Sleep deprivation resistance in the greater effective altruist community

Minerva University

NS112: Evolution Across Multiple Scales

Prof. Kinnally

Dec 19, 2025

Introduction to sleep deprivation resistance

Infamously at hackathons, certain participants remain productive deep into the second night, while others gradually descend into deadly errors.

When studying sleep deprivation, the effective altruist diaspora is particularly interesting for three reasons. First, a productivity self-experimentation culture already exists: Guzey's experimentation being a prime example, where he discovered sustaining on 4 hours per day of sleep over 12 days did not significantly impair his cognitive performance measured via the psychomotor vigilance task, SAT and a custom first-person shooter reaction time game. Thousands of essays speculating on sleep deprivation proliferate on lesswrong.com, forum.effectivealtruism.org, astralcodexten.com, gwern.net and similar sites. The availability of peptides from Chinese manufacturers encouraged self-experimentation culture, gaining a critical mass by September 2025. Secondly, as EAs carefully choose to lead high-impact careers, sleep deprivation could have disproportional downstream effects. Thirdly, this population is cognitively sensitive to sleep disturbances. However, no peer-reviewed studies examine the EA diaspora as a collective impacted by sleep deprivation.

Conventionally, sleep is characterized by the two-process model: Process S builds up sleep pressure via adenosine linearly throughout the day, while Process C initiates sleep onset originally from the suprachiasmatic nucleus of the hypothalamus (Borbély, 2022). Both processes interact to generate alertness peaks in mid-morning and early evening, and troughs during pre-waking hours and afternoons.

During extended wakefulness, Process S continues to climb while Process C cycles through its natural rhythm. Thus, energy crashes hardest during the pre-early morning hours and in the following afternoon (Durmer & Dinges, 2005).

Vigilant attention and reaction time are the first functions to deteriorate in sleep deprivation, marked by increased P300 latencies and decreased amplitudes. In the following phase, higher cognitive functions are affected as a network. There is alternating activity between the default mode network during background tasks and the frontoparietal control network during task processing instead of prolonged activation of either mode (Khan & Al-Jahdali, 2023). The thalamus becomes noisy and frequently interrupts. More lapses, microsleeps, omissions and commissions become visible. Working memory capacity drops. Executive functioning and reward systems follow: Median PFC-amygdala coupling becomes more error-prone, and decisions take a longer time. Simultaneously, memory consolidation weakens. The Hippocampal cAMP/PKA and mTOR pathways are downregulated. In the third phase, longer-horizon mechanisms are more visibly impaired: poor renormalization of synapses as well as toxic waste buildup from lowered expressions in AQP4 and glymphatic clearance (Khan & Al-Jahdali, 2023). Crystallized intelligence remains the most resilient after sleep deprivation.[1]

At the genetic level, humans carry variable-number tandem repeats (VNTRs) in PER3, with the most common genotypes being four repeats (PER3 4/4) and five repeats (PER3 5/5). PER3 5/5 individuals show greater slow-wave activity and slow-wave energy during sleep, indicating steeper accumulation and faster dissipation of homeostatic sleep pressures. Importantly, PER3 5/5 carriers face greater cognitive impairment during sleep deprivation, particularly in the early morning trough, despite having similar baseline performance to PER3 4/4 individuals, often linked to evening preferences (Viola et al., 2007). This pattern suggests that PER3^5/5 individuals have a "faster" homeostatic process: their sleep debt builds more

[1] #networks. We discuss sleep deprivation as a neurobiological network. In the second stage, the DMN and FPC oscillate and are frequently interrupted. As sleep deprivation prolongs we notice the signals between network nodes ignore priors, become increasingly noisy, arrive unstructured and leads to the network destabilizing.

steeply during wakefulness and clears more efficiently during sleep, but this also means they have less tolerance for extended wakefulness.

Likewise, the ADA22-A allele reduces extracellular adenosine accumulation. Lower adenosine release delays the onset of severe sleepiness, sustains subjective alertness longer, and reduces micro-arousals during sleep–indirectly increasing sleep efficiency (Rétey et al., 2005). Individuals carrying this allele report feeling less tired at equivalent homeostatic loads and show better maintained vigilance on objective tasks. This creates a virtuous cycle: efficient sleep leaves less residual homeostatic pressure at wake onset, permitting longer high-performance wakefulness, which in turn increases slow-wave pressure during the next sleep bout, further enhancing efficiency.

