

THE PHYSIOLOGY OF TRANSCENDENTAL MEDITATION

by

ERIN HALE

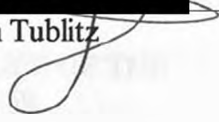
A THESIS

Presented to the Department of Biology
and the Honors College of the University of Oregon
in partial fulfillment of the requirements
for the degree of
Bachelor of Science

June 1999

APPROVED: _____

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An Abstract of the Thesis of
Erin Hale for the degree of Bachelor of Science
In the Department of Biology to be taken June 1999
Title: THE PHYSIOLOGY OF TRANSCENDENTAL MEDITATION
Approved: 
Dr. Nathan Tublitz 

Transcendental Meditation® (TM®) is a mental technique that Maharishi Mahesh Yogi introduced to the world. Over 600 scientific studies have been conducted on TM. I have summarized several physiology studies, and a few psychology and sociology studies.

Transcendental Meditation brings about a state of hypometabolic wakefulness. This state is indicated by reduced respiration and heart rate, increased skin resistance, decreased lactate and cortisol secretion, and a change in brain wave patterns.

Many Transcendental Meditators experience episodes when the meditation becomes particularly profound. These episodes represent a fourth major state of consciousness—called transcendental consciousness—which is as different from waking, sleeping, and dreaming consciousness as these three are from each other.

Transcendental Meditators experience dramatically improved mental and physical health. TM is the best method known for reducing substance abuse, overcoming psychological trauma, and reducing recidivism.

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INTRODUCTION

Maharishi Mahesh Yogi brought Transcendental Meditation® (TM®) to the world in 1957. Since then, over 5 million people have learned the Transcendental Meditation technique. People of all ages, from all over the world, of all religions and cultures practice TM. TM is a simple mental technique practiced for 15 to 20 minutes twice a day while comfortably seated with the eyes closed. The technique is learned from a TM teacher trained by Maharishi. The TM practice requires no change in religion, philosophical beliefs, or life style with the exception of sitting down to meditate twice a day. TM meditation involves no concentration or mental or physical control. Maharishi defines the technique as “turning the attention inwards towards the subtler levels of a thought until the mind transcends the experience of the subtlest state of thought and arrives at the source of the thought.” He goes on to explain that “This expands the conscious mind and at the same time brings it in contact with the creative intelligence the gives rise to every thought” (1). During TM, the meditator's mind and body settle down to a unique state of restful alertness. Regular Transcendental Meditators describe the experience as easy, enjoyable, and profoundly peaceful. Furthermore, they enjoy drastically improved health of mind and body. In addition to TM, the meditator can choose to learn an advanced TM technique called the TM-Sidhi® program after he/she has been meditating regularly for at least two months.

TM became a topic of scientific investigation in the early 1970s; the first studies dealt with the physiology of TM and were published in *Science* (1970), *The American Journal of Physiology* (1971), and *Scientific American* (1972). Since then, there has been an explosion of research on all aspects of TM and the TM-Sidhi program. More than 600 studies have been conducted at 200 independent universities and research institutions in 30 countries, and published in over 100 scientific journals. The findings of this research have been replicated extensively and meta-analyses have shown the results to be highly consistent. Furthermore, the results are corroborated by cross-validation; studies in physiology, psychology, and sociology confirm each other.

In the present work, I draw from this large body of research in an attempt to characterize the physiology of TM. This attempt, however, will necessarily fall short of creating a holistic, integrated picture of the physiology of TM. In a system as vast and complex as the human mind and body, it is a Herculean task to document every biological, chemical, and physical interaction. With the present tools of modern science, the best we can do is chase around this molecule or that one, measure the electricity involved in this or that process, and so on. Of course, the human development of science is a glorious triumph, but given 30 pages and my current understanding of nature, the best I can do is lightly scratch the surface of what happens in one's universe while practicing Transcendental Meditation. This paper is organized into the following sections: the state of the physiology during Transcendental Meditation; the physiology in the daily life of the meditator; comparison of TM and other techniques aimed at mitigating stress; and brief cross-validation of TM physiology research with psychology and sociology.

