# Application for NIH R25

**Multi-Institutional Summer Undergraduate Research Program to Promote**

**Diversity and Excellence in Sleep and Circadian Research Careers**

# Send application package to [Kenneth.wright@colorado.edu](mailto:Kenneth.wright@colorado.edu)

# Completed version of this document

# Copy of undergraduate transcript(s)

# Two letters of recommendation - (must be submitted from the letter writer directly to kenneth.wright@colorado.edu). Please have letter writers indicate “Multi-Institutional R25 recommendation letter” and the trainees name in the email subject line.

**Diversity Statement -** This R25 training program is committed to justice, equity, diversity and inclusive excellence in the training of future biomedical research scientists, including women. We welcome applications from undergraduate trainees that are underrepresented in the biomedical sciences (UBR) (minorities, students with disabilities, and students from disadvantaged backgrounds according to [NIH NOT-OD-20-031](https://grants.nih.gov/grants/guide/notice-files/NOT-OD-20-031.html)) for this training effort. We believe that innovation in our research and training efforts is enhanced by unique perspectives and viewpoints. We are committed to providing a strong respectful and supportive community and the skills and resources to help our trainees meet their career and personal goals.

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| APPLICANT NAME: | CURRENT INSTITUTION AND DEGREE PROGRAM: | |
| EMAIL(s): | IF GRADUATED, DEGREE AND DATE: | |
| PHONE/CELL PHONE: |  | |
| CURRENT ADDRESS: | ADDRESS/POSTAL CODES WHERE YOU GREW UP | |
| Date of Birth: | |  |
| Sex: | |  |
| Citizenship Status:  (U.S. citizen, noncitizen national or permanent resident) | |  |
| Are you a member of one or more of the UBR groups defined by the NIH?   * NIH considers the following groups as UBR (underrepresented in biomedical research)  [NIH NOT-OD-20-031](https://grants.nih.gov/grants/guide/notice-files/NOT-OD-20-031.html)   + Racial/ethnic minority     - Blacks or African Americans     - Hispanics or Latinos     - American Indians or Alaska Natives     - Native Hawaiians and other Pacific Islanders   + Individual with a disability   + physical or mental impairment that substantially limits one or more major life activities   + Individual from a disadvantaged background based on two or more of the required criteria (e.g., first generation college student, grew up in a qualifying U.S. rural area) | |  |
| Have you experienced any challenges enroute to education that you have had to overcome? | |  |
| How did you hear about us? | |  |
| Undergraduate GPA – If more than one institution provide for each institution | |  |
| Do you have any previous research experience(s). Please describe. | |  |
| If currently employed by University of Colorado please provide: | | Employee ID#:  Campus:  Dept/Division:  Dept/Division Administrator’s email: |

|  |  |
| --- | --- |
| **Where do you prefer to conduct your summer research?**  **(see list at the end of this application for options).** | |
| **First Choice** Faculty Name: Research Institution: |  |
| **Second Choice** Faculty Name: Research Institution: |  |
| **Third Choice** Faculty Name: Research Institution: |  |
| **Fourth Choice** Faculty Name: Research Institution: |  |
| **PRIOR RESEARCH EXPERIENCE(S)**  Research Institution: Research Program: Research Advisor: Department Title: |  |
| **OTHER RELEVENT EXPERIENCE(S)**  Type of Experience: Organization Name: Dates: -  Average Hours Per Week: Experience Description: |  |

**Statement of Purpose**

Describe any relevant past life, educational, and/or research experiences and explain how these experiences have contributed to your personal and professional growth. Describe your career goals and interest in a research career that incorporates sleep and circadian research.

**Attachment:** Copy of undergraduate transcript(s) – unofficial copy permitted

**Multi-Institutional Summer Undergraduate Research Program to Promote**

**Diversity and Excellence in** **Sleep and Circadian Research Careers**

Please reach out to the Training program director with questions. Prof. Kenneth Wright [Kenneth.wright@colorado.edu](mailto:Kenneth.wright@colorado.edu)

***General Criteria and Selection Process of Mentees***

**See information for this R25 at the dedicated webpage:** <https://www.colorado.edu/iphy/research/sleep-and-chronobiology/r25-training-grant>

**Eligibility**

Applicants must:

