The Faculty of Medicine of Harvard University
Curriculum Vitae

Date Prepared:	March 14, 2025
Name:	Peng Li
Office Address:	149 13th Street, Suite 4.015, Charlestown, MA 02129
Work Phone:	617-643-9514
Work Email:	pli9@mgh.harvard.edu

Education:

9/05-7/09	BS	Biomedical Engineering	Shandong University, Jinan, Shandong Province, China
7/06-7/09	BBA	Business Administration	Shandong University
9/09-6/14	PhD	Biomedical Engineering (Changchun Liu)	Shandong University

Postdoctoral Training:

6/14-12/15	Postdoctoral Fellow	Nonlinear Dynamics for Cardiovascular Physiology (Mengsun Yu)	Shandong University
12/15-12/18	Research Fellow	Sleep and Circadian Disorders and Neurophysiology (Kun Hu)	Brigham and Women's Hospital (BWH), Harvard Medical School (HMS)

Faculty Academic Appointments:

1/19-6/21	Instructor	Medicine	HMS
7/21-11/23	Assistant Professor	Medicine	HMS
11/23-	Assistant Professor	Anesthesia	HMS

Appointments at Hospitals/Affiliated Institutions:

1/19-6/21	Investigator (Associate Physiologist)	Sleep and Circadian Disorders	BWH
7/21-11/23	Lead Investigator (Physiologist)	Sleep and Circadian Disorders	BWH
11/23-	Investigator, Assist Prof	Anesthesia, Critical Care and Pain Medicine	Massachusetts General Hospital (MGH)

Faculty Membership in Harvard Initiatives, Programs, Centers, and Institutes:

2021-	Associate Member	The Broad Institute of MIT and Harvard

Other Professional Positions:

2010-2012	R&D Researcher	Jinan Huiyironggong Technology Corporation Ltd., Jinan, China	
2013-2014	Research Assistant	Institute of Biomedical Engineering, School of Control Science and Engineering, Shandong University	
2014-2015	Consultant	Jinan Huiyironggong Technology Corporation Ltd., Jinan, China	
2024-	Chair of Cardiac Dynamics of the Scientific Advisory Board, Honorary Lifetime Co-Founder	iFutureLab Inc., Palo Alto, CA	1.5 days per year

Major Administrative Leadership Positions:

Local

2019-	Research Director, Medical Biodynamics Program	Division of Sleep and Circadian Disorders, BWH
2024-	Research Director, Medical Biodynamics Center	Department of Anesthesia, Critical Care and Pain Medicine, MGH

Committee Service:

Local

2022-	Pathways Opportunities Steering Committee	Harvard University Center for AIDS Research
	2022-	Member
2023	2023 DOM Mentoring Award Selection Committee	Brigham and Women's Hospital, Department of Medicine
	December 2023	Member

International

2023-	Student Mentoring Program, Student Activities Committee	IEEE Engineering in Medicine and Biology Society
	June – November 2023	Mentor

	Aug – December 2024	Mentor

Professional Societies:

2014-2019	Chinese Society of Biomedical Engineering	Member
2015-	IEEE Engineering in Medicine and Biology Society	
	2015-2021	Member
	2022-	Senior Member
2016-	Society for Research on Biological Rhythms	
	2016	Postdoc member
	2020	Member
2017-	American Heart Association	
	2017	Postdoc member
	2021-	Member
2017-	Sleep Research Society	
	2017-2018	Postdoc member
	2019-	Member
2017-	American Academy of Sleep Medicine	
	2017-2018	Postdoc member
	2019-	Member
2017-	The Alzheimer's Association International Society to Advance Alzheimer Research and Treatment (ISTAART)	
	2017-2017	Postdoc member
	2020-	Member
2018-2022	Beijing Society for Cognitive Neuroscience	Member
2018-2021	Society for Neuroscience	Member

Grant Review Activities:

2020	Scientific Review Committee	National Natural Science Foundation, China
	June 11-30	Ad hoc reviewer, Young Scientists Fund
	June 11-30	Ad hoc reviewer, Regional Program
2024	Scientific Review Committee	National Natural Science Foundation, China
	May 1-20	Ad hoc reviewer, Regional Program

Editorial Activities:

- **Ad hoc Reviewer**

Advanced Biology

Aging Cell

AIDS Research and Human Retroviruses

Alzheimer's & Dementia: Diagnosis, Assessment & Disease Monitoring

Alzheimer's & Dementia: The Journal of the Alzheimer's Association

Alzheimer's & Dementia: Translational Research & Clinical Interventions

Applied Acoustics

Artificial Intelligence in Medicine

Biocybernetics and Biomedical Engineering

Biomedical Research International

Biomedical Signal Processing and Control

British Medical Journal (BMJ)

