



Universität
Zürich^{UZH}



ZNZ Zentrum für Neurosensibilität und
Neuroscience Center Zürich
uzh | eth | zürich



Comparative Physiology and Pharmacology of Sleep

Local sleep

Reto Huber
University Children's Hospital

Bio 333: HS 2012; 19.11.2012



Universität
Zürich^{UZH}

Studienangebotsentwicklung

Lehrveranstaltungsbeurteilung (LVB) HS 2012

Im Auftrag der Universitätsleitung zentral organisierte, fakultätsübergreifende

Online-Befragung von Bachelor- und Master-Studierenden

vom 19. November bis 2. Dezember 2012

Weitere Informationen zur LVB erhalten Sie zum Befragungsstart am
19.11.2012 per E-Mail.

Herzlichen Dank für Ihre Teilnahme!

Kontakt: Sarah Colombo, lvb@lehre.uzh.ch

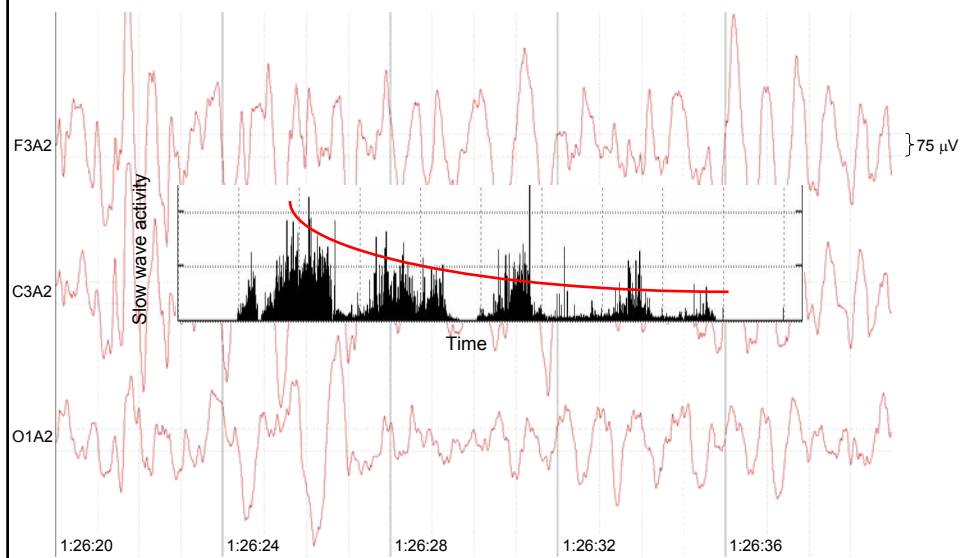
HS 2012

Learning objectives

At the end of the lecture you should be able to:

