

## The Effect of Dream Deprivation

The need for a certain amount of dreaming each night is suggested by recent experiments.

William Dement

About a year ago, a research program was initiated at the Mount Sinai Hospital which aimed at assessing the basic function and significance of dreaming. The experiments have been arduous and time-consuming and are still in progress. However, the results of the first series have been quite uniform, and because of the length of the program, it has been decided to issue this preliminary report.

In recent years, a body of evidence has accumulated which demonstrates that dreaming occurs in association with periods of rapid, binocularly synchronous eye movements (1-3). Furthermore, the amount and directional patterning of these eye movements and the associated dream *content* are related in such a way as to strongly suggest that the eye movements represent scanning movements made by the dreamer as he watches the events of the dream (3). In a study of undisturbed sleep (4), the eye-movement periods were observed to occur regularly throughout the night in association with the lightest phases of a cyclic variation in depth of sleep, as measured by the electroencephalograph. The length of individual cycles averaged about 90 minutes, and the mean duration of single periods of eye movement was about 20

minutes. Thus, a typical night's sleep includes four or five periods of dreaming, which account for about 20 percent of the total sleep time.

One of the most striking facts apparent in all the works cited above was that a very much greater amount of dreaming occurs normally than had heretofore been realized—greater both from the standpoint of frequency and duration in a single night of sleep and in the invariability of its occurrence from night to night. In other words, dreaming appears to be an intrinsic part of normal sleep and, as such, although the dreams are not usually recalled, occurs every night in every sleeping person.

A consideration of this aspect of dreaming leads more or less inevitably to the formulation of certain rather fundamental questions. Since there appear to be no exceptions to the nightly occurrence of a substantial amount of dreaming in every sleeping person, it might be asked whether or not this amount of dreaming is in some way a necessary and vital part of our existence. Would it be possible for human beings to continue functioning normally if their dream life were completely or partially suppressed? Should dreaming be considered necessary in a psychological sense or a physiological sense or both?

The obvious attack on these problems

was to study subjects who had somehow been deprived of the opportunity to dream. After a few unsuccessful preliminary trials with depressant drugs, it was decided to use the somewhat drastic method of awakening sleeping subjects immediately after the onset of dreaming and to continue this procedure throughout the night, so that each dream period would be artificially terminated right at its beginning.

### Subjects and Method

The data in this article are from the first eight subjects in the research program, all males, ranging in age from 23 to 32. Eye movements and accompanying low-voltage, nonspindling electroencephalographic patterns (4) were used as the objective criteria of dreaming. The technique by which these variables are recorded, and their precise relationship to dreaming, have been extensively discussed elsewhere (2, 4). Briefly, the subjects came to the laboratory at about their usual bedtime. Small silver-disk electrodes were carefully attached near their eyes and on their scalps; then the subjects went to sleep in a quiet, dark room in the laboratory. Lead wires ran from the electrodes to apparatus in an adjacent room upon which the electrical potentials of eye movements and brain waves were recorded continuously throughout the night.

Eye movements and brain waves of each subject were recorded throughout a series of undisturbed nights of sleep, to evaluate his base-line total nightly dream time and over-all sleep pattern. After this, recordings were made throughout a number of nights in which the subject was awakened by the experimenter every time the eye-movement and electroencephalographic recordings indicated that he had begun to dream. These "dream-deprivation" nights were always consecutive. Furthermore, the subjects were requested not to sleep at any other time. Obviously, if subjects were allowed to nap, or to sleep at home on any night in the dream-

The author is on the staff of Mount Sinai Hospital, New York, in the department of psychiatry.

deprivation period, an unknown amount of dreaming would take place, offsetting the effects of the deprivation. On the first night immediately after the period of dream deprivation, and for several consecutive nights thereafter, the subject was allowed to sleep without disturbance. These nights were designated "recovery nights." The subject then had a varying number of nights off, after which he returned for another series of interrupted nights which exactly duplicated the dream-deprivation series in number of nights and number of awakenings per night. The only difference was that the subject was awakened in the intervals between eye-movement (dream) periods. Whenever a dream period began, the subject was allowed to sleep on without interruption, and was awakened only after the dream had ended spontaneously. Next, the subject had a number of recovery nights of undisturbed sleep equal to the number of recovery nights in his original dream-deprivation series. Altogether, as many as 20 to 30 all-night recordings were made for each subject, most of them on consecutive nights. Since, for the most part, tests could be made on only one subject at a time, and since a minute-by-minute all-night vigil was required of the experimenter to catch each dream episode immediately at its onset, it can be understood why the experiments have been called arduous and time-consuming.

