

AN EXPERIMENTAL STUDY OF THE SLEEP OF ATHLETES

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Our common language has two ways of describing the way in which sleep may be enjoyed. There is, first, the belief that one can and sometimes does go to bed and "sleep like a log" for a full eight or ten hour period. It is said, for example, that extreme fatigue may be followed by a motionless rest that will "knit up the raveled sleeve of care" and bring the individual forth to a new morning and to new levels of energy. This is the way small infants are said to sleep, and it is a matter of plain observation that they do remain almost motionless for considerable periods of time. It is also said that this is the way invalids sleep, and one draws the inference that absolute motionlessness is the only way to gain a real rest. Infants do move, however, and so do invalids, and any half hour's observation of a sleeping adult will show that he is almost constantly in motion. But in these cases our common language says that the infant, the invalid, or the adult is a restless sleeper, and the implication is that restlessness in sleeping is more or less of a disadvantage or that it is a habit that robs one of his real rest. We frequently say that we have "tossed all night," and it is with the idea of "tossing" that we associate almost every form of movement during the night. It is by no means obvious, however, that motionlessness during sleep is the ideal way to sleep, and neither do we believe that a great amount of restlessness yields the ideal conditions for recuperation by night.

The older methods of studying sleep were not adequate to answer the questions one might raise about the optional amount of motion during the night. Up until two or three years ago, the standard method consisted in finding out how far a ball of a given weight must be dropped before the sound would awaken the sleeper. This was said to be a measure of the depth of sleep, for if the ball has to drop from a great height in order to make sufficient sound to awaken a man, he must be sleeping more deeply than he is when the ball has to drop but a foot or two. But such a measure of the depth of sleep is by no means a measure of the extent to which the period of sleep is giving real recuperation.

Consequently, a new method of studying sleep has been recently devised at the Mellon Institute under the direction of H. J. Johnson, senior fellow on a research program supported by the Simmons Bed Company. It is this method which has been used in our studies on athletes at the University of Illinois.

Underneath the bed occupied by each of the subjects in our experiments there is hung a recorder which automatically registers every movement made by the sleeper during the night. Upon a frame hung from the bed is a constant-speed motor of the type commonly used in electric phonographs. This motor drives a band of paper at the rate of about one centimeter per second past a pair of writing points. One of the writing points is activated by a timer that is nothing more than an alarm clock upon which a wheel with a series of small contact points have been put in place of the minute hand. The contact points are so arranged that a mark is made upon the moving band of paper every five minutes during the night. These marks form the time line. The second writing point is connected with the springs of the bed in such a way that any change in the level of the mattress appears as a "sleep curve" or a "sleep line" on the paper just above the time line.

Before getting into bed each night the subject winds the alarm clock, makes a note as to his time of retiring, records any other items that may have a connection with his sleep period, starts the motor and climbs into bed. From that moment until he arises in the morning to record the hour of awakening and turn off the motor, every movement that he makes appears on the record. The subjects in the experiment up to the present time have been members of the 1927-1928 and 1928-1929 football teams, members of the 1927-1928 and 1928-1929 basketball teams and such other members of athletic teams, principally track men, as were available between the football and the basketball seasons. The results in our own experiments bear comparison with similar results gained by Johnson at the Mellon Institute and Anderson at the Child Research Center of the University of Minnesota.

The first thing of interest in these experiments is the determination of the period of average restlessness during the night. No persons have been found who go to bed and "sleep like a log." The longest period of absolute motionlessness we have found lasted for sixty-five minutes. There are a few other periods of forty-five minutes or longer, but the most of the intervals are much shorter

than this. The period of average restlessness for all of the men engaged in this experiment stands at a little over twelve minutes. This means that, on the average, each of our men made some movement of his body at least once every twelve minutes during the night. It may not be that the subject moves his whole body, but the results do mean that some movement of a major degree occurs, on the average, every twelve minutes. There are, of course, certain large individual differences. The most restless of the men with whom we have experimented moved, on the average, at least once every seven and one-half minutes, while the heaviest sleeper moved at least once every sixteen minutes. These results are directly comparable with those obtained by studying the sleep of small children at Minnesota and the sleep of adults and of hospital patients at Pittsburg.

But the average period of restlessness was not our main objective, since this has already been established. We were searching, instead, for the effect of heavy exercise on the sleep of our subjects. In keeping with popular opinion we should have found, perhaps, that, on the night after a hard basketball or football game, the athlete would go to bed and sleep like a log, that is, sleep without very much bodily movement. The long periods of motionless rest mentioned above were periods which occurred under these very conditions. That is, a long period of motionlessness is more apt to occur after heavy exercise than at any other time; but this fact does not tell the whole tale. The full story is told only when we get a report from the individual himself as to his condition on the morning after such motionless sleep and after we gain from him some objective records of his performance in simple tests that test his quickness and muscular control. When we gain this information we see the full significance of his restfulness. Motionless sleep is not restful sleep. It does not lead to the kind of recuperation which the athlete is in search of. This is gotten, strange to say, by the men who go to bed and who move more than their normal amount during the night. That is, there appears to be a type of increased restlessness which is actually more conducive to recuperation after heavy exercise than the so-called log-like sleep. Our records show that heavy exercise will result, on the average, either in a two-minute decrease of the average period of restfulness or in a four-minute increase of the average period. The men who yield an increase, that is, the men who do not move so often, are not as rested the next morning, and neither do they

appear to be so efficient in small tests of skill, as the men who yield a decrease in average period of motionless, that is, who move more often after extreme exercise.

These facts suggest a new statement of the functions of sleep, a statement that sounds strange at first but which appears simple and plain after it is fully understood. Sleep is, or should be, a period of recuperation. Recuperation takes place when the blood stream has a free and uninterrupted access to all parts of the body and especially to those that have been used most recently and most strenuously. It is easy to see that if a man falls to sleep and remains motionless on a part of the body that has been heavily exercised, that part will not receive an adequate supply of fresh blood. Sleeping like a log, then, means becoming more or less loggy because of improper sleeping conditions. The increased restlessness of the man who has exercised heavily appears to be nature's way of seeing to it that all parts of the body get their proper amount of rest by being on the top side as often as possible.