- Describe local aspects of sleep
- Understand the use dependence of sleep

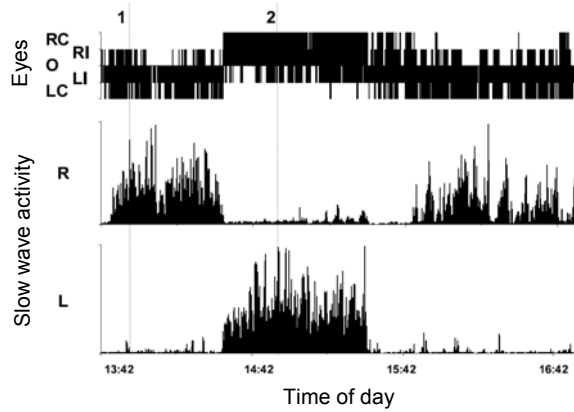
Global sleep



Unihemispheric sleep

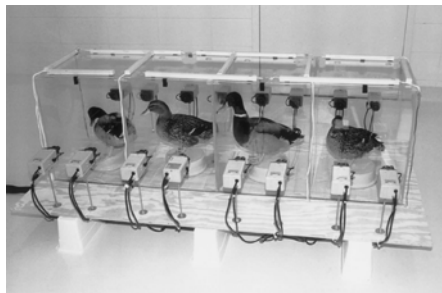


Beluga whale

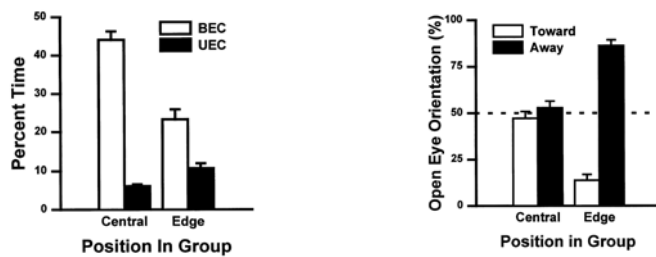


Lyamin et al., Behav Brain Res 2002

Unihemispheric sleep



Mallard ducks

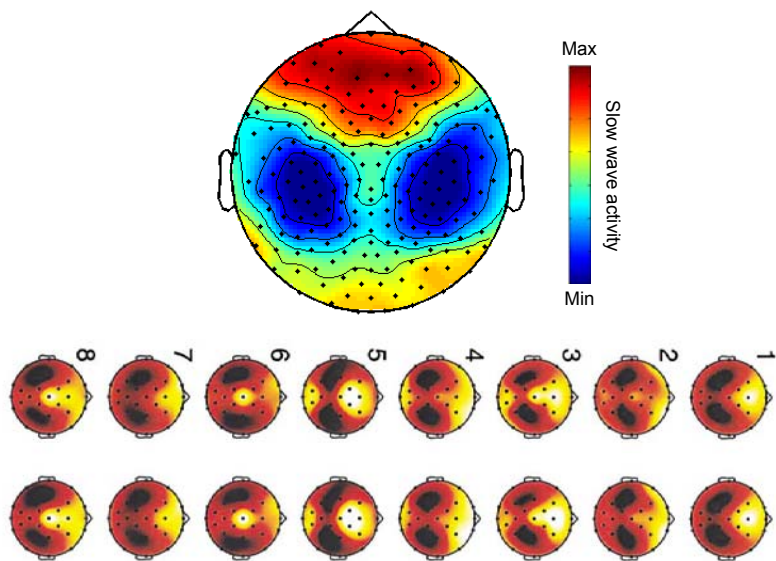


Rattenborg et al., Behav Brain Res 1999

Local differences in sleep exist in animals.

What about in humans?

Local sleep in humans



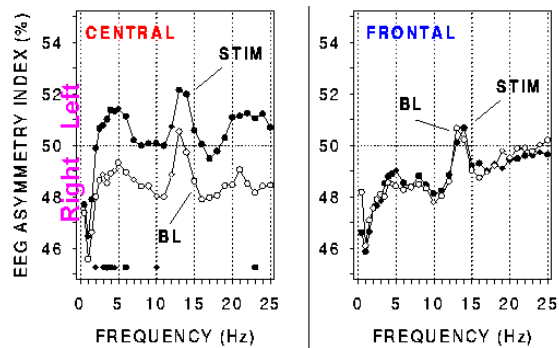
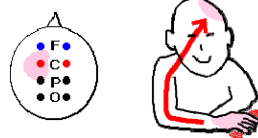
Finelli et al., Neuropsychopharmacol 2001

Use dependence

Where do these local differences in sleep depth come from?

- Frontal cortex is most used brain region (Horne 1993)
- Kattler experiment
- Rotation learning