BMJ Public Health

Cancer Management and Research

Circulation

Complexity

Computational and Mathematical Methods in Medicine

Computers in Biology and Medicine

Current Alzheimer Research

Ecological Indicators

Entropy

Frontiers in Endocrinology

Frontiers in Physiology

Frontiers in Neurology

Frontiers in Neuroscience

Healthcare Technology Letters

Hypertension

IEEE Access

IEEE Journal of Biomedical and Health Informatics

IEEE Sensors

IEEE Signal Processing Letters

IEEE Transactions on Biomedical Engineering

Innovation and Research in BioMedical Engineering

Journal of Alzheimer's Disease
Journal of Biological Rhythms
Journal of Cardiovascular Development and Disease
Journal of Medical and Biological Engineering
Journal of Medical Imaging and Health Informatics
Journal of Neural Engineering
Journal of Neurology, Neurosurgery and Psychiatry
Journal of the American Geriatrics Society
Journal of The American Heart Association
Measurement
Life
Medical & Biological Engineering & Computing
Medical Science Monitor
Nature and Science of Sleep
Nonlinear Dynamics
Nutrition, Metabolism and Cardiovascular Diseases
PAIN
Physiological Measurement
Plos One
Plos Medicine
Psychiatry and Clinical Neurosciences
Scientific Reports
Sleep
Sleep Medicine Reviewers

- **Other Editorial Roles**

2015-2022	Associate Editor	*Journal of Medical Imaging and Health Informatics*
2017-2018	Guest Editor	*Computational and Mathematical Methods in Medicine*
2018	Guest Associate Editor	*Frontiers in Physiology*
2020	Special Issue Guest Editor	*Entropy*
2020-2023	Academic Editor	*Computational and Mathematical Methods in Medicine*
2020	Special Issue Guest Editor	*Journal of Healthcare Engineering*
2021-	Associate Editor	*Frontiers in Physiology*

2021-	Review Editor	*Frontiers in Network Physiology*
2021-	Review Editor	*Frontiers in Neurology*
2021-	Review Editor	*Frontiers in Endocrinology*
2021-2023	Special Issue Editor	*Entropy*
2022-2023	Guest Editor	*Advanced Biology*
2023-2024	Topic Editor	*Frontiers in Network Physiology*
2024-	Assistant Editor	*Journal of American Heart Association*
2024-	Editorial Board Member	*SLEEP*

Honors and Prizes:

2008	First Prize (Provincial Level)	Shandong Provincial Education Department	Undergraduate Electronic Design Contest
2009	Excellent Bachelor's Thesis	Shandong University	
2010	Second Prize (National Level)	Organizing Committee of Mathematical Contest in Modeling	Graduate Mathematical Contest in Modeling
2012	National Scholarship	Ministry of Education, China	Excellent doctoral research
2014	Outstanding PhD Student (Provincial Level)	Shandong Provincial Education Department	Excellent doctoral research
2014	International Travel Award	Shandong University	
2015	International Travel Award	China Postdoctoral Council	
2017	2016 Provincial Award for Science and Technology Innovations	Shandong Provincial Government, China	Key techniques and applications of the early diagnosis of cardiovascular diseases (No. FM2016-2-7-R04)
2017	2016 Innovation Discovery	Partners Healthcare	Stability and Fragmentation of Daily Activity Rhythm
2018	Trainee Professional Development Award	Society for Neuroscience	
2019	Microgrant	Brigham and Women's Hospital Research Institute	Advanced research training in deep learning
2020	Travel Award to attend the International Workshop on HIV & Aging 2020 (award received but converted	Harvard University Center for AIDS Research (HU CFAR)	

	to registration fee waiver due to Covid-19 travel/meeting ban)	
2021	Young Investigators Research Forum Award	American Academy of Sleep Medicine
2022	Early Career Mentoring Award	Department of Medicine, BWH
2024	Nominated for the Excellence in Mentoring Awards	Harvard Medical School

Report of Funded and Unfunded Projects

Past:

2012-2013 Quality assessment of ambulatory ECG recordings
Shandong University, Graduate Research Award yzc12082
PI
The goal of this project was to establish an easier-to-implement algorithm for assessing the quality of ambulatory ECG recordings. This grant is awarded to well-qualified PhD students with rigorous peer-review.

2014-2015 The evaluation of the nonlinear properties of cardiac dynamics through short-term heartbeat interval data
China Postdoctoral Council 2014M561933
PI
The major goal of this project was to develop a robust entropy method for evaluating the complexity of short-term heartbeat interval data.

2015 Distribution entropy method and its application in the complexity analysis of cardiac dynamics
Shandong Provincial Natural Science Foundation ZR2015FQ016
PI
The goal of this project was to examine the performance of the distribution entropy method PI developed in cardiac dynamics in term of accurately detecting heart failure patients from healthy control group through short-term ECG measurement.

