

Introduction to Forum on Critical Topics in SLEEP

Commentaries on Dworak et al. Sleep and brain energy levels: ATP changes during sleep. *Journal of Neuroscience* 2010;30:9007-16.

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In this issue of *SLEEP* there are a series of commentaries and a response by the authors to the manuscript by Dworak and colleagues published in the *Journal of Neuroscience* (2010;30(26):9007-16).¹ This manuscript reports the interesting and somewhat surprising result of a 200-400% surge in ATP in different brain regions with sleep. Their investigation was motivated by the energy hypothesis of sleep/wake control.^{2,3} Study of this hypothesis is challenging as the commentaries point out. Sacrifice of an animal results in extremely rapid changes in the energy status of the brain, as well as other tissues, that have necessitated specific methodologies to capture the in vivo energy status. Indeed, one of the earliest studies addressing the energy hypothesis of sleep/wake control by Karnovsky et al.⁴ used a special cage that while rat sleep was being recorded the floor of the rat cage disappeared and the animal was plunged immediately into liquid nitrogen! Two of the commentaries argue that with the techniques employed by Dworak et al.,¹ in vivo

changes in ATP in brain with sleep and wake cannot be measured reliably.

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REFERENCES

1. Dworak M, McCarley RW, Kim T, Kalinchuk AV, Basheer R. Sleep and brain energy levels: ATP changes during sleep. *J Neurosci* 2010;30:9007-16.
2. Benington JH, Heller HC. Restoration of brain energy metabolism as the function of sleep. *Prog Neurobiol* 1995;45:347-60.
3. Scharf MT, Naidoo N, Zimmerman JE, Pack AI. The energy hypothesis of sleep revisited. *Prog Neurobiol* 2008;86:264-80.
4. Karnovsky ML, Reich P, Anchors JM, Burrows BL. Changes in brain glycogen during slow-wave sleep in the rat. *J Neurochem* 1983;41:1498-501.

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