Kattler experiment

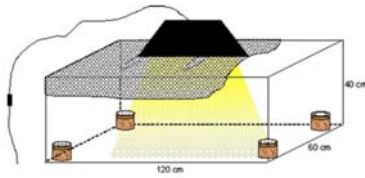


Kattler et al., J Sleep Res 1994

Shift in asymmetry



Domestic chick



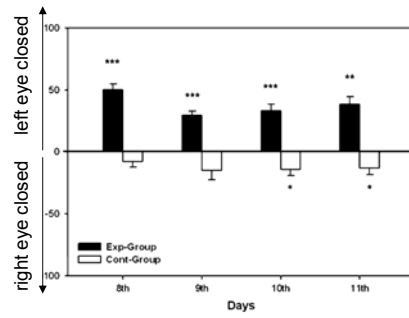
Feeding places



Exp-Group

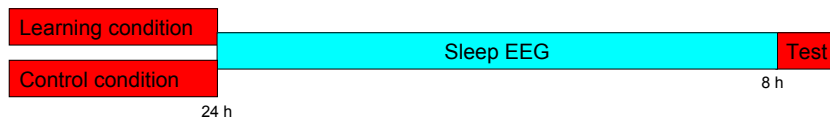


Cont-Group



Nelini et al., Exp Brain Res 2010

Rotation learning: study design



Learning
test
45 min



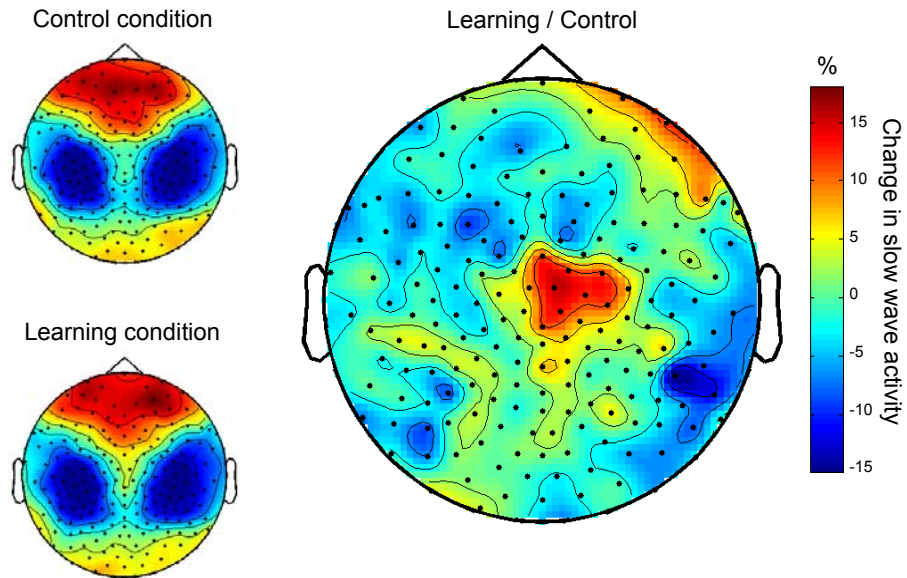
hdEEG
sleep



Re-test
20 min

Huber et al., Nature 2004

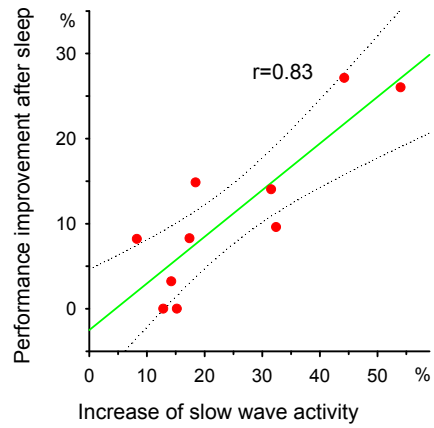
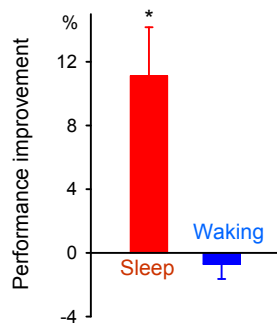
Local increase in SWA after learning