2015 Distribution entropy analysis to the cardiac electrical and mechanical activities' interval time-series in patients with coronary heart disease
National Natural Science Foundation of China 61471223
Co-Investigator (PI: Changchun Liu)
The major goal of this project was to explore the potential of a new developed distribution entropy method in characterizing the complexity of neurological cardiovascular control of patients with coronary heart disease through the cardiac electrical and mechanical activities' interval time-series, e.g., heartbeat interval, diastolic time.

2016 Entropy measures-based study on the effects of circadian disorders on the complexity of cardiac dynamics
China Postdoctoral Council, Research Fellowship 20150042
PI
This goal of this project was to study the effects of circadian misalignment on

physiological complexity. The Postdoctoral fellowship fully covered my first-year salary at the Brigham and Women's Hospital.

2018-2023 Fractal motor activity regulation and the risk for Alzheimer's disease in middle-to-old aged adults
National Institutes of Health (NIH)/National Institute on Aging (NIA) RF1AG059867
Co-Investigator (PI: Kun Hu)
The goal of this grant is to test whether fractal activity regulation, a recently revealed novel dynamic control in motor activity fluctuations, can be used as a cost-efficient, reliable tool to predict the risk of Alzheimer's disease in middle-to-old aged adults.

2021-2022 Circadian disturbances and cognitive impairment in people living with HIV
Harvard University Center for AIDS Research (HU CFAR), Developmental Award (subcontract to NIH 5P30AI060354-17)
PI ($79,714)
The goal of this project is to determine the role of circadian regulation in HIV-associated cognitive impairment.

2021-2022 Association between rest activity circadian rhythm and cognition in PLWH
University of Alabama, Birmingham, HIV and Aging Research Consortium HIV/Aging Pilot Program (subcontract to NIH R33AG067069-01)
PI ($60,000, including $10,000 internal matching fund from the HU CFAR)
The goal of this project is to characterize the circadian patterns in PLWH using a novel data adaptive tool for analyzing rest activity data, examine the association between circadian variations and cognition in PLWH, and explore the potential mechanisms.

2020-2022 Circadian multiscale activity regulation and the risk for delirium in elderly hospitalized patients
NIH/NIA R03AG067985
Co-Investigator (PI: Lei Gao)
The goal of this project is to determine the long-term relationship between earlier-life circadian/sleep regulation and delirium, in the context of cognition and normal aging.

2020-2023 Circadian regulation, autonomic function and Alzheimer's disease
BrightFocus Foundation, Standard Award A2020886S
PI ($285,000)
The goal of this project is to determine the roles of circadian dysregulation and autonomic dysfunction in the development/progression of AD utilizing novel circadian and autonomic measures derived from nonlinear analyses.

2019-2024 Integrated motor activity biomarker for the risk of Alzheimer's dementia
NIH/NIA RF1AG064312
Co-Investigator (PI: Kun Hu)
The goal of this project is to develop an integrated, non-invasive biomarker for the risk of Alzheimer's dementia using motor activity recordings.

2023-2024 Circadian rest-activity rhythms and links with cognitive function in women aging with HIV
Brigham Research Institute (BRI) Fund to Sustain Research Excellence (FSRE)
PI ($50,000)
The BRI Fund to Sustain Research Excellence (FSRE) will provide support to allow the team to prepare more compelling preliminary results to boost the success of a resubmission of an R01 application that will evaluate circadian rest-activity rhythms

(CRAR), the influence of menopause on CRAR, and the association of CRAR with cognition in women living with HIV (WLH) and HIV seronegative women.

Current:

2023-2026 Li Lab start-up fund
Department of Anesthesia, Critical Care and Pain Medicine
PI ($350,000)
This start-up package is established for the PI to successfully initiate his independent research program at MGH. The funding serves to facilitate the expeditious start-up of the research lab, including the support of reasonable expenses such as effort and the PI and other personnel as well as materials and supplies.

2023-2028 Circadian disturbance and dementia in Latin America
NIH, R01AG083799
Co-Investigator (PI: Hu)
The goal of this project is to determine the effects of age, sex, and socioeconomic status on circadian function in Latin America countries, and the involvement of circadian disturbance in the development/progression of Alzheimer's disease and frontotemporal dementia in Latin America.

2024-2025 Improving the accuracy of sleep detection from ambulatory wearables
Philanthropy Gift, managed by the MGH
PI ($120,000)
This project is made available by a generous gift from a philanthropy donor. The fund will help the PI pursue a prior unfunded research direction to improve the accuracy of sleep detection from ambulatory wearables.

