M. Izumo, and C.H. Johnson. 2007. Cycling of CRYPTOCHROME Proteins Is Not Necessary for Circadian-Clock Function in Mammalian Fibroblasts. *Current Biology 17*: 1091–1100.

Woelfle, M.A., Y. Xu, X. Qin, and C.H. Johnson. 2007. Circadian rhythms of superhelical status of DNA in cyanobacteria. *Proc. Natl. Acad. Sci. USA 104*: 18819–18824.

Bonneau, R., M.T. Facciotti, D.J. Reiss, A.K. Schmid, M. Vuthoori, K. Whitehead, A. Madar, L. Suzuki, T. Mori, D.-E. Chang, J. DiRuggiero, C.H. Johnson, L. Hood and N.S. Baliga. 2007. A predictive model for transcriptional control of physiology in a free living cell. *CELL 131*: 1354-65.

Xu, X., C.T. Hotta, A.N. Dodd, J. Love, R. Sharrock, Y.W. Lee, Q. Xie, C.H. Johnson, and A.A.R. Webb. 2007. Distinct light & clock modulation of cytosolic free Ca^{2+} oscillations in *Arabidopsis*. *Plant Cell 19*: 3474-90.

Ciarleglio, C.M., K. Ryckman, S.V. Servick, A. Hida, S. Robbins, N. Wells, J. Hicks, K. Carver, N. Hamilton, K.K. Kidd, J.R. Kidd, J.R. Smith, J. Friedlaender, D.G. McMahon, S. Williams, M.L. Summar, and C.H.

Johnson. 2008. Genetic Differences in Human Circadian Clock Genes Among Worldwide Populations. *J. Biol. Rhythms 23*: 330-340.
Johnson, C.H., Y. Xu, T. Mori. 2008. A Cyanobacterial Circadian Clockwork. *Current Biology 18*: R816–R825.
Johnson, C.H., M. Egli, P.L. Stewart. 2008. Structural Insights into a Circadian Oscillator. *Science 322*: 697-701.

D. Research Support

Ongoing Research Support

R01 GM067152 Johnson (PI) 01/01/2003-12/31/2010
National Institute of General Medical Services
Circadian Programs in Bacteria
This project is to analyze the molecular mechanism of the circadian clock in cyanobacteria and also to determine the adaptive significance and function of this biological clock.

R21 MH082258-01A2 Johnson (PI) 05/01/09-04/30/11
National Institute of Mental Health
Circadian Clock Gene Polymorphisms Associated with Depression
This project is to study the association between polymorphisms in human clock genes and phenotypes in a population of unipolar depressed humans.

R21 NS 054991 Johnson (PI) 09/01/2007- 06/30/2009 (NCE to 06/30/10)
National Institute of Neurological Disorders and Stroke
Screening for Chronotherapeutics Applied to Hypersomnia and Other Sleep Disorders
This project is to use mammalian fibroblasts that are stably transfected with clock-controlled luciferase reporters to develop a high-throughput screen for clock-active drugs.