GENERAL ARTICLE

Secret of waking-up fresh and having a great day!

Felix Bast

After a long night's sleep, now that you are sitting on a chair with morning cuppa and the Science Reporter-both indeed neuro-stimulants, and hoping to have a great day, no matter had you woke-up fresh or not. Believe it or not, seemingly perplexing conundrum the title of this write-up might have been, solutions have already been discovered by scientists (first part, almost four decades ago) albeit remained pretty much a coveted secret and mostly obscured from the public. So the purpose of this is straight forward; being a popular science enthusiast, let me divulge it, to make a bit of modern science-essence of three primary research papers that are filled with technical jargons and beyond the comprehension for most of us-improve our daily life.

Have you ever wondered how much sleep we should get every night in order to be healthy and wake-up fresh? An adage says "eight hours of sleep and eight glasses of water, a day", but these do not have any scientific basis, especially the latter [1]. Now, have you ever wondered even after that perfect eight hours of sleep (or even longer!), why do we wake-up at times sleepy, exhausted, listless and lazy? And once in a while you wake earlier than your usual get-up time, yet you feel fresh and full of energy.

Here's what the science reveal, after rigorous experiments with night-long EEG scans on sleep volunteers done four decades ago. We sleep in the so called "sleep cycles"; each lasting about 90 minutes, passing through four stages of NREM (Non-Rapid Eye Movement) and last 1 stage of REM (Rapid Eye Movement). This 90-minute sleep cycle is well-known since 1960s among scientists, yet using this information for making our days better had been comparatively a recent phenomenon [2]. When we fall asleep, we begin with a light sleep-the first stage of NREM. As we progress, sleep gets increasingly deeper with decreased brain activity, and by fourth stage of NREM we are almost entirely in deep sleep, which continues till REM, the final stage when brain activity is again increased and it's when we dream (See Fig 1). An adult need five to six sleep cycles, while infants need more. It is extremely unpleasing if we wake-up during the last two stages. Ideally, the most pleasing time to wake-up is right in the end of REM; i.e., right after the last episode of our dream comes to an end, not before then. Haven't you sometimes wished to go back to the dream, to see the climax? In my opinion one physiological function of dreams is to let us wake up at the end of it, to the day of freshness! Who would like to get out of theatre when the show have not yet culminated? Even if the show is of the horror genre (i.e., nightmare). However what about shows that are so boring (aka soporific=sleep-inducing) and repelling? Well, who knows, when dreams comes out to be boring ("Soporific Dreams!"), it induces more NREM sleep. In my experience, no dreams are boring, ever! By "last episode" when I said earlier, do you think dreams are like TV soap operas-a series of continuous episodes? Alternatively is it as cinemas, but somehow we remember only the last film we dream in final sleep cycle? In my experience, at times I could

vividly recollect two unrelated dreams in the same night, but we do not know much about the dreams yet!

Now, how can we use this piece of scientific evidence to make our lives easy? How to wake-up fresh, and with full of energy? It's all about timing our bed-time in order to wake up at the end of sleep-cycle, not in between. Suppose you would like to wake up by 7 AM, perfect time to sleep can be calculated by subtracting in multiples of 90 minutes, keeping in view of 5-6 sleep cycles that we minimally need; therefore it is either 10 PM (6 cycles), or 11: 30 PM (5 cycles). We usually need 15-20 minutes to fall in sleep, which need to be factored to calculate the perfect bed-time. So perfect bed-time for waking up at 7 AM is around 9:45 PM or 11:15 PM. I had been using this trick for quite some time now and believe me, this works all the time!