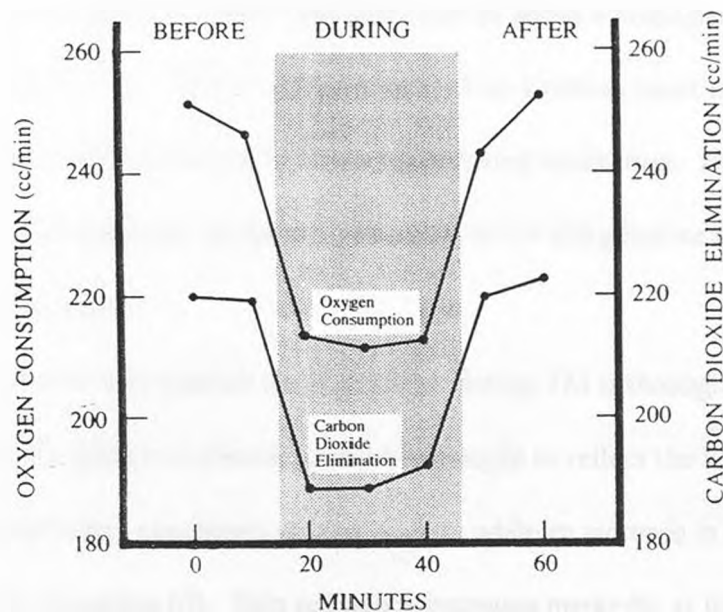
PHYSIOLOGY DURING TRANSCENDENTAL MEDITATION

TM is Deeply Restful

In terms of physiology, rest is low metabolic activity. The rest and rejuvenation we associate with sleep, for example, is largely a result of prolonged reduced metabolism during sleep. Metabolism is defined as the sum of all the chemical processes that occur within a cell or organism; these processes make energy and matter available to the cell and the organism. During Transcendental Meditation, metabolism is significantly reduced. TM is not the same as sleep, however; it is a unique form of rest that is physiologically distinct.

TM affects many physiological factors of metabolism such as respiration rate, heart rate, skin-resistance, and biochemistry. In contrast, no significant changes have been found for generic relaxation, eyes-closed rest, hypnosis, or autosuggestion. In beginning and intermediate meditators, respiration rate decreases by 17-20% from resting respiration rate within 5-10 minutes of beginning meditation (figure 1) (2, 3). Advanced meditators experience a 40% decrease in respiration rate during the TM session and a maximum decrease of 60% at the end of the session (4). This reduced respiration rate is defined as reduced oxygen consumption and carbon dioxide elimination with no change in respiratory quotient (oxygen consumption/carbon dioxide elimination) (2, 3, 4). The decrease in respiration is manifested as either a decreased frequency of breath or decreased tidal

Figure 1. Reduction in respiration rate during TM.

