

From: Robert Lawrence Kuhn <[REDACTED]>

To: "jeffrey E." <jeevacation@gmail.com>

Subject: Kuhn - The Science of Sleep and Dreams

Date: Wed, 15 Feb 2017 06:27:38 +0000

Attachments: To_Jeffrey_from_Robert_-_Sleep_&_Dreams_analysis_-_3.15.17.docx;
McNamara,_Patrick_-_Sleep_References.docx

Pardon the formality below - I want to approach your very legitimate questions / concerns in a serious manner. Attached and below the same.

Dear Jeffrey:

As requested, the following addresses your two questions / concerns about our proposed Closer To Truth TV series "The Science of Sleep and Dreams":

(i) Have there been sufficient breakthroughs in Sleep and Dreams (significantly beyond traditional understandings) to justify a major TV series?

(ii) Even if 'yes' to (i), is now the proper time for such a foundational series, or are more years needed for corroborative studies and further research to solidify the breakthroughs?

In preparing this response, my primary source is Professor Patrick McNamara, Department of Neurology, Boston University School of Medicine, with whom CTT Producer/Director Peter Getzels and I spoke with at length today. Patrick is one of the leading sleep and dream researchers (he himself more dreams). More importantly, he is perhaps the leading chronicler of the field, with many publications (including 26 entries in related encyclopedias). He is co-editor-in-chief of the "Encyclopedia of Sleep and Dreams" (2012) and the sole author of the forthcoming "An Introduction to the Neuroscience of Sleep and Dreams" (Cambridge University Press, 2018), which intends to present the latest science and to become a main textbook for graduate courses/seminars. Patrick is a CTT contributor and colleague.

When we asked Patrick, his first response – "This is the ideal time to tell the sleep-and-dreams story" – and he cited (in essence) your two questions, in that (i) the multiple breakthroughs are now sufficiently well corroborated by numerous independent labs such that a substantial foundation for the new, deeper understanding of sleep and dreams is now for the first time (over the past few years) confirmed and established, and (ii) there are now interesting application and critical clinical questions to pose, explore and pursue, such as for the treatment of various mental-related illnesses that have known sleep-related syndromes (e.g., PTSD and Depression).

To understand the significance of recent breakthroughs, a defining characteristic of sleep and dreams is that there are two distinct kinds of sleep – REM (rapid-eye-movement) Sleep and NREM (non-rapid-eye-movement) Sleep. Most dreams are associated with REM sleep (though complex). The eye movement gives the eponymous name, but a more important designation defines the two stages in terms of brain waves (electroencephalograph – EEG): REM is Fast-Wave Sleep (similar to the waking state) and NREM Sleep is Slow-Wave Sleep (very different from the waking state). This difference between REM and NREM sleep has been known since 1953 (different EEGs since 1937), but its deep significance has only been discovered and confirmed in very recent years (as explained below).

Following are the key areas of breakthrough in sleep and dreams (from Patrick). Patrick states that these are now reproducible, non-controversial, and well-accepted among experts, although still not appreciated by the public -

hence the high value of our CTT TV series. The organizing idea is why and how are sleep and dreams essential for normal memory consolidation and bodily health / well-being.

Memory Consolidation. There is a fundamental difference between REM and NREM Sleep for memory consolidation: REM is for emotional memories, whereas NREM is for declarative and procedural memories. Hence, understanding and dealing with REM emotional memories can lead to treatment for the many neuropsychiatric illnesses that have sleep/dream-related disorders or syndromes (Parkinson's Disease, Anxiety, Substance Abuse, many sleep disorders such as Nightmare Disorder, etc., in addition to PTSD and Depression). Research shows bi-directional causality between neuropsychiatric disorders and sleep disorders. This is a superb example of how fundamental science breakthroughs lead to clinical breakthroughs. This fact that REM is associated with emotional memories is nicely consistent with the apparent psychotic nature of dreams, because in REM Sleep the frontal cortex is 'down-regulated' (and the frontal cortex is associated with rational planning, reflection, controlling impulses), while in REM Sleep the limbic system is 'up-regulated' (and the limbic system is associated with emotions and feelings) – see Neuroimaging below. This is why dream states flood the ego with emotional fantasies without rational control. However, it is also true that the limbic system enables creative ideas, thus grounding in science the long-suspected idea that sleep and dreams can enhance creativity.