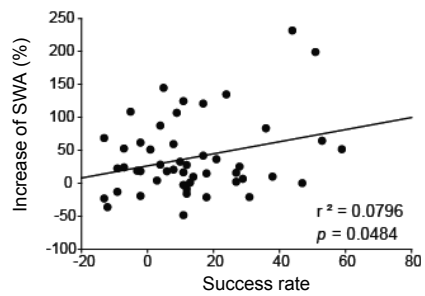
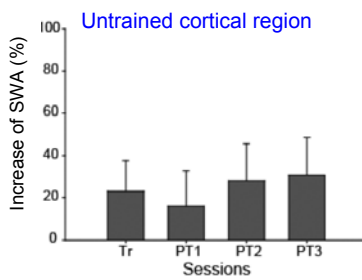
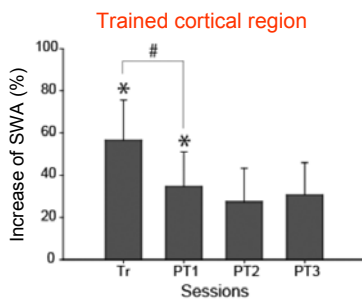
Local differences show use dependence.

Are they also related to sleep dependent performance improvements?

Sleep dependent performance improvement

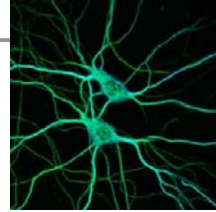


Reaching task in rats

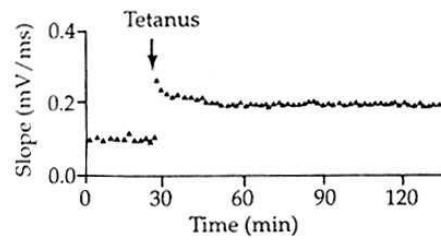


Hanlon et al., Sleep 2009

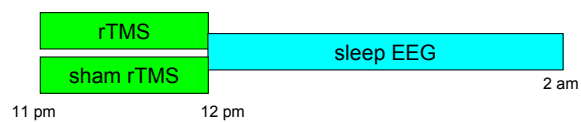
Learning basics



Long term potentiation (LTP; Bliss and Lomo 1973)