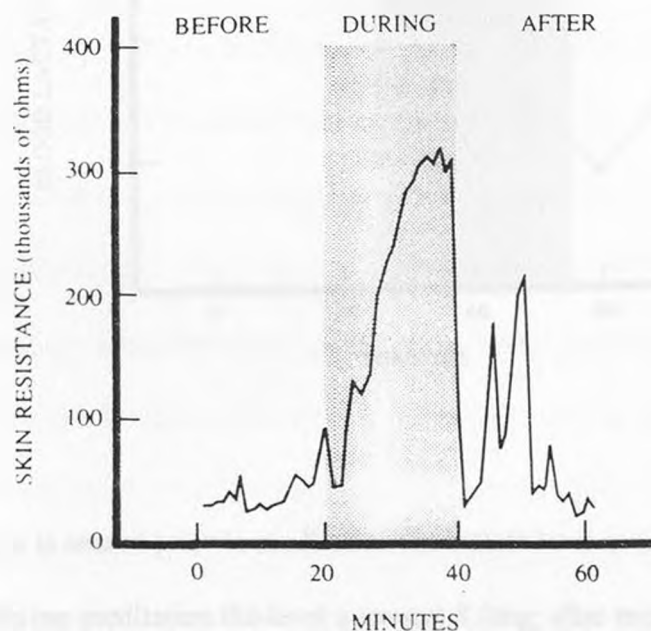


volume, depending on the subject. The reduced respiration is not followed by compensatory hyperventilation. There are occasional periods of spontaneous respiratory suspension during meditation, which are also not followed by compensatory hyperventilation (4, 5). Since there is no compensatory hyperventilation and no change in respiratory quotient, the reduced respiration is consistent with a natural reduction of metabolic requirement during TM rather than an oxygen deprivation that TM imposes upon the physiology. During TM, the metabolism is reduced even more than it is during deep sleep, indicating profound rest. The deepest state of sleep is reached after 6-7 hours and is marked by a 15% decrease in respiration rate, whereas TM induces a 17-40% decrease within 5-10 minutes (2, 3, 6).

The lowered metabolism during TM meditation is also associated with a change in heart rate and heat production. Heart rate decreases by about 4 beats per minute from resting during TM (2, 3, 7). This is a 5% decline—from a resting heart rate of 77.2 beats/minute prior to meditation, to 73.3 beats/min during meditation. Heat production also declines during meditation by about 10%--from 109.4 kJ/kg before meditation to 98.9 kJ/kg during meditation (7).

Another way to characterize the physiology during TM is through skin resistance. The resistance of the skin to an electric current is thought to reflect the level of anxiety. A decrease in skin resistance represents greater anxiety while an increase in skin resistance represents greater relaxation (6). Skin resistance increases markedly at the onset of meditation with a mean increase of 144 kohms, and drops again after meditation but remains slightly higher than premeditation values (figure 2) (2, 3, 6).

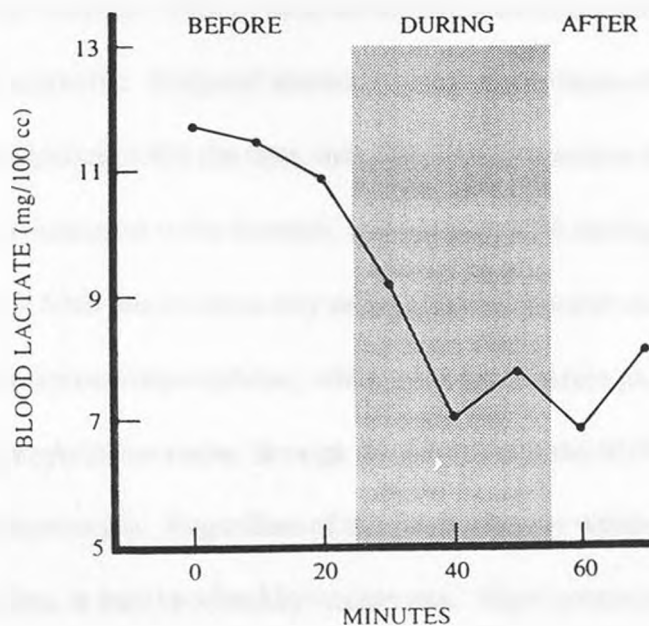
Figure 2. Rapid rise in the electrical resistance of the skin during TM.



This objective measurement of greater relaxation during Transcendental Meditation is consistent with subjective reports. Skin resistance typically increases during sleep, but the magnitude and rate of increase are generally smaller than that accompanying TM (3, 6).

Another physiological correlate of the meditative state that indicates lowered metabolism and a reversal of stress is the change in lactate concentration in the blood (3, 6). Skeletal muscles release lactate into the blood as a product of anaerobic metabolism. (Anaerobic metabolism, as opposed to aerobic metabolism, is the production of energy in the absence of oxygen.) During TM, blood lactate levels decrease markedly (figure 3).

Figure 3. Rapid decline in the concentration of blood lactate during TM.



When the meditator is seated prior to meditation the lactate level averages

11.4mg/100mL; during meditation the level averages 8.0mg; after meditation while the

meditator is still seated the level averages 7.3mg. The rate of lactate decline during meditation is more than three times greater than the rate for people resting in a supine position (lying flat on the back), and the rate for the same meditators during the pre-meditation period (6, 3).