* Be current or recently graduated undergraduate students from underrepresented populations in the U.S. Biomedical Sciences\*
* Have completed at least two semesters of university; students who have completed an undergraduate degree in the past year from the application due date and have not attended a PhD or MD/PhD program are eligible
* Have a cumulative G.P.A. of 3.0 or above
* Demonstrate interest and potential to pursue graduate study toward a PhD or MD/PhD
  + (Note: The Multi-Institutional Summer Undergraduate Research Program is not designed for students pursuing professional training for careers in clinical medicine, clinical psychology, or the allied health professions)
* Be at least 18 years old by the start date of the program.
* Be a U.S. citizen or non-citizen national of the United States, or must have been lawfully admitted for permanent residence
  + (Note: Individuals on temporary or student visas are not eligible)
* Be able to devote full-time effort over the entire duration of the summer program **June 10-Aug 9, 2024**

\*We use [NIH NOT-OD-20-031](https://grants.nih.gov/grants/guide/notice-files/NOT-OD-20-031.html) for determining UBR status as being one or more of the following:

* Racial/ethnic minority
  + Blacks or African Americans
  + Hispanics or Latinos
  + American Indians or Alaska Natives
  + Native Hawaiians and other Pacific Islanders
* Individual with a disability
  + physical or mental impairment that substantially limits one or more major life activities
* Individual from a disadvantaged background based on two or more of the required criteria (e.g., first generation college student, grew up in a qualifying U.S. rural area)
* Letters of recommendation – **2 total** *(must be submitted from the letter writer to the committee directly via* [*kenneth.wright@colorado.edu*](mailto:kenneth.wright@colorado.edu)*). Please have letter writers indicate Multi-Institutional R25 recommendation letter and the trainees name in the email subject line.*
* Copy of undergraduate transcript(s) - unofficial copies permitted

**Description of Summer 2024 research experiences and project areas**

**The following three pages contain information on available faculty and research projects for the Summer 2024 multisite program at each of the participating institutions for this summer. Please select your top four choices and note these in your application. You may select projects from different institutions. As part of the selection process, the R25 executive committee will conduct a ZOOM interview with candidate being considered and match candidates with the summer research experience.**

**Washington University St. Louis and Washington University School of Medicine**

<https://wustl.edu/>

<https://medicine.wustl.edu/>

Research in Professor Erik Herzog laboratory <https://sites.wustl.edu/herzoglab/> studies the molecules, cells, and circuits underlying daily rhythms in physiology and behavior.  We have projects related to understanding the functional connectivity in circadian brain circuits, and the role of daily diffusible signals in birth and brain cancer.

Research in Professor David Holtzman’s laboratory <https://holtzmanlab.wustl.edu/> works to better understand the molecular and cellular underpinnings of the most common cause of dementia which is Alzheimer’s disease (AD).  Utilizing mouse models that develop different aspects of the pathology of AD, we have previously found that disrupted sleep leads to enhanced AD pathology and that AD pathology further disrupts sleep. In recent studies, we have found that a component of the immune system in the brain, microglia, play an important role in brain injury due to AD pathology and that microglial function is regulated by sleep. We will be further exploring the role of microglia in mouse models of AD and how microglia are influenced by sleep in ways that are either protective or injurious.

Research in Professor Paul Shaw’s laboratory <https://sites.wustl.edu/shawlab/> aims to elucidate the function of sleep using the power of *Drosophila* genetics. The lab has demonstrated that we can enhance sleep, and in so doing,  fully restore cognitive functioning to a 1) a diverse set of prototypical memory mutants, 2) flies expressing human Alzheimer’s related genes, and 3) in flies with catastrophic brain damage. Current studies use behavioral genetics in combination with classic memory assays to assess brain functioning. Follow up studies explore how sleep changes anatomy and physiology using immunohistochemistry and live-brain imaging.

Research in Professor Paul Taghert’s laboratory <https://sites.wustl.edu/taghertlab/> studies the physiology of neural circuits that contain intrinsic circadian pacemaking information.  The primary rhythmic output we measure is a daily rhythm in locomotion.  The work is performed on the fruit fly Drosophila, and we use biochemistry, imaging, genetics, and behavioral analysis.  We have a special focus on better understanding of the regulation of circadian neural circuits by neuropeptide modulation via GPCR signaling.  Current experiments involve imaging of neuropeptide GPCRs in real-time in vivo, as well as a description of proteins that interact with the GPCRs.