Study design



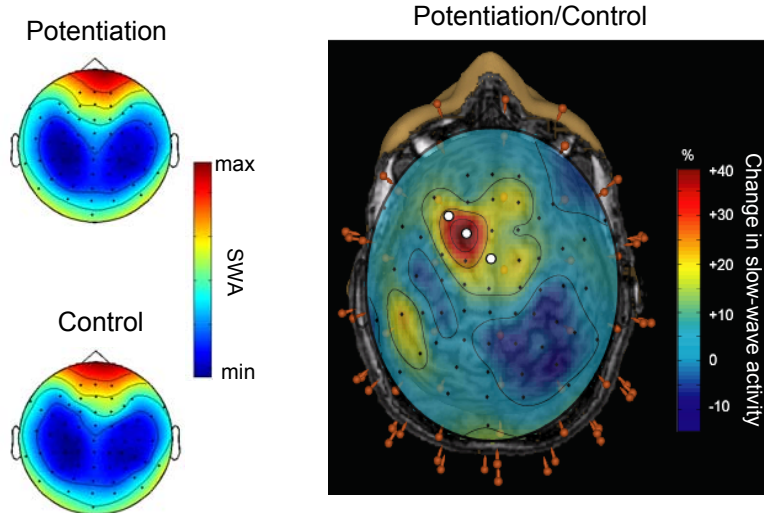
rTMS
Conditioning
1500 pulses



hdEEG
Sleep
First cycle

Huber et al., PLoS1 2007

Local increase of SWA after rTMS



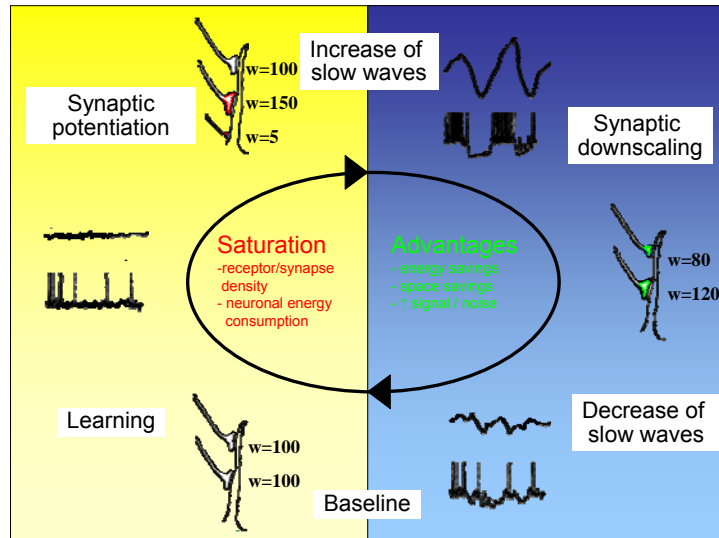
Conclusions

Sleep intensity is locally regulated.

The local regulation of sleep is use dependent.

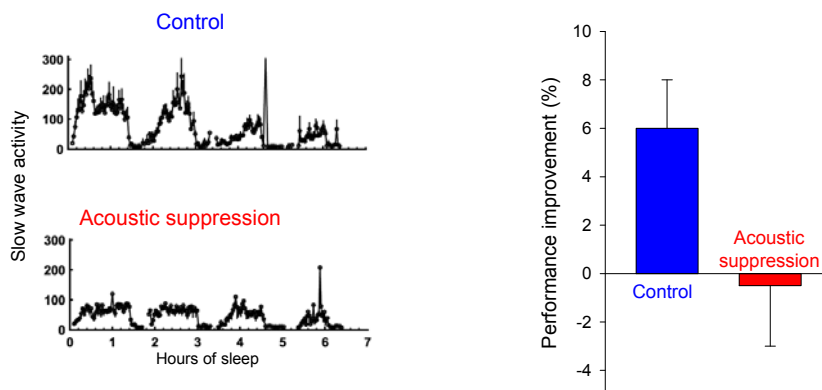
Possible relationship between cortical plasticity and slow waves during sleep.

Synaptic homeostasis hypothesis



Tononi and Cirelli, 2003;2006

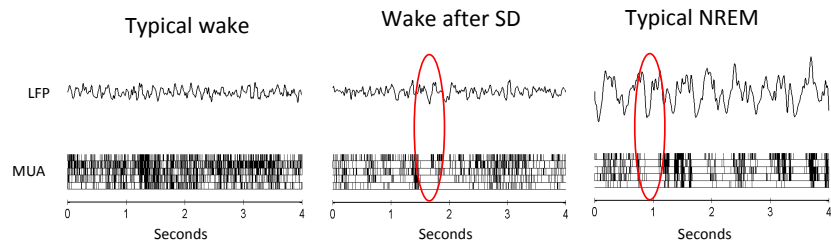
Suppression of slow waves



Landsness et al., Sleep 2009

Local sleep in awake rats

Multiunit activity (MUA) and local field potential (LFP) recordings

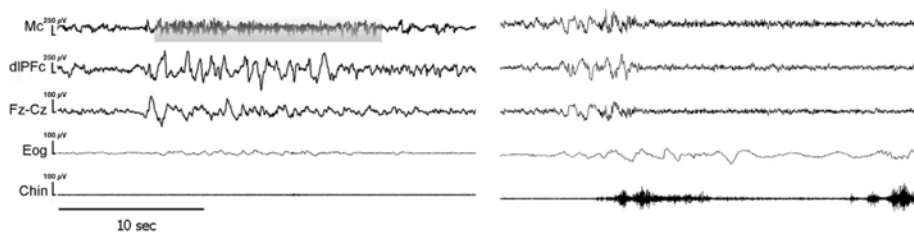


Vyazovskiy et al., Nature 2011

Wake like cortical activity during sleep

Intracranial recordings in humans:

- motor cortex (Mc)
- dorso-lateral prefrontal cortex (dlPFC)
- Scalp EEG (Fz-Cz)



Nobili et al., NeuroImage 2011