The mechanism by which meditator's blood lactate levels fall is not known. The proposed explanation is that Transcendental Meditation reduces the activity of the sympathetic nervous system (SNS) (6). The SNS is the subdivision of the autonomic nervous system that dominates in emergency or stressful situations. Reduction of sympathetic activity may decrease plasma lactate by two mechanisms. First, constriction of blood vessels would be reduced, thus allowing slightly increased flow of oxygenated blood to the skeletal muscles. This, in turn, would allow aerobic metabolism to predominate over anaerobic. Reduced anaerobic metabolism means reduced lactate production. This explanation fits the data, including the observation that blood flow to the skeletal muscles, as measured in the forearm, increases by 32% during TM. The second mechanism by which SNS deactivation may reduce lactate concentrations stems from the fact that the SNS secretes norepinephrine, which stimulates lactate production. So, a reduction in norepinephrine secretion through deactivation of the SNS is expected to reduce lactate production (6). Regardless of the mechanism by which lactate concentrations decline, it may be a healthy occurrence. High lactate levels are correlated with stress, and if concentrations are kept high, the body's normal functioning is impaired. Consider that individuals with anxiety neuroses have elevated lactate levels, and that injection of lactate into normal subjects can produce symptoms of stress (8).

Endocrinological changes during meditation indicate lowered metabolism and suggest a reversal of stress. The endocrine system is one of the two major control systems of the body, the other being the nervous system (9). The endocrine system comprises endocrine glands that are located throughout the body. Endocrine glands release hormones, chemical messengers, into the blood such that they may be delivered to their target cells. Cortisol is secreted by an endocrine gland called the adrenal cortex, and has a general metabolic effect of increasing the concentration of blood glucose by stimulating the degradation of protein and lipid stores (Glucose is converted into usable energy). Thus, cortisol contributes to general metabolism by maintaining relatively stable glucose levels. In addition to general metabolic activity, extra cortisol is secreted by the adrenal cortex as part of the fight-or-flight stress response to increase the availability of glucose (9).

Cortisol concentrations in the blood plasma decline during meditation. Long-term Transcendental Meditators experience a 27% decline of plasma cortisol concentration during meditation (10). This decline in cortisol suggests reduced adrenal cortex secretion as opposed to increased clearance of cortisol since blood flow to the liver, the site of cortisol degradation, declines markedly during TM. The significance of the decline in cortisol is that it is an endocrinological marker of reduced metabolism that occurs during rest. Furthermore, it suggests a reversal of stress, as elevated cortisol concentrations are correlated with acute and chronic stress. Also note that TM is a different sort of rest from sleep since sleep is not accompanied by significant alteration of plasma cortisol concentration (10).

Some physiological parameters do not change during TM. As alluded to previously, blood concentrations of oxygen and carbon dioxide do not change significantly. Also, rectal temperature remains constant during TM meditation (3).

The Meditator Remains Alert during TM

While the above physiological measures indicate that TM quickly lowers the metabolism, thus allowing deep rest, TM is also characterized by mental alertness. Paradoxical as it may seem, metabolism during TM is reduced even beyond that of sleep while consciousness remains awake rather than “blacking out” as it does in sleep. TM is called a state of “restful alertness” or “hypometabolic wakefulness.” This characterization is agreed upon subjectively, by those who meditate, and objectively, by those who study TM with the tools of modern science.

One way to know that the meditator remains alert during TM is simply that he/she can still perform functions characteristic of an awake as opposed to a sleeping state. In one study, for example, subjects were asked to press a button upon experiencing a certain phenomenon during meditation (4). Although this study was not designed to test alertness during TM, it did show that meditators can voluntarily press a button even when the metabolism is greatly reduced (by 40-60%). TM meditators report expanded inner awareness during TM, without a reduction in awareness of the outside environment. They also report being able to hear sounds and move their body at will, just as if they were in waking consciousness. I am not aware of any studies that verify these reports, except for the “button-pressing” study.

