LETTERS

TM: Meditation or Sleep?

R. R. Pagano *et al.* conducted their study, "Sleep during transcendental meditation" (Reports, 23 Jan., p. 308), with care; however, the authors unfortunately chose to give an overall emphasis to the report that tends to be quite misleading.

One of the main findings of their study, which was not sufficiently emphasized in earlier research, is that during the actual practice of the transcendental meditation (TM) technique the subjects may experience several "states of consciousness" including electroencephalogram (EEG) sleep stages 1, 2, 3, and 4. In addition, the authors further document the fact that the subjects' experiences during meditation as judged by both subjective reports and objective measurements may vary both from meditation to meditation and from subject to subject. However, even though a subject may experience more than one state of consciousness, and in fact may fall asleep during the TM technique, this in no way alters the previous well-documented finding that at other times during the practice of this technique the subject may be experiencing a unique "wakeful hypometabolic physiologic state." Considerable research has shown that such periods do exist during TM and that they are characterized by a number of physiological changes, including a lowering of breath rate and oxygen consumption and an increase of alpha and theta wave activity in which there appears to be a high degree of synchronous electroencephalograph activity quite distinct from that of EEG sleep stages (*1*).

Individuals who start the TM technique are informed that they may experience occasional periods of sleep if they are tired before starting the meditation period. These periods of sleep are considered to be both necessary and useful to normalize any fatigue in the body, thereby allowing the individual to maintain mental alertness while the body goes into a state of deep physical relaxation. The extent to which subjects may fall asleep during experimental periods will of course vary considerably with many factors, such as the overall health of the individual, physical activity before the experiment, the setting, and the type of equipment used. However, because of the limited number of subjects used in the study by Pagano *et al.*, no generalization can be made concerning how frequently sleep occurs during the practice of TM. The fact that there was a high degree of correlation between the subjective experience and the EEG measurements of sleep during the meditation period merely indicates that the subjects themselves are good judges of whether they are asleep or awake during the meditation period.

The important conclusion gained from the study by Pagano *et al.* is that if researchers are interested in studying sleep, they can probably find much more convenient settings, and that if they are interested in studying the "unique state of consciousness" produced by the TM technique, they should confine themselves to those periods when subjects report they are not sleeping.

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References

1. R. K. Wallace, *Science* **167**, 1751 (1970); ———, H. Benson, A. F. Wilson, *Am. J. Physiol.* **221**, 795 (1971); P. Levine, *Proc. San Diego Biomed. Symp.* **15**, 237 (1976); D. W. Orme-Johnson, *Psychosom. Med.* **35**, 341 (1973); J.-P. Banquet, *Electroencephalogr. Clin. Neurophysiol.* **35**, 143 (1973); B. C. Glueck and C. F. Stroebel, *Compr. Psychiatry* **16**, 303 (1975); R. Jevning, R. Smith, A. F. Wilson, M. Martin, *J. Clin. Res.* **24**, 1139 (1976); R. Jevning, A. F. Wilson, E. VanderLaan, S. Levine, in *Proceedings of the Endocrine Society. Abstracts* (Endocrine Society, Bethesda, Md., 1975); D. W. Orme-Johnson, L. H. Domash, J. T. Farrow, Eds., *Scientific Research on Transcendental Meditation: Collected Papers* (Maharishi European Research Univ. Publications, Weggis, Switzerland, in press), vol. 1.

Wallace agrees with two of the main findings of our study. These findings are (i) that during the practice of transcendental meditation (TM) subjects may experience several "states of consciousness" including sleep stages 1, 2, 3, and 4; and (ii) that there may be considerable variability from meditation to meditation and from meditator to meditator in the states of consciousness experienced. Since we feel these are important points which help more accurately portray what occurs during TM, we wish to thank Wallace for his candor in setting the record straight.