2025-2026 Scientific exchange between Dr. Li at Mass General/Harvard and Dr. Karmakar at Deakin University, Australia
American Heart Association International Visiting Professorship Award
PI ($10,000)
This project will facilitate the scientific exchange between Dr. Li (PI) and Dr. Karmakar (Co-PI) by making available Dr. Karmakar's short-term visit (1-week) to the Laboratory for Sleep and Digital Health directed by Dr. Li at MGH, a two-day workshop on sleep and cardiovascular risks, and a seminar series to catalyze new collaborative projects.

Projects Submitted for Funding:

2025-2027 ROOTs: Revealing cognitive Outcomes in 'zeroth gen' Older immigranTS
NIH R21, scored 24th percentile, resubmitted
PI ($275,000)
The goal of this project is to examine the relationships between acculturative stress with sleep, circadian, and cognitive health in zeroth-generation Chinese immigrants, defined as those who have immigrated to the US to join their adult children.

2025-2027 Menopause, circadian rest-activity rhythms, and cardiovascular risk in women with and without HIV
NIH, R21
PI ($275,000)
The goal of this project is to investigate the relationships among menopause, rest-activity rhythms, and CVD risk in a cohort of women with HIV on suppressive ART and women without HIV.

2025-2030 Circadian Rest-Activity Rhythms and Dementia: Understanding Causal Associations and Pathways

NIH, R01
PI ($2,398,312)
This project is designed to strengthen the understanding of the causal relationship between disrupted circadian rhythms and risk for ADRD and the underlying mechanisms. Achieving the aims will provide new modifiable targets for designing treatments to lower individual's risk of ADRD and/or slow or even halt the progression.

2025-2030 Cardiovascular health and cognitive decline in older adults with dementia in Latin America
NIH, R01 (ND on first submission; resubmitted)
MPI, contact PI ($2,495,212)
This project will examine the cardiovascular function in people with Alzheimer's disease, frontotemporal lobe dementia, as well as cognitively normal adults living in Latin American countries. The results will help understand the link between the heart and the brain in Latinos and determine whether cardiovascular health contributes to brain or cognitive outcomes in these older adults. The project will also provide insights into the change of cardiovascular health in Latinos with dementia and its role in the progression of dementia.

2025-2030 Circadian rhythms, cognition, and HIV infection
NIH, R01, scored 40th percentile, resubmitted
PI ($2,432,953)
The overarching goal of this project is to investigate CRAR alterations and their relationships with cognitive function in PLWH, and to understand this link by investigating proteomic signatures.

Training Grants and Mentored Trainee Grants:

2022-2025 Timing and irregularity of daytime napping and Alzheimer's disease
Alzheimer's Association Research Fellowship to Promote Diversity Program
Primary Mentor
The proposed study will address two aims: (1) To investigate the relationship of timing and irregularity of daytime naps with longitudinal cognitive decline, and AD; and (2) To determine whether timing and irregularity of daytime naps interact with genetic risks of AD to influence the trajectory of cognitive change and incident Alzheimer's dementia.

2023 Daytime napping and Alzheimer's disease in middle-to-older aged adults: Timing, irregularity, and interaction with genetic risks
American Academy of Sleep Medicine, Focused Projects for Junior Investigators
Primary Mentor
We will address two aims: (1) To investigate the relationship of timing and irregularity of daytime naps with cross-sectional and longitudinal cognitive decline, and AD; and (2) To determine whether timing and irregularity of daytime naps interact with genetic risks of AD to influence the trajectory of cognitive change and incident AD

Unfunded Current Projects:

2024-2026 Extracting biological age of circadian function from actigraphy
NIH, R21 (scored missing payline; to be resubmitted)
PI
The goal of this project is to define and evaluate a proxy for the biological age of circadian function (circadian age: CircAge) by integrating multiple features from actigraphy for rest-activity rhythms (RARs) and/or deep learning the graphical representation of actigraphy—actogram—that sketches rest-activity patterns over the course of a day.

2024-2029 Sleep, Circadian Rhythms, and Aging with HIV: A Botswana-Boston Collaborative Project
NIH, R01 (ND; to be re-submitted)
MPI/ Contact PI
We propose to initiate a comparative cohort of PLWH and HIV-uninfected controls in Boston (US, North America) and Gaborone (Botswana, Africa), i.e., the Botswana-Boston Collaborative (BBC), to study disparities in SCH in PLWH that synergize with SDoH representing varied life exposures to biological and social stressors to drive dysregulation of inflammatory-bioenergetic homeostasis (IBH), and over time resulting in reduced cognitive and physical reserves.