Table 1 summarizes most of the pertinent data. As can be seen, the total number of base-line nights for the eight subjects was 40. The mean sleep time for the 40 nights was 7 hours and 2 minutes, the mean total nightly dream time was 82 minutes, and the mean percentage of dream time (total dream time to total sleep time  $\times 100$ ) was 19.4. Since total sleep time was not held absolutely constant, percentage figures were routinely calculated as a check on the possibility that differences in total nightly dream time were due to differences in total sleep time. Actually, this is not a plausible explanation for any but quite small differences in dream time, because the range of values for total sleep time for each subject turned out to be very narrow throughout the entire study. When averaged in terms of individuals rather than nights, the means were: total sleep time, 6 hours 50 minutes; total dream time, 80 minutes; percentage of dream time, 19.5; this indicates that the figures were not skewed by the disparate number of base-line nights per subject. The re-

markable uniformity of the findings for individual nights is demonstrated by the fact that the standard deviation of the total nightly dream time was only plus or minus 7 minutes.

#### **Progressive Increase in Dream "Attempts"**

The number of consecutive nights of dream deprivation arbitrarily selected as a condition of the study was five. However, one subject left the study in a flurry of obviously contrived excuses after only three nights, and two subjects insisted on stopping after four nights but consented to continue with the recovery nights and the remainder of the schedule. One subject was pushed to seven nights. During each awakening the subjects were required to sit up in bed and remain fully awake for several minutes. On the first nights of dream deprivation, the return to sleep generally initiated a new sleep cycle, and the next dream period was postponed for the expected amount of time. However, on subsequent nights the number of forced awakenings required to suppress dreaming steadily mounted. Or, to put it another way, there was a progressive increase in the number of attempts to dream. The number of awakenings required on the first and last nights of deprivation are listed in Table 1. *All* the subjects showed this progressive increase, although there was considerable variation in the starting number and the amount of the increase. An important point is that each awakening was preceded by a minute or two of dreaming. This represented the time required for the experimenter to judge the emerging record and make the decision to awaken the subject after he first noticed the beginning of eye movements. In some cases the time was a little longer, as when an eye-movement period started while the experimenter was looking away from the recording apparatus. It is apparent from this that the method employed did not constitute absolute dream deprivation but, rather, about a 65- to 75-percent deprivation, as it turned out.

#### **Nightly Dream Time Elevated after Deprivation**

The data on the first night of the dream deprivation recovery period are summarized for each subject in Table 1. As was mentioned, one subject had quit

the study. The mean total dream time on the first recovery night was 112 minutes, or 26.6 percent of the total mean sleep time. If the results for two subjects who did not show marked increases on the first recovery night are excluded, the mean dream time is 127 minutes or 29 percent, which represents a 50-percent increase over the group base-line mean. For all seven subjects together, on the first recovery night the increase in percentage of dream time over the base-line mean (Table 1, col. 3, mean percentage figures; col. 10, first recovery night percentages) was significant at the  $p < .05$  level in a one-tail Wilcoxin matched-pairs signed-ranks test (5).

It is important to mention, however, that one (S.M. in Table 1) of the two subjects alluded to above as exceptions was not really an exception because, although he had only 1 hour 1 minute of dreaming on his first recovery night, he showed a marked increase on *four* subsequent nights. His failure to show a rise on the first recovery night was in all likelihood due to the fact that he had imbibed several cocktails at a party before coming to the laboratory so that the expected increase in dream time was offset by the depressing effect of the alcohol. The other one of the two subjects (N.W. in Table 1) failed to show a significant increase in dream time on any of five consecutive recovery nights and therefore must be considered the single exception to the over-all results. Even so, it is hard to reconcile his lack of increase in dream time on recovery nights with the fact that during the actual period of dream deprivation he showed the largest build-up in number of awakenings required to suppress dreaming (11 to 30) of any subject in this group. One may only suggest that, although he was strongly affected by the dream loss, he could not increase his dream time on recovery nights because of an unusually stable basic sleep cycle that resisted modification.

