

Editorial

REM-Sleep Deviations and Their Role for Psychiatric Disorders

Roumen Kirov*

Department of Cognitive Psychophysiology, Institute of Neurobiology, Bulgarian Academy of Sciences, Bulgaria, Europe

***Corresponding author:** Roumen Kirov, Department of Cognitive Psychophysiology, Institute of Neurobiology, Bulgarian Academy of Sciences, Sofia, Bulgaria, Europe

Received: June 29, 2016; **Accepted:** July 08, 2016;

Published: July 11, 2016

Keywords

REMS; Dreaming; Psychopathology

Abbreviations

REMS: Rapid Eye Movement Sleep; ADHD: Attention-Deficit/Hyperactivity Disorder; IQ: Intelligence Quotient; EEG: Electroencephalographic; PLM: Periodic Limb Movements; RLS: Restless Legs Syndrome; SDB: Sleep-Disordered Breathing; RBD: REMS Behavior Disorder

Editorial

Rapid Eye Movement-Sleep (REMS) and its neurophysiological signatures and brain activation patterns have been shown to support many cognitive and psychological adaptive functions, including consolidation of emotional memory [1], resolution of affect and emotional processing [2], consolidation, stabilization and elaboration of previously transformed memories [3,4], procedural memory and implicit or motor learning [4,5], and heuristic creativity [6]. However, the precise functions of REMS remain elusive, and REMS' physiological processes and associated dreaming state may have more complex functional significance than proposed so far [7,8]. These latter functions refer to less well recognized adaptive processes. First, REMS and dreaming were proposed to generate an innate virtual model of the world, which is proposed to promote predictive coding or Bayesian inference/complexity reduction in wakefulness [7]. Second, it was assumed that the periodic occurrence of REMS and associated dreaming may be regarded as a recurrent adaptive interference that may incorporate previously encoded and consolidated memories into a broader vital context comprising residuals of hypotheses testing, related emotions, basic needs, and individual genetic traits [8]. Third, REMS dreaming state also has been proposed to sub-serve mental activity that is oriented to changes in environment or of the subjects view and approach to these, according to personal needs without definite probability forecast to the outcomes, but with a regular consideration of the outcomes in the process of active behavior - the so called search activity, which acts differentially in relation to norm and psychopathology [9].

From a developmental perspective, it is to be noted that infants have much more REMS proportion which descends through

childhood and adolescence, than adults [10]. It has been proposed that this developmental decrease in REMS support brain maturation through internally-generated stimulation of neuronal assemblies and genetic programming [11].

Collectively, the above mentioned REMS and dreaming functions suggest strongly that deviations of REMS timing and proportion, and REMS physiological signatures and dreaming state during either maturation or later in life can lead to worsened cognitive, emotional and psychosocial adaptation. This in turn could result in occurrence of various psychiatric disorders and psychopathological conditions [12].

Factors that could produce REMS deviations are many. First, inappropriate developmental decrease in REMS is considered as a prerequisite for numerous common child and adolescent psychiatric disorders [13,14,15]. For example, we have previously demonstrated that youths with Attention-Deficit/Hyperactivity Disorder (ADHD) displayed more REMS compared with healthy peers, and whilst the REMS proportion in ADHD patients was associated positively with inattention and negatively with performance Intelligence Quotient (IQ), in the healthy peers it was associated negatively with inattention and positively with performance IQ [16]. A more recent study showed that whereas decreased REMS theta (4 Hz - 8 Hz) Electroencephalographic (EEG) power was associated with worsened emotional memory in ADHD children, this REMS EEG signature was associated positively with emotional memory in healthy subjects [17]. Further, a literature review indicated that dominance of tics and motor activities such as Periodic Limb Movements (PLM) and Restless Legs Syndrome (RLS) in REMS among children and adolescents with Tourette syndrome may lead to impaired daytime adaptive functions [18]. Last but not at least, two reviews substantiated of many experimentally-driven data showed that 1) nightmares in REMS may be predictors of many psychiatric conditions during adolescence [13], and 2) brain activation patterns during wakefulness and REMS are very similar in common youth psychiatric disorders compared to typically developing children, thus suggesting a dream-like state during wakefulness in these patients [15]. Next, Sleep-Disordered Breathing (SDB), PLM and RLS were shown to dominate during REMS, especially in child psychiatric disorders and aging [13,18,19,20]. Whilst this leads to REMS fragmentation, the exact daytime behavioral consequences are still less well understood. Similarly, REMS Behavioral Disorder (RBD) in association with PLM and RLS, which is most common in elderly with Parkinson or Alzheimer's diseases, can also deteriorate REMS and its dreaming state [20]. However, it is so far unclear whether the behavioral deficits in REMS disorders like SDB, PLM, RLS, and RBD are illness-specific, medication-induced, or may result simply from REMS fragmentation.

Likewise, treatment approaches in neuropsychiatric diseases

and mood and sleep disorders also may lead to interrupted and/or reduced REMS, thus hampering its natural functions for the successful adaptation. For example, dopamine agonists, selective serotonin and norepinephrine reuptake inhibitors reduce REMS significantly [15,18]. A psychotherapeutic approach in treatment of sleep disorders and related psychopathological conditions, such as lucid dreaming [21], has been shown to change the normal REMS EEG signatures and brain activity and the associated dreaming state [22]. However, the intact REMS features are mandatory for the normal functions that REMS and the associated dreaming is proposed to support [1,2,3,4,7,8,9,11].