Finally, ecological niches describe the set of environmental conditions and resource requirements that allow a phenotype to persist. In hunter-gatherer societies, social vigilance and infant care formed different ecological niches, imposing disruptive selection on chronotypes; Modern human societies contain a rich diversity of cognitive and behavioral niches, created by the division of labor and technical complexity. Some occupations demand sustained vigilance (air traffic controllers, emergency physicians, security analysts); others prioritize creativity and problem-solving (research scientists, designers, entrepreneurs); still others require crystallized expertise and procedural skill (surgeons, pilots, software engineers). Night owls gravitate toward careers with flexible schedules, remote work, or evening-shifted hours; morning larks toward traditional office jobs with early starts. Many ecoservices are available on demand and the majority of modern humans are "lions" may indicate stabilizing selection on chronotypes.[2]

[2] #naturalselection: We speculate that hunter-gatherer societies may have disruptive selection followed by stabilizing selection in chronotypes. Similar selection forces among the EA community leads to less chronotype variance within the effective altruist population than the general population.

Occupation also shapes allostatic load along with chronic environmental factors: socioeconomic status, chronic noise exposure, access to green space, diet quality, and chronic psychosocial stress. Individuals living in quiet, low-stress, high-SES environments accumulate less baseline allostatic load, freeing metabolic reserves that can be deployed to cope with acute stressors like sleep deprivation.

With the three factors above, individuals with fast and efficient adenosine clock cycles, low allostatic load, and adaptive ecological niche constructions will be the most resistant to sleep deprivation.

Our hypothesis expects the EA community to have higher-than-population frequencies of PER3 4/4 and ADA22-A alleles due to self-selection into high-intensity, time-pressured work. While PER3 4/4 is genetically vulnerable, performance is mitigatable via niche construction: Teams that pre-commit to mandatory nap breaks for all members will be more *effective* on code quality than teams where naps are not a norm. We expect that in a 36-hour interventional study in the form of an AI safety hackathon, the vigilance decline will be steeper in genetically resilient individuals assigned to an eco-naive niche than in genetically resilient individuals in eco-smart niches by a significant amount.[3]

36-hour hackathon as interventional study

The interventional study will include participants who (1) self-identify as EA-adjacent and (2) have coding abilities sufficient to attend a hackathon. We exclude any participants with

[3] #complexcausality. We discuss the genetic causes of having PER3 4/4 genes, ADA-22A allele present, becoming an indirect source of sleep quality improvement and hence sending the individual into a virtuous cycle. Additionally, we also think this study will contribute to an open data set that has second order effects inspiring replication studies, as well as indirectly contribute to AI safety and mental wellbeing.

(1) severe sleep deprivation 3 days prior to the hackathon (2) recent trans-meridian travels, or (3) have night-shift work.[4]

Independent variables include PER3 genotypes, ADA22-A alleles. These will be gathered from saliva, with consent, to be used with PCR to correlate 4/4, 4/5 or 5/5 on PER3 VNTR and ADA22-A allele presence.

Dependent variables include cognitive attrition measures: Karolinska Sleepiness Scale for subjective state, performance vigilance tasks will be administered at meal times (9:00 am, 12pm, 7pm) to avoid additional cognitive load. We also measure work quality, as tracked by number of git commits per hour, quality of commit messages and code reviews analyzed post-event from the team's public repo.

We establish two separate tracks. The treatment track imposes team-wide mandatory napping of 20 minutes beyond 00:00, and coffee beans with caffeine microdoses to flatten adenosine rebound. Dynamic lighting with distinct shades during 09:00–12:00, 18:00–21:00 and 00:00–06:00 is offered to mimic natural light. A second track allows participants to do whatever they want, referred to as eco-naive. Participants are prohibited from using any unprescribed amphetamines, modafinil or sleep peptides during the event. Mentors will circulate on site to verify rule-following.

We aim to recruit 270 participants, as hackathons have sign-up and submission attrition rates to satisfy a sample size of 30 per track.[5]

---

[4] #interventionalstudy: The independent, dependent and controlled variables are discussed with two treatment conditions. The study has control, attempts to minimize extra cognitive load by mimicking the natural state of hackathons by having tracks and also performing tests during meal time.

[5] #testability: The hypothesis is testable via psychometrics (vigilance task and karolinska sleepiness scale), code quality (commits and code reviews) and cluster correlation to performance is confirmable by PCR analyses after the hackathon.

Could eco-niches mitigate genetic vulnerability in sleep?

We will sort the psychometric data, objective output and saliva samples into heatmaps. We expect to observe several different profiles:

	Gene resilient	Gene vulnerable
Eco-smart	Best performance	Second-best performance
Eco-naive	Average performance	Worst performance

Within eco-smart environments, genetically resilient individuals with ADA22-A and PER3 4/4 should dominate. We would observe a shallow decline in KSS and PVT as well as code quality. Following, genetically vulnerable individuals in eco-smart conditions should match or exceed resilient individuals.[6] This resonantes with popular sentiment that conscientiousness drives the institutional engine more than raw genetic intelligence.