Report of Local Teaching and Training

Research Supervisory and Training Responsibilities:

2021-2023	Supervision of post-doctoral research fellows (average of 1-2 fellows per year)	Brigham and Women's Hospital One hour lab meeting per week; biweekly 1:1 supervision one hour per fellow
2024-	Supervision of post-doctoral research fellows (average of 2-3 fellows per year)	Massachusetts General Hospital One hour lab meeting per week; biweekly 1:1 supervision one hour per fellow

Other Mentored Trainees and Faculty:

2014-2017 Lizhen Ji, PhD / Instructor, Shandong Normal University, Jinan, Shandong, China
Career stage: doctoral student; Mentoring role: research co-advisor; Accomplishments: Co-author on 4 published papers.

2014-2019 Chang Yan, PhD / Postdoctoral fellow, Southeast University, Nanjing, China
Career stage: doctoral student; Mentoring role: research co-advisor; Accomplishments: Co-author on 4 published papers.

2015-2019 Yang Li / Postdoctoral fellow, Shanghai Jiao Tong University, Shanghai, China
Career stage: doctoral student; Mentoring role: research co-advisor; Accomplishments: Co-author on 3 published papers.

2015-2020 Lianke Yao / PhD student, Shandong University, Jinan, Shandong, China
Career stage: doctoral student; Mentoring role: research co-advisor; Accomplishments: Co-author on 1 published paper and 2 under review.

2016-2017 Melissa Patxot, BS / Program Manager at RIP ROAD, Inc., New York, NY
Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: 1 local poster presentation.

2016-2018 Tommy To, BS / Medical student at Virginia Tech Medical School, Roanoke, VA
Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: 4 poster presentations in local and national conferences, and successfully enrolled in an MD program.

2017-2019 Chelsea Hu, BS / Postgraduate student at Loyola University, Chicago, IL
Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: 2 poster presentations in local and national conferences.

2018-2019	Lei Gao, MBBS / Assistant Professor in Anesthesia, Massachusetts General Hospital, Boston, MA Career stage: T-32 fellow; Mentoring role: research co-mentor; Accomplishments: 2 published journal article, 1 manuscript submitted, and 3 conference oral presentations. He was promoted to Assistant Professor in April 2020.
2019-2020	Longchang Cui, MS / Co-Founder, Lead Unity Developer at Hyper Artisan Inc., Boston, MA Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: co-author on 2 manuscripts under review, 1 poster presentation.
2019-2020	Arlen Gaba, BS / MD student at Wake Forest School of Medicine, Winston-Salem, NC Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: co-author on 3 manuscripts, 1 poster presentation.
2020-2022	Hui-Wen Yang, PhD / Postdoctoral Fellow, BWH Career stage: postdoctoral fellow; Mentoring role: research co-mentor; Accomplishments: one first-author paper, and one first-author manuscript in preparation
2020-2022	Ma Cherrysse Ulsa, MS / Research Assistant, BWH Career stage: research assistant; Mentoring role: research co-mentor; Accomplishments: 1 first-author abstract to a scientific meeting; obtained Trainee Merit-based Award from SLEEP 2021
2020-2024	Xi Zheng, MS / Research Assistant, BWH, MGH Career stage: research assistant; Mentoring role: research mentor; Accomplishments: 2 first-author abstracts to scientific meetings; obtained Trainee Merit-based Award from SLEEP 2021
2021-	Chenlu Gao, PhD / Postdoctoral Fellow, BWH, MGH Career stage: postdoctoral fellow; Mentoring role: mentor; Accomplishments: Honorable Mention in Div. Sleep Medicine, Sleep Benefit Dinner Poster Session 2021 and Presentation Award in Sleep Benefit Dinner Poster Session 2022; published several first-author papers; >5 first-authored conference abstracts; received a fellowship grant from Alzheimer's Association in 2022; received a Focused Grant for Junior Investigators from American Academy of Sleep Medicine in 2023
2021-	Max Wagner / Research Trainee, BWH, MGH Career stage: high-school research trainee; Mentoring role: mentor; Accomplishments: one first-author abstract submitted to SLEEP 2022; Honorable Mention in HMS Div. Sleep, Sleep Benefit Dinner Abstract Session 2022
2022-	Ruixue Cai / Visiting PhD Student, BWH, MGH Career stage: graduate student; Mentoring role: mentor; Accomplishments: multiple presentations in academic conferences including SLEEP, SRBR, etc. Received a Trainee Merit Award from SLEEP 2023. One manuscript was published in *Nature Communications* in 2023. Several oral/poster presentations.
2024-	Shahab Haghayegh / Instructor, MGH Career stage: junior faculty; Mentoring role: research co-advisor on K99 award;
2024-	Kevin Wang / Research Trainee, MGH Carrer stage: high-school research trainee; Mentoring role: mentor; Accomplishments: awarded 2nd place in regional high school Science Fair

2024- Zhong Liu / Postdoctoral Fellow, MGH
Career stage: postdoctoral fellow; Mentoring role: mentor;

