“Time-restricted Feeding in the Prevention and Prognosis of Metabolic Diseases”

Presented by:
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Regulatory Biology Laboratory
Salk Institute for Biological Sciences
La Jolla, California

Learning Objectives:

1. The daily eating-fasting rhythm is a determinant of metabolic health.

2. Maintaining a consistent eating-fasting rhythm without overt attempt to alter caloric intake or nutrition quality can prevent or treat metabolic diseases in model organisms.

Monday, November 7, 2016
5:00 p.m. – KCBD Room 1103
(900 E. 57th Street)

The University of Chicago Pritzker School of Medicine is accredited by the Accreditation Council for Continuing Medical Education (ACCME) to provide continuing medical education for physicians. The University of Chicago Pritzker School of Medicine designates this educational activity for a maximum of 1 AMA PRA Category 1 Credits™. Physicians should only claim credit commensurate with the extent of their participation in the activity.

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Major research focus:

- Mechanism of circadian rhythm regulation in mammals.
- Leveraging the interaction among clock, ambient light and nutrition to prevent disease and accelerate prognosis in humans.

Four Major Contributions to Science.

1. My research into the genome-wide circadian gene expression pattern revealed a significant portion of the expressed genome is circadianly expressed in a tissue specific manner. I laid the experimental framework and data analyses pipeline that illustrated how circadian gene expression of key regulators is timed to different times of the day. These discoveries identified key nodes through which circadian oscillator modulates physiology, behavior and metabolism to optimize adaptation to the ambient condition. These findings attracted a new wave of scientists from different fields of cell biology, metabolism, neuroscience and physiology to the field to understand how circadian disruption contributes to chronic diseases.


2. I have made seminal discoveries in the area of how light entrains the circadian clock to the ambient lighting condition. Rodents and humans with outer retina degeneration can still entrain to ambient light, thus indicating a novel non-rod, non-cone photoreceptor entrains the clock. Using mouse genetics I discovered that melanopsin, expressed in a small number of retinal ganglion cells, plays a dominant role in circadian phototentrainment. I also established that rod/cone and melanopsin account for all ocular photoresponses in the visible spectrum of light in mammals. Subsequent elucidation of the signaling pathways, spectral sensitivity of melanopsin, and discovery of a non-retinoid antagonist of melanopsin has wide impact in multiple disciplines of science including neuroscience, vision science, circadian biology, behavioral science, architecture, and lighting industry.
3. My research has identified key components of the circadian clock in model organisms spanning plants, insects and mammals. By forward genetics approach I identified a key regulator of NAD metabolism affecting the core circadian clock in plants. This relation between circadian clock and NAD metabolism is conserved across species and forms a reciprocal regulatory mechanism between clock and cellular metabolism. Using a novel functional genomics approach, we identified ROR group of nuclear hormone receptors as key positive regulators of the circadian oscillator, which offered a direct connection between circadian clock and metabolism. Subsequently, my lab has been instrumental in the discovery of Jumonji class of chromatin regulators as conserved components of the circadian clock from plants to mammals. While the cell autonomous clocks generate cellular oscillations, cellular synchronization is also important for organism-level rhythms. I have recently discovered a role of Lhx transcription factor as a master regulator of factors that mediate intercellular synchrony of oscillator neurons in the suprachiasmatic nucleus.

4. My pioneering work on transcriptome regulation by circadian clock and by the time of food intake has led to the discovery that eating pattern profoundly affects physiology. We have leveraged this knowledge to devise time-restricted-feeding (TRF) in which animals have access to food a defined period of time. TRF does not restrict caloric intake and hence is not caloric restriction, yet it imparts beneficial pleiotropic effects on prevention and prognosis of metabolic diseases. Surprisingly, TRF also improves sleep and neuromuscular function, thus offering novel entry point to understanding how metabolism can affect CNS function.


Education
Ph.D. The Scripps Research Institute, La Jolla, USA. 2001
Field of Study: Macromolecular, Cellular, and Structural Chemistry

M.Sc. Tamilnadu Agricultural University, Coimbatore, India. 1994
Biotechnology,

B.Sc. Orissa University of Agriculture and Technology, Orissa, India. 1991
Agriculture, Major in Genetics & Plant breeding.

