

## H-Reflex in Lucid Dreams

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When I started medical school, I wanted to continue doing psychophysiological research into consciousness during REM sleep, but many of my mentors suggested that by definition this was impossible. I was going to have to come up with some sort of unequivocal proof that the phenomenon I was talking about was indeed REM sleep and not a micro-awakening. After collaborating with Stephen LaBerge, and others, and reviewing the literature, we decided that the best thing to do would be to continuously monitor H-reflex amplitude throughout the night, its suppression being a unique criterion of REM sleep.

To induce the H-reflex, we stimulated the posterior tibial nerve, which is a nerve behind your knee, every 5 seconds to produce a contraction of the soleus muscle, which was then recorded as a pen detection on the polygraph record. What the literature had documented was that the H-reflex amplitude was variably present in all states of non-REM sleep and wakefulness, but during REM sleep, when all your muscle tension is gone, and when you are in effect paralyzed and not receiving any sensory input from the external environment, this H-reflex is suppressed. By documenting H-reflex suppression during lucid dreaming, we added further support to the growing body of knowledge that the phenomenon is indeed a REM sleep occurrence and not a micro-awakening.

In Figure 1, the left side of the diagram is REM sleep with an eye movement signal indicating that I'm lucid, and the right side of the diagram is awake with eyes closed and an eye movement signal which we agreed means that I perceive myself to be awake. The top nine lines are brain wave activity, followed by three lines for eye movements, a line each for anger pulse, submental muscle tension, heart rate and H-reflex, and two lines for respiration.

The dream behind this polygraph record was one in which I was not lucid. I was walking around minding my own business when all of a sudden Jimmy Stewart started to talk with me. I immediately realized I was dreaming, since Jimmy Stewart normally doesn't come and talk with me. I decided to signal left-right, left-right, up-down, up-down, left-right, left-right. I awakened shortly thereafter and made a left-right, left-right, left-right, left-right signal, which means that I perceive myself to be awake.

Figure 2 shows that the H-reflex is significantly more suppressed during lucid REM

sleep than during any other stage of sleep or wakefulness. These statistics were generated by scoring each 5-second epoch within each REM period as awake, Stage 1, Stage 2, REM or lucid REM sleep. The H-reflex amplitude was measured after each 5-second epoch and 95% confidence limits were established. As you can see, the H-reflex is significantly more suppressed during lucid REM sleep than during any other stage. This would fit with a hypothesis that increasing brain activation during REM sleep leads to further suppression of reflex activity.

In the future, I hope to further investigate the physiology of lucid dreaming in order to better understand how the teaching of this skill to various patient populations may be useful as an adjunct to current treatment plans.