Local Invited Presentations:

☒ *No presentations below were sponsored by 3rd parties/outside entities*

☐ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

2013 Entropy measures with application to the complexity analysis of cardiac dynamics / Keynote speaker
'Haiyou' doctoral academic forum, School of Control Science and Engineering, Shandong University, Jinan, Shandong, China

2016 Night shift work disrupts fractal activity regulation / Invited presentation
Boston mini symposium on Circadian Rhythms, Metabolism, and Beyond
Division of Sleep and Circadian Disorders, BWH

2018 Fractal regulation and Alzheimer's disease / Invited talk
Clinical Data Animation Center, Massachusetts General Hospital, Boston, MA

2018 Alzheimer's disease: Prevalence, diagnosis, and pathogenesis / Invited lecture at the MBP/MCP mini course series
Division of Sleep and Circadian Disorders, BWH

2020 Physiological complexity, brain health, and well-being / Invited talk
Alzheimer's Clinical and Translational Research Unit, Massachusetts General Hospital, Boston, MA

2020 Physiological complexity, brain health, and well-being / Invited talk delivered to visitors from Stanford
Division of Sleep and Circadian Disorders, BWH

2020 Physiological complexity, brain health, and well-being / Invited talk at the Scientific Staff Meeting
Division of Sleep and Circadian Disorders, BWH

2023 Circadian rest-activity rhythms and cognitive performance in people living with HIV / Invited talk at the "HIV Research in Progress" series
Harvard University Center for AIDS Research

Report of Regional, National and International Invited Teaching and Presentations

☒ *No presentations below were sponsored by 3rd parties/outside entities*

☐ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

Regional:

2017 Physiological consequences of altered fractal regulation / Invited presentation
Massachusetts Life Sciences Innovation Day 2017, Massachusetts Technology Transfer Center, Boston, MA

National:

2016	Aging effect on multiscale activity control / Invited talk 7th Religious Orders Study/Memory and Aging Project (ROS/MAP) investigators meeting, Rush Alzheimer's Disease Center, Chicago, IL
2017	Physiological consequences of altered fractal regulation / Invited talk 8th ROS/MAP investigators meeting, Rush Alzheimer's Disease Center, Chicago, IL
2018	Fractal regulation and dementia-related pathologies / Invited talk 9th ROS/MAP investigators meeting, Rush Alzheimer's Disease Center, Chicago, IL
2019	Fractal motor regulation and adverse health consequences / Invited talk 10th ROS/MAP investigators meeting, Rush Alzheimer's Disease Center, Chicago, IL
2020	Daytime napping in community-based elderly adults / Invited talk 11th ROS/MAP investigators meeting (Virtual)
2022	Multidimensional actigraphy features: Link between circadian rest activity rhythms and Alzheimer's disease / Symposium talk SLEEP 2022, Charlotte, NC
2024	When to sleep? The influence of timing and regularity of napping on cognitive outcomes / Symposium talk American College of Sports Medicine 2024 Annual Meeting, Boston, MA
2024	Circadian rhythms and cognitive health in people aging with HIV / Invited speaker HIV & Aging Research Consortium (HARC) Investigator's Meeting, online and in-person at Seattle, WA

International:

2020	O4-12 Biomarkers (non-neuroimaging): Alzheimer's Disease Incidence, Risk Factors and Biomarkers / Session Chair Alzheimer's Association International Conference, Amsterdam, the Netherlands (Virtual)
2020	Physiological complexity, brain health, and well-being / invited lecture the 2020 cross-disciplinary research forum on mathematics, artificial intelligence, and chronic diseases, Taiyuan, China (on-site and online)
2021	Resting heart rate complexity and all-cause and cardiorespiratory mortality in a middle-to-older aged, population cohort / Invited talk Mini-symposia 12 "The control of cardiovascular system in health and disease" in the Society for Mathematical Biology Annual Meeting 2021, Online and at the University of California Riverside, USA
2021	Predicting patterns in daily activities / Invited talk the 2021 Taishan Scientific Forum, Jinan, China (on-site and online)
2022	Circadian rhythms: analytical approaches and novel insights into cognitive health in older adults / Invited talk Departmental Seminar, Department of Psychology, The University of Hong Kong, Online Zoom and On-site in Hong Kong
2023	Cardiovascular autonomic function and cognitive aging in older adults / Invited talk Centre for Intelligence Healthcare, Coventry University, UK (delivered through Zoom)