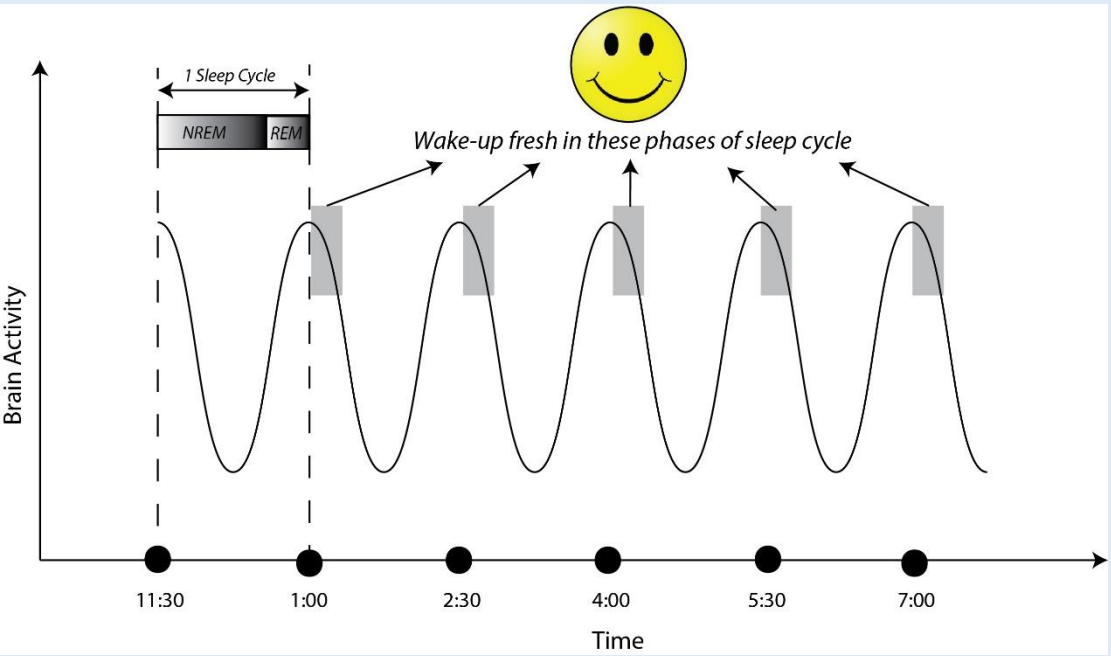

Fig 1. Sleep cycles illustrating stages (top-left) and ideal times to sleep/wake-up (bottom).

Wish you had a smart alarm-clock that wakes you up every morning at your optimum time? Here's the finest example of how innovators pick-up ideas from primary research papers and make the idea working in real life. A number of smartphone apps are now available in the market (for example, "Sleep-Cycle" for android/iPhone) that can wake you up at the optimal time based on this principle and the time you fall sleep. These apps make use of the accelerometer (motion-sensor) which is available in most of the smartphones of today; therefore, you should keep the phone in the mattress while sleeping for these alarms to work. We tend to move around a while before we fall asleep and these apps look at the moment we stop these movements. So instead of waking you up at the exact time you specify, the algorithm calculate ideal time based on the time you fall asleep and wakes you up at or before the time you specify, very smart isn't it? The principle of sleep cycle applies for naps too; an ideal afternoon siesta should last for at least 90 minutes. Coming to naps, there are a number of scientific studies

that associated taking naps with increased memory retention and creativity. Maybe it is high time for employers and HR department to inculcate napping practice in their workforce.

Now the second part of the story, is there any hack for having a great day besides waking up fresh? Of course, having a great day depends on lot many "extrinsic" factors, like how others interact with us, local weather, unplanned incidents etc., but what I was referring is increasing our cognitive ability; having a great day of attention and mindfulness! As per the research the key is exercise, even as short as 20 minutes of the brisk walk. In a 2010 study, researchers compared brain activity of volunteers who underwent 20 minutes of aerobic activity against those who have not, with the fMRI (functional MRI) approach, and found those who exercised had significantly higher and longer-lasting basal ganglia volume compared with those who haven't [3]. Basal ganglia volume in turn is an indicator of cognitive potential and attentiveness. The same study compared test scores of students who underwent 20 minutes of moderate physical activity before the exams against those who haven't and concluded that the first group had significantly increased scores, taking in consideration of other factors. In yet another, unrelated study, hippocampal volume was found to be increasing with aerobic exercise in pre-adolescent (9-10 year old) children [4]. Hippocampus is involved with relational memory and, therefore, it can reasonably be concluded that aerobic exercise boost memory power. These findings seemed to me as a déjà vu; I remember a number of instances in the past where I unknowingly did some physical activity, such as rushing for the bus, running to the venue to be in time etc., prior to tests (written exams, interviews etc.), results of which turned out quite positive in retrospection. Probably telling your children run (or run, if you are the candidate) for 20 minutes in the morning of the big day would be a scientifically-sound piece of advice, apart from timing their bed-times to wake up in the end of sleep cycle, for boosting their test scores, and ultimately for waking up fresh and having a great day!

(Felix Bast, *Ph.D., IFA* is working as Assistant Professor at Centre for Biosciences, Central University of Punjab. He can be contacted at felix.bast@gmail.com)

Cited References:

1. Valtin H (2002) "Drink at least eight glasses of water a day." Really? Is there scientific evidence for "8× 8"? American Journal of Physiology-Regulatory, Integrative and Comparative Physiology 283: R993-R1004.

2. Hartmann E (1968) The 90-minute sleep-dream cycle. Archives of general psychiatry 18: 280-286.

3. Chaddock L, Erickson KI, Prakash RS, VanPatter M, Voss MW, et al. (2010) Basal ganglia volume is associated with aerobic fitness in preadolescent children. Developmental neuroscience 32: 249-256.

4. Chaddock L, Erickson KI, Prakash RS, Kim JS, Voss MW, et al. (2010) A neuroimaging investigation of the association between aerobic fitness, hippocampal volume, and memory performance in preadolescent children. Brain research 1358: 172-183.