Professional Experience
International Flavors and Fragrances Inc., Chennai, India Research Associate – Natural Flavors 1994 -1996

University of Manitoba, Dept. of Immunology, Winnipeg, Canada Graduate Research Associate 1996 -1997

The Scripps Research Institute, La Jolla, CA Graduate student 1997 - 2001

Genomics Institute of Novartis Research Foundation, San Diego, CA Postdoctoral Fellow, Institute Fellow 2001 - 2004

The Salk Institute for Biological Studies, La Jolla, California Assistant Professor 2004 – 2011

The Salk Institute for Biological Studies, La Jolla, California Associate Professor 2011– 2016

The Salk Institute for Biological Studies, La Jolla, California Professor 2016– Present

University of California - San Diego, Division of Biology, Adjunct Assistant Professor 2005 - 2014

University of California - San Diego, Division of Biology, Adjunct Associate Professor 2014 - present

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Awards and Honors

2003  Finalist for Science-Eppendorf Prize in Neurobiology.
2006  Dana Foundation award in brain and immune system imaging
2006  Pew Scholar in Biomedical Research
2006  Whitehall Foundation Junior faculty award
2014  The Julie Martin Mid-Career Award in Aging Research

Publications

(Total citations: 11000+, h-index =42, Average citations/paper >120)


46. Time-Restricted Feeding without Reducing Caloric Intake Prevents Metabolic Diseases in
   Mice Fed a High-Fat Diet. Hatori M, Vollmers C, Zarrinpar A, Ditacchio L, Bushong EA,

47. Fear of the light or need for action: the IGL will judge. Mure LS, Panda S (2012). Neuron
   75(4): 546-548.

48. Circadian clock protein cryptochrome regulates the expression of proinflammatory

49. Transcriptional code and disease map for adult retinal cell types. Siegert S, Cabuy E, Scherf

50. Circadian Oscillations of Protein-Coding and Regulatory RNAs in a Highly Dynamic
   Mammalian Liver Epigenome. Vollmers C, Schmitz RJ, Nathanson J, Yeo G, Ecker JR,

51. Aberrant development of the suprachiasmatic nucleus and circadian rhythms in mice lacking
   the homeodomain protein Six6. Clark DD, Gorman MR, Hatori M, Meadows JD, Panda

52. Co-expression of VAL- and TMT-opsins uncovers ancient photosensory interneurons and
   motorneurons in the vertebrate brain. Fischer RM, Fontinha BM, Kirchmaier S, Steger J,
   e1001585.


55. Small-molecule antagonists of melanopsin-mediated phototransduction. Jones KA, Hatori M,
   Mure LS, Bramley JR, Artymyshyn R, Hong SP, Marzabadi M, Zhong H, Sprouse J, Zhu

56. Local circadian clock gates cell cycle progression of transient amplifying cells during
   regenerative hair cycling. Plikus MV, Vollmers C, de la Cruz D, Chaix A, Ramos R,

57. Lhx1 maintains synchrony among circadian oscillator neurons of the SCN. Hatori M, Gill S,

58. PER1 phosphorylation specifies feeding rhythm in mice. Liu Z, Huang M, Wu X, Shi G, Xing

59. X-Ray Microscopy as an Approach to Increasing Accuracy and Efficiency of Serial Block-
   Face Imaging for Correlated Light and Electron Microscopy of Biological Specimens.
   Bushong EA, Johnson DD, Kim KY, Terada M, Hatori M, Peltier ST, Panda S, Merkle A,


Note: For an updated list please use search string "panda s [au] AND (Circadian OR melanopsin OR opsin OR retina)" in Pubmed or ISIwebofsicence.