2023	Analytical approaches for circadian rest-activity rhythms and new insights into cognitive aging / Invited speaker The 12th International Conference on Biomedical Engineering and Biotechnology, hybrid (in person at Macao and online through online meeting platform)
2023	Rest-activity rhythms, cardiovascular dynamics, and dementia: Towards digital biomarkers for brain health / Invited lecturer Public Lecture, National Science and Technology Council, Taiwan (delivered through Google meet)
2024	Digital biomarkers for brain health outcomes / Session chair and speaker IEEE Engineering in Medicine and Biology Society 46th Annual International Conference, Orlando, FL
2024	Multiscale motor activity regulation: relevance to dementia pathology and cognitive resilience / Invited featured research session speaker Alzheimer's Association International Conference 2024, Philadelphia, PA
2024	Introductory statistical data analytics with MATLAB (16-h, 1 credit) / Invited lecturer China Pharmaceutical University, International Summer School Program, Nanjing, China
2025	Circadian rhythms and cognitive outcomes: Towards digital biomarkers for brain health / Invited speaker IEEE Engineering in Medicine and Biology Society Academic & Professional Skills Training Webinar (delivered through Zoom)

Report of Scholarship

Peer-Reviewed Scholarship in print or other media:

Research Investigations

(#: contributed equally; **: mentee)

1. Liu C, Li L, Zhao L, Zheng D, **Li P**, Liu C. A combination method of improved impulse rejection filter and template matching for identification of anomalous intervals in RR sequences. J Med Biol Eng. 2012;32:245–50.
2. Liu C, Zheng D, Zhao L, **Li P**, Li B, Murray A, Liu C. Elastic properties of peripheral arteries in heart failure patients in comparison with normal subjects. J Physiol Sci. 2013;63:195–201. PMID: 23519698
3. **Li P**, Liu C, Wang X, Li L, Yang L, Chen Y, Liu C. Testing pattern synchronization in coupled systems through different entropy-based measures. Med Biol Eng Comput. 2013;51:581–91. PMID: 23337958
4. **Li P**, Liu C, Wang X, Zheng D, Li Y, Liu C. A low-complexity data-adaptive approach for premature ventricular contraction recognition. Signal Image Video Process. 2014;8:111–20.
5. Liu C, **Li P**, Di Maria C, Zhao L, Zhang H, Chen Z. A multi-step method with signal quality assessment and fine-tuning procedure to locate maternal and fetal QRS complexes from abdominal ECGcg recordings. Physiol Meas. 2014;35:1665–83. PMID: 25069817
6. Sun X, Li K, Ren H, **Li P**, Wang X, Liu C. Influence of timing algorithm on brachial-ankle pulse wave velocity measurement. Bio-Med Mater Eng. 2014;24:255–61. PMID: 24211905
7. Ji L**, **Li P**, Li K, Wang X, Liu C. Analysis of short-term heart rate and diastolic period variability using a refined fuzzy entropy method. Biomed Eng Online. 2015;14:64. PMID: 26126807. PMCID: PMC4487860

8. Ji L**, Liu C, **Li P**, Wang X, Yan C, Liu C. Comparison of heart rate variability between resting state and external-cuff-inflation-and-deflation state: a pilot study. Physiol Meas. 2015;36(10):2135–46. PMID: 26333766
9. **Li P**, Liu C, Li K, Zheng D, Liu C, Hou Y. Assessing the complexity of short-term heartbeat interval series by distribution entropy. Med Biol Eng Comput. 2015;53:77–87. PMID: 25351477
10. Hu K, Riemersma-van der Lek RF, Patxot M, **Li P**, Shea SA, Scheer FA, Van Someren EJ. Progression of dementia assessed by temporal correlations of physical activity: results from a 3.5-year, longitudinal randomized controlled trial. Sci Rep. 2016;6:27742. PMID: 27292543. PMCID: PMC4904193
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8. Cai R**, Zheng X, Gao L, Hu K, **Li P**. Current shift work and frailty: findings from the uk biobank. Associated Professional Sleep Societies 2023 Annual Meeting; Indianapolis, IN. Abstract: 246
   Trainee Ruixue Cai received a Trainee Merit Award
9. Gao C**, Zheng X, Yu L, Buchman AS, Bennett DA, Leng Y, Gao L, Hu K, **Li P**. Napping in the morning is associated with risk of alzheimer's dementia in older adults. Alzheimer's Association International Conference (AAIC) 2023; Amsterdam, Netherlands.
10. Gao C**, Lim ASP, Yu L, Bennett DA, Gao L, Hu K, **Li P**. Cardio-autonomic control and cognitive decline in older adults. Alzheimer's Association International Conference (AAIC) 2023; Amsterdam, Netherlands.
11. Cai R**, Gao C, Zheng X, Hu K, Gao L, **Li P**. Frailty and risk of delirium among UK Biobank participants. Alzheimer's Association International Conference (AAIC) 2024; Philadelphia, PA. Abstract: 682
12. Gao C**, Haghayegh S, Zheng X, Cai R, Rutter MK, Bennett D, Gao L, Hu K, **Li P**. Actigraphy-Assessed Daytime Napping Links to Mild Cognitive Impairment and Dementia in Middle-to-Older Aged Adults. Associated Professional Sleep Societies 2024 Annual Meeting; Houston, TX. Abstract: 225
13. Sun H, Yang J, Vialle RA, Gao C, Cai R, Haghayegh S, Gao L, Rutter MK, Hu K, **Li P**. Target trial emulation analysis linking dampened circadian rest-activity rhythms and dementia. Alzheimer's Association International Conference (AAIC) 2024; Philadelphia, PA. Abstract: 722

