

Sleep orchestrates indices of local plasticity and global network stability in the human cortex

Jonathan G Maier, Marion Kuhn, Florian Mainberger, Katharina Nachtsheim, Stephanie Guo, Ulrike Bucsenez, Bernd Feige, Christian Mikutta, Kai Spiegelhalter, Stefan Klöppel ... [Show more](#)

Sleep, Volume 42, Issue 4, April 2019, zsy263, <https://doi.org/10.1093/sleep/zsy263>

Published: 22 December 2018 **Article history** ▼

Views ▼ Cite Permissions Share ▼

Abstract

Animals and humans spend on average one third of their lives in sleep, but its functions remain to be specified. Distinct lines of research propose that sleep promotes local strengthening of information-bearing synapses (plasticity) and global downscaling of synaptic strength (stability) in neural networks—prerequisites for adaptive behavior in a changing environment. However, the potential orchestration of these processes, particularly in humans, needs to be further characterized. Here, we use electrophysiological, behavioral, and molecular indices to noninvasively study cortical plasticity and network stability in humans. We observe indices of local strengthening of prior induced long-term potentiation-like plasticity (paired associative stimulation induced change in motor-evoked potential) and global network stabilization (homeostatic regulation of wake EEG theta activity) after brief periods of nonrapid eye movement sleep compared with wakefulness. The interplay of local sleep slow oscillations and spindle activity, previously related to synaptic refinements during sleep, is identified as a potential mechanism. Our findings are consistent with the notion that sleep-specific brain activity patterns reduce the plasticity–stability dilemma by orchestrating local plasticity and global stability of neural assemblies in the human cortex. Future studies are needed to further decipher the neural mechanisms underlying our indirect observations.

[sleep](#), [transcranial magnetic stimulation](#), [paired associative stimulation](#), [electroencephalography](#), [cortical plasticity](#), [LTP](#), [slow-wave activity](#), [sleep spindles](#), [phase-amplitude coupling](#)

© Sleep Research Society 2018. Published by Oxford University Press on behalf of the Sleep Research Society. All rights reserved. For permissions, please e-mail journals.permissions@oup.com.

This article is published and distributed under the terms of the Oxford University Press, Standard Journals Publication Model (https://academic.oup.com/journals/pages/open_access/funder_policies/chorus/standard_publication_model)

Topic:

[electroencephalography](#)

[motor evoked potentials](#)

[sleep](#)

Issue Section: [Basic Science of Sleep and Circadian Rhythms](#)

You do not currently have access to this article.

Sign in

Don't already have an Oxford Academic account? [Register](#)

Oxford Academic account

Email address / Username [?](#)

Password

[Sign In](#)

[Forgot password?](#)

[Don't have an account?](#)

Sleep Research Society members



[Sign in via society site](#)

American Academy of Sleep Medicine members



[Sign in via society site](#)

Sign in via your Institution

[Sign in](#)

Purchase

[Subscription prices and ordering](#)

Short-term Access

To purchase short term access, please sign in to your Oxford Academic account above.

Don't already have an Oxford Academic account? [Register](#)

Sleep orchestrates indices of local plasticity and global network stability in the human cortex - 24 Hours access

EUR €36.00

GBP £28.00

USD \$45.00

Rental



This article is also available for rental through DeepDyve.

[View Metrics](#)

Email alerts

[New issue alert](#)

[Advance article alerts](#)

[Article activity alert](#)

[Subject alert](#)

[Receive exclusive offers and updates from Oxford Academic](#)

Related articles in

[Google Scholar](#)

Related articles in PubMed

Deep learning-based electroencephalography analysis: a systematic review.

Long-term seizure outcomes after pediatric temporal lobectomy: does brain MRI lesion matter?

Utility of neuromonitoring during lumbar pedicle subtraction osteotomy for adult spinal deformity.

Low entropy of interictal gamma oscillations is a biomarker of the seizure onset zone in focal cortical dysplasia type II.

Citing articles via

Google Scholar

CrossRef

Latest | **Most Read** | **Most Cited**

Characterization of the sleep disorder of anti-IgLON5 disease

Actigraphic detection of periodic limb movements: development and validation of a potential device-independent algorithm. A proof of concept study

Simultaneous tonic and phasic REM sleep without atonia best predicts early phenoconversion to neurodegenerative disease in idiopathic REM sleep behavior disorder

Residual symptoms after natural remission of insomnia: associations with relapse over 4 years

Sleep duration and fragmentation in relation to leukocyte DNA methylation in adolescents

Looking for your next opportunity?

Chair of Pain Research
Boston, Massachusetts

PEDIATRIC EMERGENCY PHYSICIAN
Saskatoon Shines, Saskatchewan

Endowed Chair of Occupational
Health/Medicine
Saint John, New Brunswick

CHIEF OF THE DIVISION OF ALLERGY,
IMMUNOLOGY AND INFECTIOUS
DISEASE
New Brunswick, New Jersey

[View all jobs](#)

OXFORD
UNIVERSITY PRESS

[About SLEEP](#)

[Editorial Board](#)

[Author Guidelines](#)

[Facebook](#)

[Twitter](#)

[Contact Us](#)

[Purchase](#)

[Recommend to your Library](#)

[Advertising and Corporate Services](#)

[Journals Career Network](#)

Online ISSN 1550-9109

Print ISSN 0161-8105

Copyright © 2019 Sleep Research Society

[About Us](#)

[Contact Us](#)

[Careers](#)

[Help](#)

[Access & Purchase](#)

[Rights & Permissions](#)

[Open Access](#)

Resources

[Authors](#)

[Librarians](#)

[Societies](#)

[Sponsors & Advertisers](#)

[Press & Media](#)

[Agents](#)

Connect

[Join Our Mailing List](#)

[OUPblog](#)

[Twitter](#)

[Facebook](#)

[YouTube](#)

[Tumblr](#)

Explore

[Shop OUP Academic](#)

[Oxford Dictionaries](#)

[Oxford Index](#)

[Epigeum](#)

[OUP Worldwide](#)

[University of Oxford](#)

Oxford University Press is a department of the University of Oxford. It furthers the University's objective of excellence in research, scholarship, and education by publishing worldwide

Copyright © 2019 Oxford University Press

[Accessibility](#)

[Get Adobe Reader](#)

[Cookie Policy](#)

[Privacy Policy](#)

[Legal Notice](#)

[Site Map](#)