**University of Pennsylvania Perelman School of Medicine**

<https://www.med.upenn.edu/>

Research in Matthew Kayser’s lab <https://www.med.upenn.edu/uep/faculty_kayser.html> studies the regulation and function of sleep during early life, primarily using Drosophila (the fruit fly). All animals exhibit changes to sleep throughout development, suggesting a crucial role for sleep in young animals. Sleep disturbances are a common co-morbidity in neurodevelopmental disorders like autism, perhaps increasing severity of deficits. Identifying the mechanisms and purpose of sleep early in development is thus crucial for understanding brain maturation in health and disease. Summer projects will focus on using fly mutant models of genes associated with human neurodevelopmental disorders to examine 1) changes to sleep in response to sensory stimulation and 2) the role of sleep in neural repair. Students will learn genetic, behavioral, and imaging approaches.

Research in Michael Perlis’ research program <https://www.med.upenn.edu/bsm/faculty_perlis.html> focuses on applying a plurality of perspectives to the study of sleep and the treatment of sleep disorders. This includes principles, measures, and practices spanning from the neurophysiologic, to the neuropsychological, to the behavioral, to the epidemiologic (and sometimes even the qualitative J). Dr. Perlis’s general areas of interest (over the course of his career) include: behavior, cognitive, and physiologic factors in acute and chronic insomnia; cortical arousal and conditioned CNS activation as primary perpetuators of chronic insomnia; sensory and information processing and long term memory formation as key features of Insomnia Disorder; Insomnia as a CNS hybrid state between wake and sleep; sleep homeostasis effects on the frequency and severity of insomnia (and the patterning of insomnia over time); the relative efficacy of behavioral and pharmacologic treatments of insomnia; the potential of conditioning and partial reinforcement with placebos (behavioral pharmacotherapeutics) as a means to change how medical maintenance therapy is conducted for insomnia and other chronic conditions; and the anti-depressant effects of CBT-I. His most recent work focuses on the *natural history of insomnia* (collaborators: Ellis, Grandner, Posner, and Muench); *nocturnal wakefulness as a risk factor for “suicidality”* (collaborators: Grandner, Tubbs, Fernandez, Klerman, Chakravorty); *mapping placebo effects over time*, the relative efficacy and safety of insomnia treatments (collaborators: Cheung, Scott, Muench, Schwab, Thase, Keenan); and the *potential of CBT-I to slow the progression of cognitive decline in MCI patients* (collaborators: Gooneratne, Reddy, Veasey). Further information can be found at: [www.michaelperlis.com](https://nam10.safelinks.protection.outlook.com/?url=http%3A%2F%2Fwww.michaelperlis.com%2F&data=05%7C02%7CKenneth.Wright%40colorado.edu%7C535d1fe1e4c24efbbe9f08dc12d10678%7C3ded8b1b070d462982e4c0b019f46057%7C1%7C0%7C638405936174709460%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C3000%7C%7C%7C&sdata=Zznn60kYqaHUfwiOQU31usgWGUHX8T9dwB3Mm6hQwZo%3D&reserved=0). Summer research projects will be in one of the above areas.

Research in David Raizen’s lab <https://www.med.upenn.edu/raizen-lab/dr-raizen.html> focuses on understanding the molecular and neural mechanisms of sleep regulation both in sickness and in health. We primarily use the microscopic nematode *C. elegans* for our studies. Possible summer projects include screening for drugs or genes that modulate sleep. The student would learn Mendelian genetics, behavioral analysis, and microscopy.

Research in Amita Sehgal’s lab <https://www.med.upenn.edu/sehgallab/> works on cellular and molecular mechanisms underlying sleep and circadian rhythms. Our studies use largely the fruit fly *Drosophila melanogaster* as a model, with limited use of mouse models, and are targeted towards understanding how sleep is regulated, why sleep is important on a cellular level and how sleep and circadian systems interact with basic physiology. We are also interested in how disruption of circadian rhythms and sleep increase susceptibility to disease, in particular through impairment of metabolic pathways. Approaches used include genetic manipulations, behavioral assays, such as assays for sleep and memory, immunohistochemistry coupled with cellular/neuronal imaging, cell culture, metabolic measurements and molecular biology. Projects for trainees: (1) exploring the role of sleep in lipid metabolism in the fly brain; (2) mapping circuits underlying sleep in the fly brain; (3) behavioral and molecular analysis of fly models of disease.