In conclusion, deviant changes in REMS could certainly affect its natural functional significance for the successful adaptation. Such deviant REMS patterns may result from the following reasons. (1) Inappropriate maturation of sleep-wake cycle and particularly, the developmental REMS decrease. (2) REMS-specific disorders, especially in association with developmental psychopathologies and age-related morbid conditions. (3) Pharmaco- or psychotherapeutic approaches (lucid dreaming) in treatment of sleep and neuropsychiatric disorders. But the adverse effects of some of these REMS deviations have been overlooked frequently in sleep medicine. Bringing the attention of sleep medicine specialists to these issues could improve treatment of neuropsychiatric diseases associated with REMS deviation.

References

- Nishida M, Pearsall J, Buckner RL, Walker MP. REM sleep, prefrontal theta, and the consolidation of human emotional memory. *Cereb Cortex*. 2009; 19: 1158–1166.
- Van der Helm E, Yao J, Dutt S, Rao V, Saletin JM, Walker MP. REM sleep depotentiates amygdala activity to previous emotional experiences. *Curr Biol*. 2011; 21: 2029–2032.
- Llewellyn S. Such stuff as dreams is made on? Elaborative encoding, the ancient art of memory, and the hippocampus. *Behav Brain Sci*. 2013; 36: 589–607.
- Rasch B, Born J. About sleep's role in memory. *Physiol Rev*. 2013; 93: 681–766.
- Yordanova J, Kolev V, Verleger R, Bataghva Z, Born J, Wagner U. Shifting from implicit to explicit knowledge: different roles of early- and late-night sleep. *Learn Mem*. 2008; 15: 508–515.
- Cai DJ, Mednick SA, Harrison EM, Kanady JC, Mednick SC. REM, not incubation, improves creativity by priming associative networks. *Proc Natl Acad Sci U S A*. 2009; 106: 10130–10134.
- Hobson JA, Hong CC, Friston KJ. Virtual reality and consciousness inference in dreaming. *Front Psychol*. 2014; 5: 1133.
- Kirov R. REM sleep and dreaming functions beyond reductionism. *Behav Brain Sci*. 2013; 36: 621–622; discussion 634–659.
- Rotenberg VS. Lucid dreams: their advantage and disadvantage in the frame of search activity concept. *Front Psychol*. 2015; 6: 1472.
- Roffwarg HP, Muzio JN, Dement WC. Ontogenetic development of the human sleep-dream cycle. *Science*. 1966; 152: 604–619.
- Marks GA, Shaffery JP, Oksenberg A, Speciale SG, Roffwarg HP. A functional role for REM sleep in brain maturation. *Behav Brain Res*. 1995; 69: 1–11.
- Benca RM, Obermeyer WH, Thisted RA, Gillin JC. Sleep and psychiatric disorders. A meta-analysis. *Arch Gen Psychiatry*. 1992; 49: 651–668; discussion 669–670.
- Brand S, Kirov R. Sleep and its importance in adolescence and in common adolescent somatic and psychiatric conditions. *Int J Gen Med*. 2011; 4: 425–442.
- Garcia-Rill E, Charlesworth A, Heister D, Ye M, Hayar A. The developmental decrease in REM sleep: the role of transmitters and electrical coupling. *Sleep*. 2008; 31: 673–690.
- Kirov R, Brand S. Sleep problems and their effect in ADHD. *Expert Rev Neurother*. 2014; 14: 287–299.
- Kirov R, Uebel H, Albrecht B, Banaschewski T, Rothenberger A. Two faces of REM sleep in normal and psychopathological development. *Eur Psychiatry*. 2011; 422–423.
- Prehn-Kristensen A, Munz M, Molzow I, Wilhelm I, Wiesner CD, Baving L. Sleep promotes consolidation of emotional memory in healthy children but not in children with attention-deficit hyperactivity disorder. *PLoS One*. 2013; 8: 65098.
- Kirov R, Becker A, Rothenberger A. Sleep in Tourette syndrome. *Curr Dev Disord Rep*. 2014; 1: 252–259.
- Hornyak M, Feige B, Riemann D, Voderholzer U. Periodic leg movements in sleep and periodic limb movement disorder: prevalence, clinical significance and treatment. *Sleep Med Rev*. 2006; 10: 169–177.
- Bombois S, Derambure P, Pasquier F, Monaca C. Sleep disorders in aging and dementia. *J Nutr Health Aging*. 2010; 14: 212–217.
- Aurora RN, Zak RS, Auerbach SH, Casey KR, Chowdhuri S, Karippot A et al. Best practice guide for the treatment of nightmare disorder in adults. Standards of Practice Committee; American Academy of Sleep Medicine. *J Clin Sleep Med*. 2010; 6: 389–401.
- Voss U, Holzmann R, Tuin I, Hobson JA. Lucid dreaming: a state of consciousness with features of both waking and non-lucid dreaming. *Sleep*. 2009; 32:1191-1200.