The number of consecutive recovery nights for each subject in this series of tests was too small in some cases, mainly because it was naively supposed at the beginning of the study that an increase in dream time, if it occurred, would last only one or two nights. One subject had only one recovery night, another two, and another three. The dream time was markedly elevated above the base-line on all these nights. For how many additional nights each of these three subjects would have maintained an elevation in dream time

Table 1. Summary of experimental results. TST, total sleep time; TDT, total dream time.

Mean and range, base-line nights			Dream-deprivation nights (No.)	Awakenings (No.)		Dream-deprivation recovery nights			First control recovery night			
TST	TDT	Percent		First night	Last night	No.	First night			TST	TDT	Percent
							TST	TDT	Percent			
6 <sup>h</sup> 36 <sup>m</sup> 6 <sup>h</sup> 24 <sup>m</sup> –6 <sup>h</sup> 48 <sup>m</sup>	1 <sup>h</sup> 17 <sup>m</sup> 1 <sup>h</sup> 10 <sup>m</sup> –1 <sup>h</sup> 21 <sup>m</sup>	19.5 17.0–21.3	5	Subject W. T. (4 base-line nights) 8      14		1	6 <sup>h</sup> 43 <sup>m</sup>	2 <sup>h</sup> 17 <sup>m</sup>	34.0	6 <sup>h</sup> 50 <sup>m</sup>	1 <sup>h</sup> 04 <sup>m</sup>	15.6
7 <sup>h</sup> 27 <sup>m</sup> 7 <sup>h</sup> 07 <sup>m</sup> –7 <sup>h</sup> 58 <sup>m</sup>	1 <sup>h</sup> 24 <sup>m</sup> 1 <sup>h</sup> 07 <sup>m</sup> –1 <sup>h</sup> 38 <sup>m</sup>	18.8 15.4–21.8	7	Subject H. S. (5 base-line nights) 7      24		2	8 <sup>h</sup> 02 <sup>m</sup>	2 <sup>h</sup> 45 <sup>m</sup>	34.2	8 <sup>h</sup> 00 <sup>m</sup>	1 <sup>h</sup> 49 <sup>m</sup>	22.7
6 <sup>h</sup> 39 <sup>m</sup> 5 <sup>h</sup> 50 <sup>m</sup> –7 <sup>h</sup> 10 <sup>m</sup>	1 <sup>h</sup> 18 <sup>m</sup> 1 <sup>h</sup> 11 <sup>m</sup> –1 <sup>h</sup> 27 <sup>m</sup>	19.5 17.4–22.4	5	Subject N. W. (7 base-line nights) 11      30		5	6 <sup>h</sup> 46 <sup>m</sup>	1 <sup>h</sup> 12 <sup>m</sup>	17.8	7 <sup>h</sup> 10 <sup>m</sup>	1 <sup>h</sup> 28 <sup>m</sup>	20.2
6 <sup>h</sup> 59 <sup>m</sup> 6 <sup>h</sup> 28 <sup>m</sup> –7 <sup>h</sup> 38 <sup>m</sup>	1 <sup>h</sup> 18 <sup>m</sup> 0 <sup>h</sup> 58 <sup>m</sup> –1 <sup>h</sup> 35 <sup>m</sup>	18.6 14.8–22.2	5	Subject B. M. (6 base-line nights) 7      23		5	7 <sup>h</sup> 25 <sup>m</sup>	1 <sup>h</sup> 58 <sup>m</sup>	26.3	7 <sup>h</sup> 48 <sup>m</sup>	1 <sup>h</sup> 28 <sup>m</sup>	18.8
7 <sup>h</sup> 26 <sup>m</sup> 7 <sup>h</sup> 00 <sup>m</sup> –7 <sup>h</sup> 57 <sup>m</sup>	1 <sup>h</sup> 26 <sup>m</sup> 1 <sup>h</sup> 13 <sup>m</sup> –1 <sup>h</sup> 46 <sup>m</sup>	19.3 16.9–22.7	5	Subject R. G. (10 base-line nights) 10      20		5	7 <sup>h</sup> 14 <sup>m</sup>	2 <sup>h</sup> 08 <sup>m</sup>	29.5	7 <sup>h</sup> 18 <sup>m</sup>	1 <sup>h</sup> 55 <sup>m</sup>	26.3
6 <sup>h</sup> 29 <sup>m</sup> 5 <sup>h</sup> 38 <sup>m</sup> –7 <sup>h</sup> 22 <sup>m</sup>	1 <sup>h</sup> 21 <sup>m</sup> 1 <sup>h</sup> 08 <sup>m</sup> –1 <sup>h</sup> 32 <sup>m</sup>	20.8 17.8–23.4	4	Subject W. D. (4 base-line nights) 13      20		3	8 <sup>h</sup> 53 <sup>m</sup>	2 <sup>h</sup> 35 <sup>m</sup>	29.0			
6 <sup>h</sup> 41 <sup>m</sup> 6 <sup>h</sup> 18 <sup>m</sup> –7 <sup>h</sup> 04 <sup>m</sup>	1 <sup>h</sup> 12 <sup>m</sup> 1 <sup>h</sup> 01 <sup>m</sup> –1 <sup>h</sup> 23 <sup>m</sup>	17.9 16.2–19.3	4	Subject S. M. (2 base-line nights) 22      30		6	5 <sup>h</sup> 08 <sup>m</sup> 6 <sup>h</sup> 32 <sup>m</sup> *	1 <sup>h</sup> 01 <sup>m</sup> 1 <sup>h</sup> 50 <sup>m</sup> *	19.8 28.1*	6 <sup>h</sup> 40 <sup>m</sup>	1 <sup>h</sup> 07 <sup>m</sup>	16.8
6 <sup>h</sup> 16 <sup>m</sup> 6 <sup>h</sup> 08 <sup>m</sup> –6 <sup>h</sup> 24 <sup>m</sup>	1 <sup>h</sup> 22 <sup>m</sup> 1 <sup>h</sup> 17 <sup>m</sup> –1 <sup>h</sup> 27 <sup>m</sup>	20.8 20.7–20.9	3	Subject W. G. (2 base-line nights) 9      13								