Professional Service

Professional Society

Society for Neuroscience Program Committee (2014-2017)
Society for Research on Biological Rhythms
American Diabetes Association
American Heart Association
The Obesity Society
American Association for the Study of Liver Diseases

Grant Review Panels

Ad hoc reviewer for NIH study sections NCF
Ad hoc reviewer for NSF
Regular member of NIH study section NDPR (2013-2018)
Wellcome Trust Program Project Grants, England
Human Frontier Science Program
Medical Research Council, England
Biotechnology and Biological Sciences Research Council, England
US-Israel Binational Science Foundation
Netherland Organization for Scientific Research – TOP grants
ANR, France
American Diabetes Association ad hoc reviewer
DBT-Wellcome Trust Program, India

Editorial boards

Endocrine Reviews – Associate Editor
Nature Publishing Group Journal of Aging and Mechanism of Diseases – Assoc. Editor

Scholarly Journals Peer Review


Committee service

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Meeting and Workshops Organized

Organizing committee for the Annual Symposium of the SDCSB 2005-2010
1st- 5th Annual Systems to Synthesis symposium of SDCSB
Workshop on “Next Generation Sequencing”, Salk Institute August 2009
Workshop on “Systems Biology of Circadian Rhythms” and Inaugural symposium of the Center for Chronobiology, Salk Institute October 2009
International Conference on Comparative Biology and Physiology Mini-symposium on “Light and Circadian Regulation of Physiology” Nagoya, Japan June 2011
International Brain Research Organization, Mini-symposium on “Melanopsin in vision and behavior”, Florence, Italy July 2011
International Chronobiology Conference, New Delhi October 2012
Center for Chronobiology (CCB, UCSD) Annual Symposium Center for Chronobiology (CCB, UCSD) Annual Symposium 2009 2010
Center for Chronobiology (CCB, UCSD) Annual Symposium 2011
Center for Chronobiology (CCB, UCSD) Winter workshop 2011
Center for Chronobiology (CCB, UCSD) Annual Symposium 2012
Center for Chronobiology (CCB, UCSD) Winter workshop 2012
Center for Chronobiology (CCB, UCSD) Annual Symposium 2013
Center for Chronobiology (CCB, UCSD) Winter workshop 2013
Kay Symposium on Circadian Rhythm (USC) 2014
Center for Chronobiology (CCB, UCSD) Annual Symposium 2014
Center for Chronobiology (CCB, UCSD) Winter workshop 2014
Center for Chronobiology (CCB, UCSD) Annual Symposium 2015
Center for Chronobiology (CCB, UCSD) Winter workshop 2015
Center for Chronobiology (CCB, UCSD) Annual Symposium 2016
Center for Chronobiology (CCB, UCSD) Winter workshop 2016

Selected invited seminars and meeting presentations.

University of Manchester, Manchester, UK October 2003

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Humbolt University, Berlin, Germany      October      2003
Washington University, St. Louis, Missouri, US     December    2003
University of California at San Francisco, CA, USA    December  2003
University of California at Davis, CA, USA,          December  2003
University of Virginia, Charlottesville, Virginia, USA, January 2004
Annual meeting of the American Society for Photobiology, Seattle, August  2004
University of Tokyo, Tokyo, Japan, October 2005
Japanese Biochemical Society annual Meeting, Kobe, Japan,  October 2005
Gordon Research Conference in Chronobiology, Rhode Island, USA,  August 2005
Gordon Research Conference in Phototransduction, Il Chiocco, Italy, May  2006
Winter Brain research Conference, Aspen, January 2007
University of California, Irvine. April 2007
University of Southern California. May  2008
Society for Research on Biological Rhythms Annual meeting. May  2008
International Society for Ocular Cell Biology Annual meeting, October, 2008
Clock Workshop, Govt. of India, Department of Science and Tech, Lucknow, India November, 2008
National Institute of Immunology, New Delhi, India November, 2008
The Scripps Research Institute, May  2009
Janelia Farm Conference on Invertebrate Vision, May 2009
FASEB Summer Research Conference, Snowmass, Colorado, June 2009
University of California, San Diego, Sept 2009
Optical Society of America – Vision meeting, Seattle, Sept 2009
Oxyopia Invited seminar – University of California, Berkeley, Dec. 2009
National Institute for Diabetes, Digestive and Kidney Diseases workshop May 2010
FASEB Summer Research Conference on Retinoids, Carefree, Arizona June 2010
Sanofi-Aventis, Tucson, Arizona, June 2010
National Institute for Aging workshop, June, 2010
Medical College of Georgia, Augusta, September, 2010
Penn State University, University Park, October, 2010
University of Pennsylvania, Philadelphia November, 2010
Clock Workshop, Govt. of India, Department of Science and Tech, Delhi, India Dec. 2010
Penn State University, University Park, January 2011
University of Southern California School of Medicine, Los Angeles January 2011
Yale University School of Medicine, New Haven February 2011
Center for Chronobiology Annual Symposium, San Diego February 2011
Buck Institute for Aging Research March 2011
Seminar series, Scripps Translational Science Institute, La Jolla April 2011
San Diego Consortium for Systems Biology Annual Symposium May 2011
Texas A & M University May  2011
University of Kyoto May  2011
University of Nagoya June 2011
RIKEN-Systems Biology, Kobe June 2011
ICCPB -2012, Nagoya June 2011
Sanofi-Aventis, Frankfurt July 2011
Sanofi-Aventis, Paris July 2011
IBRO Conference, Florence, Italy July 2011
Clock Symposium, Janelia Farm March 2012
NCMIR, San Diego May 2012