**Northwestern University and Northwestern University Feinberg School of Medicine**

<https://www.northwestern.edu/>

<https://www.feinberg.northwestern.edu/index.html>

Research in Professor Kristen Knutson’s lab <https://www.feinberg.northwestern.edu/faculty-profiles/az/profile.html?xid=37050> focuses on the association between sleep, circadian rhythms and chronic diseases, including diabetes, obesity, cardiovascular, kidney disease and cognitive function. Her research also examines whether sleep and circadian rhythms play a role in socioeconomic and/or racial/ethnic health disparities. She primarily focuses on these associations out in the “real world” (outside the laboratory) by examining habitual sleep patterns using ambulatory devices. She has examined sleep patterns in a variety of populations, including large observational studies in the U.S. as well as international locations such as Haiti and Brazil. Trainees will learn methodologies and study designs relevant to population-based research as well as health disparities research. Summer R25 project would include participating in study team meetings, data processing and interpretation of results.

Research in Professor Tiffany Schmidt’s Lab <https://www.schmidtlab-northwestern.com/> has a longstanding interest in understanding how light impacts our behavior, physiology, and well-being with a focus on the circuits from the retina to the brain that carry this light information. We study the melanopsin-expressing, intrinsically photosensitive retinal ganglion cells (ipRGCs) in mice, which are the sole cell type from the retina to the brain impacting circadian photoentrainment and many other subconscious, non-image forming behaviors including the direct impacts of light on sleep, mood, and learning. We have recently become interested in understanding sex differences in ipRGC-dependent behaviors and how ipRGCs may relay light information to the brain to impact the function of the estrous cycle. A summer R25 project would involve collecting histological, hormonal, behavioral, or estrous-cycle related data from mice where the light/dark cycle or ipRGC function is perturbed. Students will work closely with a senior postdoc and graduate student to collect, analyze, and present results.

Research in Professor Fred Turek’s lab <https://www.feinberg.northwestern.edu/faculty-profiles/az/profile.html?xid=16062> has centered around circadian rhythms and sleep in animal models (primarily mice, rats, and hamsters) for over 40 years, with a special interest in identifying the genes that regulate sleep and circadian rhythms. We also use of circadian models to elucidate the physiological and genetic bases that underlie sleep and rhythm abnormalities that are associated with human conditions such as diabetes, depression, aging, stress, obesity, jet lag, shift work, reproductive biology and neurodegenerative disorders. I am particularly interested in developing animal models to study the impact of disrupted sleep and circadian rhythms (environmental or genetic disruptions) on mental and physical health with a recent focus on Alzheimer's Disease (AD) and Parkinson's Disease (PD). I also have a long research interest in determining how sleep and circadian rhythms differ based on the sex of the animal. The summer research project will involve the use of animal models to develop a better understanding of the relationship of disrupted sleep and circadian rhythms before and during the development of AD and PD like symptoms.

Research in Professor Phyllis Zee’s laboratory <https://www.feinberg.northwestern.edu/faculty-profiles/az/profile.html?xid=13785> is primarily focused on human translational sleep and circadian science. Research is performed in a tightly controlled laboratory setting as well as in “real life” conditions in the field or clinic. A central theme of Zee’s research program is to understand the role of circadian-sleep interactions on the expression and development of cardiometabolic and neurologic disorders. Dr. Zee’s research is focused on the effects of sleep and circadian disruption on the development and expression of age-related disorders, such as neurodegeneration (Alzheimer’s Disease, Parkinson Disease) and cardiometabolic disorders (diabetes, obesity) and in the mechanisms that underlie circadian rhythm sleep-wake disorders. In addition, the research team is studying the effects of circadian-sleep based interventions, such as bright light and feed-fast schedules on cognitive, cardiovascular and metabolic functions and their potential to delay cardiometabolic aging and neurodegeneration. On-going projects that may be of interest to trainees are: 1) Role of time restricted eating (overnight fast) on sleep quality, cardiovascular and metabolic biomarkers of disease risk in middle age and older adults. 2) Effect of inappropriately timed light exposure on sleep and cardiometabolic function. 3) Autonomic nervous system regulation in older adults with insomnia disorder, and relationship with cardiovascular and cognitive health. 4) Pathophysiology of circadian rhythm delayed sleep wake phase disorder. 5) Sleep and circadian rhythms dysfunction in children with atopic dermatitis.