Wallace raises another important point. He argues that our results "in no way alter the previous well-documented finding that at other times during the practice of this technique the subject may be experiencing a unique 'wakeful hypometabolic physiologic state.' " Wallace is absolutely correct in the contention that our data do not *refute* the possibility that some part of the meditation period *may* be spent in a "unique wakeful hypometabolic physiologic state."

Our data showed that the meditators we studied spent an average of 40 percent of the meditation period asleep. It is, of course, possible that at other

times during the meditation period a "unique wakeful hypometabolic physiologic state" was present. We do, however, question the use of the word "unique" in describing this state. Unique with respect to what? Based on Wallace's previous publications, the answer is, "with respect to ordinary wakefulness, sleeping and dreaming." However, ordinary wakefulness is itself composed of many different states, such as anger, joy, intense mental concentration, or simple relaxation, to name a few. It is obviously premature to claim that the wakeful hypometabolic state often achieved during TM is uniquely different from these states, particularly from the states produced by other forms of relaxation. TM may result in a unique state of consciousness, but there is no controlled research supporting that contention. The studies cited by Wallace do help to establish that a wakeful hypometabolic state does often exist during some part of the meditation period, but they are woefully inadequate for establishing a claim of uniqueness. In addition to our *Science* report, a recent report by R. R. Michaels *et al.* (18 June, p. 1242) offers evidence to the contrary. It is clear that, before the uniqueness of TM can be determined, much more research needs to be done, particularly comparing TM to other techniques such as progressive relaxation, autogenic training, or ordinary relaxation.

Finally, Wallace implies that the beneficial effects of TM are due to changes that occur during the awake portion of meditation. In seven of the 13 sessions in which we observed sleep, our subjects rated their meditations as "typical." Thus, as we concluded in our report, the following question is still an open one to be resolved by future research: Are the beneficial effects reported for TM due to the sleep that occurs during the meditation period or to some other feature of the process? In addition, in light of the above discussion, there is a second and related question which awaits resolution: Are the beneficial effects reported for TM due to the ordinary rest that occurs during the meditation period in both the sleeping and awake periods or to some *unique* feature of the process?

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Doomsday Expectations

During the past 2 years I have been conducting an informal poll on the doomsday expectations of persons with whom I work. I have asked students and faculty to record, by secret ballot, their response to the following question: "How long do you think our civilization will continue to exist in the developed state before it is vastly diminished or destroyed?" I ask respondents to record their intuitive hunches. Virtually everyone polled was able to record a numerical answer within a minute.

The estimates varied among groups but were surprisingly low overall. Twelve graduate students in a class in environmental planning had a modal expectation of 100 years in 1975, which increased to 150 years (16 students) in 1976. A sample of 35 graduate students in planning as a whole gave civilization a 50-50 chance of lasting 200 years, and 16 architecture graduate students gave it 100 years (*1*). Faculty members had substantially more optimistic expectations. Eight who responded from the planning faculty gave civilization a 50-50 chance of lasting 700 years, and four members of the architecture faculty gave it 500 years. Perhaps the most provocative result came from an upper undergraduate class in environmental biology for nonmajors that had a modal expectation of 25 years (26 out of 94 students gave answers of from 20 to 30 years).

Regardless of who ultimately may prove to have guessed "best," it is significant that those who teach planning have quite different implicit planning horizons from those of their students and that a sample of undergraduates gave their society a life expectancy not as long as their own. The number of "indefinitely" or "forever" answers was very few (3 out of 122). Changing attitudes toward the apocalypse might be an interesting social indicator, although its interpretation in terms of causal factors is undoubtedly not simple.

I invite interested *Science* readers to poll their own associates similarly (*2*).

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Notes

1. For the poll of students and faculty in architecture and planning as a whole, the technique was modified by my colleague John Friedmann, such that respondents recorded the percentage probability of survival for given periods in deciles. C. E. Weaver tabulated the results.
2. I would be interested in learning the results of such polls, including approximate ages, occupations, and sizes of groups, from readers willing to communicate them to me.