The hackathon provides "ecosystem services" analogous to natural habitats: provisioning (food, water, workspace, wifi), regulating (lighting, napping pods, coffee), and cultural (mentorship, peers, education). Just as organisms in resource-rich environments express broader phenotypic ranges, participants with access to eco-smart infrastructure can exploit cognitive strategies unavailable in resource-poor settings.[7]

[6] #phenotypicplasticity: we discuss the multiple variants of the per3 gene (4/4, 4/5 and 5/5) and how genetically vulnerable individuals could be regulated by constructed eco-smart niches to perform better in hackathons and vice versa.

[7] #nicheconstruction: we compare the hackathon, its two tracks as eco-smart and naive niches, elaborating on provisioning, regulating and cultural elements, and also shapes participants' psychometric, real world outputs. We also frame ancient societies as niches that demand diverse schedules while contemporary moldable environments are adaptive.

Justification, as asked in Long Term Future Fund's application

Project start date: Jan 1, 2026. End Date: May 30, 2026

This study indirectly contributes to the cause of AI safety by understanding the mental clarity of researchers especially when peptides are becoming an increasingly chosen solution. Mental wellness is classified as secondary priorities by effective altruism.

In the best case, this generates replication attempts at hackathons and follow-up studies. In the average case, incoming EAs could copy the PCR techniques to self-screen for their chronotypes and take relevant steps followed in the paper. In the worst case: null or insignificant result, however, this study becomes recognized within the EA community. In all cases, the deliverable could be a replicable paper and an open dataset that lets EA quantify any sleep ROI beyond individual anecdotes within its community. This is comparable to the annual surveys of Astral Codex Ten and LessWrong with data that could be analyzed broadly by the community.

Budget:

Hackathon venue. Food costs, covering 4 meals and snacks for 270 people: $15k

Genotyping, done in bulk, 270 reactions would be $80 - $150 USD.

Requested amount.

Minimum: $5k, partial sponsorship for food.

Moderate: $10k, sponsorship for hackathon

Generous: $24k, $15k for food and $19k additional for 4 months of stipend for an undergraduate orchestrating such study.

Funding track record: The applicant received the 1517 Medici, Merge and Believe for original work developing low-cost microelectrode arrays within the last 6 months; He proceeded onto the final round for the Lux capital fellowship and did not obtain the Emergent ventures grant; He has also posted videos on X in the EA-adjacent community, reposted by 5 EA members that gained ~10K views within 24 hours, suggesting this research could at minimum gain awareness.

Word count: 1343 words for main

Justification: 280 words

AI statement: I used kimi.com to recommend 5 important papers for sleep so that I could outline the key assumptions underlying my paper, also brainstorming which hypotheses and impact framing could be most falsifiable and impactful before I started writing the paper. I also clarified genetic terminology by asking a mix of perplexity.ai and deepseek.

Bibliography

Alexander, S. (2025, January 29). ACX survey results 2025. *Astral Codex Ten*. https://www.astralcodexten.com/p/acx-survey-results-2025

Borbély, A. (2022). The two-process model of sleep regulation: Beginnings and outlook. *Journal of Sleep Research*, *31*(4), e13598. https://doi.org/10.1111/jsr.13598

Durmer, J. S., & Dinges, D. F. (2005). Neurocognitive consequences of sleep deprivation. *Seminars in Neurology*, *25*(1), 117–129. https://doi.org/10.1055/s-2005-867080

Guzey, A. The effects on cognition of sleeping 4 hours per night for 12-14 days: A pre-registered self-experiment - *Guzey.com*.

Khan, M. A., & Al-Jahdali, H. (2023). The consequences of sleep deprivation on cognitive performance. *Neurosciences (Riyadh, Saudi Arabia)*, *28*(2), 91–99. https://doi.org/10.17712/nsj.2023.2.20220108

Long-Term future fund. (n.d.). Effective Altruism Funds. Retrieved December 20, 2025, from https://funds.effectivealtruism.org/funds/far-future

Rétey, J. V., Adam, M., Honegger, E., Khatami, R., Luhmann, U. F. O., Jung, H. H., Berger, W., & Landolt, H.-P. (2005). A functional genetic variation of adenosine deaminase affects the duration and intensity of deep sleep in humans. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(43), 15676–15681. https://doi.org/10.1073/pnas.0505414102

Viola, A. U., Archer, S. N., James, L. M., Groeger, J. A., Lo, J. C. Y., Skene, D. J., von Schantz, M., & Dijk, D.-J. (2007). PER3 polymorphism predicts sleep structure and waking performance. *Current Biology : CB*, *17*(7), 613–618. https://doi.org/10.1016/j.cub.2007.01.073