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University of Colorado, Boulder, US          May  2012
Optogenetics for Vision Restoration, Harvard Medical School, Boston     June  2012
INSERM, Lyon, France       June  2012
Govt. of India Summer School on Chronobiology, Shillong, India      June  2012
Assam Agricultural University, India       June  2012
SANOFI-Aventis, Tucson      June  2012
Allen Brain Institute, Seattle, US     August  2012
University of Washington, Seattle  August  2012
Nanjing University, China         August  2012
Neuroscience in Architecture Conference, San Diego  September 2012
UCSD Cancer Center         October  2012
National Brain Research Institute, India  October  2012
National Institute of Immunology, India  October  2012
International Chronobiology Conference, India  October  2012
Novartis (GNF)         March  2013
Metabolon, San Diego     March  2013
Metabolon, San Francisco March  2013
Japanese Society for Bioscience, Biotechnology, and Agrochemistry
Sendai, Japan          March  2013
University of Tokyo  March  2013
Keyestone Symposium on Circadian Rhythms in Cardiometabolic diseases
April  2013
American Association Cancer Research, Washington DC April  2013
San Diego Consortium of Systems Biology  May  2013
American College of Sports Medicine, Indianapolis  May  2013
Caloric Restriction Society, Buck Institute  June  2013
Blue Light Society Annual meeting, Tokyo      June  2013
Society of Neuroscience in Africa Annual meeting, Morocco  June  2013
University of Zurich  June  2013
National Center for Microscopy and Imaging Research, UCSD
July  2013
Gordon Research Conference
July  2013
European Biological Rhythm Society Conference, Munich
August  2013
Diabetes Endocrinology Research Center, UCSD
August  2013
Latin America Chronobiology Society meeting, Mendoza November 2013
Fred Hutchinson Cancer Research Center, Seattle October 2013
Keystone Symposium on diabetes and obesity, Vancouver
January  2014
Center for Circadian Biology, UCSD
February  2014
National Institute for Science and Engineering Research, Orissa, India March  2014
Case Western Reserve University Cancer Center  March  2014
Hokkaido Anti-Aging Club, Sapporo  March  2014
Metabolon regional meeting, Houston
April  2014
The Scripps Research Institute
May  2014
Society for Research on Biological Rhythm, Bozeman, Montana
June  2014
ASHRAE Annual meeting, Seattle
June  2014
Keio University, School of Medicine, Japan
July  2014
International Conference of Neuroethology, Sapporo, Japan
July  2014
Osaka City University, Japan
July  2014
University of Tokyo, Japan
August  2014
Academy of Neuroscience for Architecture, San Diego
September 2014
University of Massachusetts, Amherst
October  2014
U Penn, Philadelphia
October  2014
Timelines in Biology conference, Weizzman Inst. of Science, Israel
December 2014
SERC Chronobiology Winter School, Mangalore, India  January 2015
Intl. Ctr for Genetic Engg. and Biotech, New Delhi  January 2015
Keystone symposium on Lipid Research, Colorado  February 2015
NIDDK workshop on on Sleep, Clock and Metabolic Diseases, NIH  February 2015
Keystone symposium on muscle metabolism, Whistler  March 2015
International Light Symposium, Stockholm, Sweden  March 2015
U Penn, Philadelphia  April 2015