As Dr. Robert Stickgold, our other advisor on the series, wrote: "It would be nice if we could talk about sleep and memory as if there were only one type of memory and one type of sleep. But this is far from the case. Sleep and memory each comes in many forms, and furthermore, memories can go through multiple forms of post-encoding processing that must be individually addressed."

Immunity / Immune System. Strengthening the immune system is now a proven product of NREM sleep. Discerning the evolutionary basis for this is a key research project (i.e., it seems counter-intuitive that sleeping facilitates fitness for survival in that predators lurked in the jungles and on the plains so that going unconscious during sleep does not, at first glance, seem especially adaptive). Studies of sleep in various non-human animals reveals a direct relationship between longer periods of NREM (Slow-Wave) Sleep and a stronger immune system, especially in fighting parasites. NREM Sleep releases molecules that fight infection; NREM Sleep works for the maintenance, repair and activation of the immune system. (This gives scientific rationale for the need or desire to sleep during illnesses.) Related are "genetic conflict" studies with respect to REM and NREM, showing differences in heredity between maternal and paternal lines, and differences between males and females in which genes get "imprinted".

Neuroplasticity. Exciting recent research has reversed the century-long conventional wisdom that new neurons are never created in adult animals/humans. The development of new neurons – neuronogenesis – is a vital part of maintaining normal brain and mental functioning. New neurons are being created, importantly, in the hippocampus (brain organ where new memories are encoded) – but, remarkably, the neuronogenesis in the hippocampus occurs only/largely during REM Sleep – a stunning finding. This is another reason why REM sleep is needed for emotional memory consolidation (normal functioning).

Dream-Content. Although dreams have sparked human fascination and fantasy for thousands of years, only in very recent years, have large-scale surveys been conducted with rigorous design, classifications and statistical analysis. Literally hundreds of thousands of dreams are enabling statistically significant theories, including cross-cultural analyses (similarities and differences). Dream-posting sites have revolutionized size and structure of dream data sets. This enables, for the first time, longitudinal studies of dreams over time. Patterns are repeated. For example, in general, the dreams of males and females differ in fundamental ways. Males will engage in fighting with other males; females with both males and females. Male dreamers are often the initiator of fights and the fights are usually physical. Females fight verbally. Aggressiveness by the dreamer is almost always in REM Sleep, rarely in NREM Sleep. (Why is a continuing question.) "Lucid Dreaming" is a new area of fascinating research. Lucid Dreaming is where the dreamer "knows" that he/she is dreaming while dreaming (a talent that a small minority possesses but more can be trained/developed). Lucid dreamers, while sleeping, can now communicate with experimenters by altering their brain activity and thus becoming detectable by neuroimaging techniques (see below).

Neuroimaging. Finally, neuroimaging technology has enabled many of these breakthroughs. As such, it is itself a methodological breakthrough that has enabled these other content breakthroughs. Neuroimaging now enables detailed location of the neuroanatomy and neurophysiology of REM and NREM Sleep. In REM Sleep, the dorsolateral, frontal cortex is “down-regulated”, whereas the limbic system is “up-regulated”, showing the physiological basis for the emotional, wild-fantasies of dreams (see above). (Neuroimaging will enable good visual images for the TV series without extra costs.)

Patrick stresses that while these breakthroughs form, for the first time, a solid foundation for understanding sleep and dreams, they also open opportunities to dig deeper into the “purpose” of sleep and dreams, as well as engender a new series of questions and directions (e.g., clinical treatments of illnesses).

Attached is Patrick’s quick compiling of summaries of a few recent leading research papers (2009 – 2017, especially 2015-2017).

You’d enjoy speaking with him, if you want.

Love to do this series together with you.

Much appreciate and warm regards,

Robert