Rebuttal

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DRS. STICKGOLD AND WALKER ASK THAT WE EXPLAIN WHY THEIR TABLE 1 IS NOT CONVINCING. THIS IS A PECULIAR TABLE. THESE AUTHORS LIST 6 SELECTED rat and human studies using different methodologies, different dependent variables and different hypotheses regarding different aspects of the relationship between sleep and learning. Most importantly, these studies have been selected according to no criteria other than, apparently, that they agree with the conclusions of Drs. Stickgold and Walker. They then extract r and R^2 values from within the results of these studies and average them across studies. There is no statistical justification for doing this. Finally, they multiply the p values across studies to come to the conclusion that, "The combined probability of 10^{-15} reflects the likelihood of all 6 studies providing such low probabilities for the null hypothesis." Using this approach, one could literally prove "beyond a shadow of a doubt" either side of any debate, on topics that range from cold fusion, to intelligent design, to alien abductions. They use a similar approach in Figure 2.

Unfortunately, this casual approach to experimental design and statistics pervades the work on sleep and memory consolidation. Drs. Stickgold and Walker describe "a truly staggering number of possible ways that sleep might affect memory consolidation.[1]" The problem is that researchers in the field appear to draw from all of these possibilities in a more or less ad hoc way to find significance in effects that vary from study to study. For example, in one of their most widely publicized papers,[2] these authors conclude that procedural learning in humans is linked to the amount of stage 2 sleep in the last ¼ of the night. Why did they not emphasize the lack of a significant effect on stage 2 sleep in the first ¼ of the night, nearest the time of learning? Why not the second ¼ or the whole night? Why not changes in REM sleep or the other sleep states that they have emphasized in prior studies? In this connection, it is disturbing that the sleep parameters found to correlate with the same types of learning appear to vary from study to study. We review this issue elsewhere.[3,4]

This loose approach to statistics appears to spill over to Drs. Stickgold and Walker's consideration of the literature. In the current paper they refer the reader to an article of theirs in which they discuss the relevance of decades of human experience with antidepressant medications to our understanding of the role of REM sleep in memory consolidation.[1] In this paper they state that previously published criticisms pointing out the near total suppression of REM sleep by MAO inhibitors were "inconsequential" because they "fail to reflect the reality that, after an initial period of intense REM suppression, most of these patients have significant REM sleep on a nightly basis.[1]" This published quote is untrue. We invite the reader to look up the following references, which demonstrate the profound suppression of REM sleep, over weeks, months and years, with chronic use of broad spectrum MAO inhibitors.[5-8] No deleterious effects of MAO inhibitors on any memory task have been reported in the PDR, and no deleterious effects on memory can be found with a literature search on PubMed, although some evidence for small improvements in memory have been reported.[3,9,10]

There are some newer MAO inhibitors that act only on MAO-A and do not profoundly suppress REM sleep.[11,12] Walker and Stickgold illogically seize on studies of these MAO-A inhibitors to claim that reports of REM sleep suppression with broad spectrum MAO inhibition were false. The relevant issue has never been whether all MAO inhibitors suppress REM sleep, but rather whether suppression of REM sleep affects memory. Since their approval in 1961, millions of individuals have taken broad spectrum MAO inhibitors that produce complete or nearly complete suppression of REM sleep for months or years, yet there is no evidence that these MAO inhibitors cause memory problems.

The lack of significant effects of drug-induced suppression of REM sleep on any type of memory is consistent with reports of brain damage induced long term suppression of REM sleep in humans. These lesions produced no detectable memory problems.[3,13-16]

It is the claim that that "no improvement" occurs in waking and, therefore, sleep is "absolutely required"[17] for performance improvement that attracts attention to the sleep-memory consolidation field. However, in their recent review,[1] these authors also surprisingly suggest that sleep may not have a role in memory consolidation, but only in enhancement of memory. This seems to be a major change from their prior claims, but this change is not reflected in their current statement. If their claim is that sleep, like exercise, fresh air, good food and a good mood improve learning, we have no argument with them. On the other hand, if their claim is that sleep is absolutely required for memory consolidation and that consolidation does not occur in waking, despite contrary data,[3,4,18] then we remain to be convinced, even though Drs. Stickgold and Walker believe that there is only a "10^{-15}" probability that we are correct.

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