\*Second recovery night (see text).

can only be surmised in the absence of objective data. All of the remaining four subjects had five consecutive recovery nights. One was the single subject who showed no increase, two were nearing the base-line dream time by the fifth night, and one still showed marked elevation in dream time. From this admittedly incomplete sample it appears that about five nights of increased dreaming usually follow four or five nights of dream suppression achieved by the method of this study.

#### Effect Not Due to Awakening

Six of the subjects underwent the series of control awakenings—that is, awakenings during non-dream periods. This series exactly duplicated the dream-deprivation series for each subject in number of nights, total number of awakenings, and total number of awakenings per successive night. The dream time on these nights was slightly below base-line levels as a rule. The purpose of this series was, of course, to see if the findings following dream deprivation were solely an effect of the multiple awakenings. Data for the first recovery nights after nights of control awakenings are included in Table 1. There was no significant increase for the group. The mean dream time was 88 minutes, and the mean percentage was 20.1. Subsequent recovery nights in

this series also failed to show the marked rise in dream time that was observed after nights of dream deprivation. A moderate increase found on four out of a total of 24 recovery nights for the individuals in the control-awakening group was felt to be a response to the slight reduction in dream time on control-awakening nights.

#### Behavioral Changes

Psychological disturbances such as anxiety, irritability, and difficulty in concentrating developed during the period of dream deprivation, but these were not catastrophic. One subject, as was mentioned above, quit the study in an apparent panic, and two subjects insisted on stopping one night short of the goal of five nights of dream deprivation, presumably because the stress was too great. At least one subject exhibited serious anxiety and agitation. Five subjects developed a marked increase in appetite during the period of dream deprivation; this observation was supported by daily weight measurements which showed a gain in weight of 3 to 5 pounds in three of the subjects. The psychological changes disappeared as soon as the subjects were allowed to dream. The most important fact was that *none* of the observed changes were seen during the period of control awakenings.

The results have been tentatively interpreted as indicating that a certain amount of dreaming each night is a necessity. It is as though a pressure to dream builds up with the accruing dream deficit during successive dream-deprivation nights—a pressure which is first evident in the increasing frequency of attempts to dream and then, during the recovery period, in the marked increase in total dream time and percentage of dream time. The fact that this increase may be maintained over four or more successive recovery nights suggests that there is a more or less quantitative compensation for the deficit. It is possible that if the dream suppression were carried on long enough, a serious disruption of the personality would result (6).

#### References and Notes

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