Narrative Report

I am a biomedical engineer and computational physiologist with a cross-disciplinary background in biomedical signal processing, sleep, circadian and neurophysiology, and physiological measurement. My Area of Excellence is Investigation. I direct the Laboratory for Sleep and Digital Health (LSDH) and serve as the Research Director of the Medical Biodynamics Center (MBC). The research in my lab (LSDH) focuses on identifying individuals at elevated risk of cognitive impairment, Alzheimer's disease, and related dementias by utilizing novel digital biomarkers linked to sleep and circadian rhythms. We investigate the role of sleep and circadian regulation in cognitive function and resilience, with a special emphasis on vulnerable and underrepresented groups. To support individualized, proactive management of sleep and circadian health, we are also dedicated to developing innovative, cost-effective, and non-invasive contactless monitoring solutions including cutting-edge products and algorithms. My prior contributions to science and/or technology are three-fold:

1) Assessing sub-clinical cardiovascular function/risk by designing novel signal processing tools.
One of the intriguing findings in physiology is the robust complexity of physiological outputs, such as heartbeat dynamics. I have contributed significantly to this field with my most important early work (10+ years ago), in which I developed a new algorithm, distribution entropy, to assess physiological complexity based on short-length signals. Prior to this work, a reliable assessment of complexity requires long data. In contrast, physiological recordings collected in standard clinical settings (e.g., routine screening ECGs at rest) are short and, thus, unsuitable for complexity analysis. The algorithm was designed to address this major limitation, allowing a reliable assessment of complexity from short recordings.

2) Understanding sleep and circadian health, cognitive aging, and dementia etiology.

Disruptions in sleep and circadian rhythms are commonly seen in people with Alzheimer's disease and related dementias (ADRD) and may contribute to the pathogenesis of ADRD. My research has contributed to the understanding of sleep and circadian disturbances as early-stage manifestations or risk factors of AD. A highlight of my recent discoveries is the link between altered daytime napping and risk for AD, which opens a new research avenue to understand behavioral rhythms or sleep behaviors in dementia etiology and to design potential interventional strategies through consolidating sleep behaviors or sleep hygiene for cognitive benefits.

3) Addressing disparities in cognitive resilience in under-served populations.

My research has also been expanded to understanding cognitive resilience in varied socioeconomic conditions and people living with chronic conditions such as HIV infection. My research has demonstrated the importance of sleep behaviors in cognitive health in people living with HIV infection. Besides, my most recent pilot study collaborated with a group in Sub-Saharan Africa found that sleep disturbances were linked to physical frailty in people living with HIV, implying a need to further understand how social determinants of health contribute to sleep and circadian function, leading to varied health anticipations.

While my primary focus is on research, I am equally passionate about teaching and mentoring others—a pursuit I consider essential to my professional and personal growth. I was honored to receive the 2022 Early Career Mentoring Award from the Department of Medicine at Brigham and Women's Hospital (BWH) and was nominated for the 2024 Excellence in Mentoring Award from Harvard Medical School. I currently supervise three postdoctoral research fellows. I also co-supervise three research trainees at the MBC. I give weekly 1-hour tutorials to these trainees on topics including physiological complexity, nonlinear dynamical analysis, applied statistics, software application, and machine learning. I meet with postdoctoral fellows and PhD students on a 1 on 1 basis every other week, to provide personalized mentoring and guidance on project progress, career advancement, and other relevant topics regarding their professional and personal growth.

During my appointment as an Assistant Professor, I spent on average five hours/week co-directing the Medical Biodynamics Center (MBC) at MGH as Research Director, with responsibilities including administration and coordination, conceiving research ideas, implementation of analytical tools, design of the training program, and mentoring of research trainees. I also serve on the Pathways Opportunities Steering Committee, Harvard University Center for AIDS Research (HU CFAR). Committee members meet monthly to discuss strategies and plans that address issues of disparities in opportunities with the aim of increasing the number of underrepresented trainees who engage in HIV science and to develop pathways to successful careers in science and medicine. Additionally, I am privileged to serve on the Editorial Board of the journal SLEEP and as an Assistant Editor for the Journal of the American Heart Association.