NHLBI Workshop on sleep biomarker discovery, Washington DC  April 2015
Natl Center for Biological Studies, Beijing  April 2015
Annual Conf. Chinese Society of Cell Biology, Shenzhen  April 2015
Kansas Univ. Medical Center  May 2015
University of Michigan, Ann Arbor  May 2015
Japan Anti-Aging Meeting 2015, Fukuoka, Japan  May 2015
Boston University Nutrition Obesity Research Center, Boston  July 2015
Max Planck Institute on Aging Research, Cologne  August 2015
Anti-aging update, Tokyo, Japan  September 2015
Nestle Institute for Health Sciences, Lausanne, Switzerland  September 2015
LIMNA conference on obesity, Lausanne, Switzerland  September 2015
Janelia conference on hypothalamic circuits, HHMI campus  September 2015
Brain Conference, Copenhagen  October 2015
Cincinnati Children Hospital, Cincinnati  October 2015
University of Southern California  November 2015
Johns Hopkins Medical Institute, Baltimore  November 2015
MRC Laboratory of Molecular Biology, Cambridge  December 2015
Royal Society of Medicine symposium on circadian rhythm and nutrition  December 2015
UK Clock club annual symposium, Edinburgh  December 2015
Tamasek Lifescience Laboratory, Singapore  March 2016
SBIC, Singapore  March 2016
Deuel Conference on Lipid Metabolism  March 2016
University of Indiana, Indianapolis  April 2016
University of Miami, Miami  April 2016
Society for Research on Biological Rhythms, Bi-annual symposium  May 2016
Gordon Research Conference on Cardiac diseases and mechanisms  June 2016
Annual Meeting of Intestinal Microbiology, University of Tokyo  June 2016
Washington University, St. Louis  June 2016
Fred Hutchinson Cancer Research Center, Seattle  June 2016
Japanese Society for the Treatment of Obesity Annual Conference  July 2016
RIKEN Brain Science Institute, Yokohama, Japan  July 2016
The Institute of Medical Science , The University of Tokyo  July 2016
Essential Self Tech Networking meeting, University of Chicago  July 2016
University of Lausanne, Switzerland  September 2016
IFOM, IEO, Milan, Italy  September 2016
New York Academy of Science symposium on Big data & Obesity  September 2016
Intl. Society of Nephrology Annual Symposium, San Diego  September 2016

Public lectures, Presentation to Lay audience

Salk High School Science Day  August 2011
Salk Diabetes Day  September 2011
1230 Club, La Jolla  December 2012
Qualcomm, San Diego       December 2012
Association for Neuroscience in Architecture     October 2012
Back to basic, Salk Institute        April  2013
Rotary Club of Rancho Sante Fe      March  2013
TiE, San Diego                     April  2013
Salk Healthy Aging                  May    2013
University of Virginia, Aniridia patient symposium August 2013
Academy of Neuroscience for Architecture October 2013
Salk Excellerator                   November 2013
TEDx                              November 2013
Music and Science series at Salk Institute June 2015
Sci-Foo Googleplex                June    2015
High School Science Day, Salk Institute January 2016
Explore Salk, Salk Institute       April  2016

Selected media coverage


Books covering Panda lab research


8 hours Diet. (2015). David Zinczenko and Peter Moore

Buddha’s Diet: The Ancient Art of Losing Weight Without Losing Your Mind (2016). Tara Cottrell and Dan Zigmond

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