Another indication of the alert component of TM is cerebral blood flow (CBF) patterns. TM elicits a significant increase in cerebral blood flow in frontal (17%) and occipital (20%) regions while generic rest does not cause a significant increase in cerebral blood flow (11). Because CBF is generally coupled with cerebral activity in everyday circumstances, increased CBF suggests increased cerebral activity. TM is not concentration, contemplation, or an increase in thoughts, however; the increase in CBF simply indicates that the mind is alert. This increase in CBF shows that TM is physiologically different from sleep since stages I and II of sleep are accompanied by decreased CBF (5).

Another way to characterize the meditative state is through electroencephalographic (EEG) methods. In an EEG measurement, electrodes placed on the scalp detect electrical activity of many hundreds of thousands of brain cells. As the electrodes detect this electrical activity in the brain, the EEG machine produces a graph that represents the subject's brain waves. Brain waves are very complex, and the frequency and amplitude of the waves can vary considerably even in a short time (12). Nevertheless, some typical frequency and amplitude patterns have been identified. These patterns are called alpha (8-13 Hz), beta (13-30 Hz), delta (0.5-4 Hz), and theta (4-7 Hz). The unit Hertz (Hz) refers to the number of waves per second. *In general*, alpha waves occur during a state of relaxed wakefulness, beta waves during intense mental activity, and delta and theta waves during sleep (12).

Transcendental Meditation is accompanied by distinct brain wave patterns (2, 3). While seated with the eyes closed before beginning meditation, the meditator experiences alpha waves. During meditation, the regularity and amplitude of the alpha waves increase.

In many meditators, alpha waves change to a lower frequency and in some cases stop, giving way to low-voltage theta waves. Some scientists believe this increased alpha band activity indicates alertness or inner awareness. After meditation but before opening the eyes, regular alpha waves continue. Irregular alpha waves develop after opening the eyes. This TM EEG pattern is distinct from that observed during sleep. During sleep there are predominantly slow, high-voltage delta waves with a mixture of weaker waves at various frequencies. This pattern is not present during TM (2, 3).

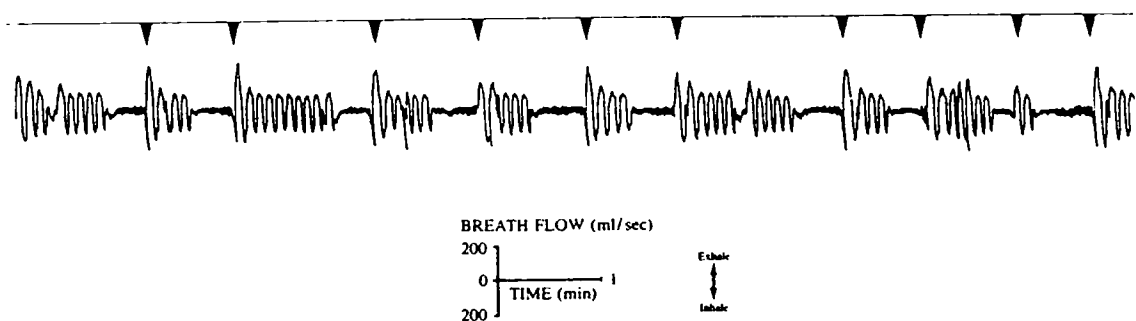
Transcendental Consciousness during TM

While the overall experience of Transcendental Meditation is subjectively described as peaceful and relaxing, many meditators report particularly poignant periods when the meditation becomes more profound. In these periods, called transcendental consciousness, “the mind transcends the subtlest level of mental activity and experiences a state of complete mental quiescence in which thoughts are absent and yet consciousness is maintained” (4). TM meditators describe these episodes as perfectly still, orderly, and by a “complete absence of mental boundaries.” The subjective experience of transcendental consciousness has some objective physiological correlates.

Periods of spontaneous respiratory suspension are frequently associated with the experience of transcendental consciousness (4). In a study designed to determine the temporal relationship between the subjective experience of transcendental consciousness and periods of breath suspension, advanced TM meditators were instructed to push a button after each experience of transcendental consciousness. Nonintrusive respiration transducers were attached to the subjects along with a variety of electrodes to disguise the

purpose of the experiment. In the eight subjects exhibiting breath suspension (three did not), there were 84 button presses and 57 episodes of breath suspension. Thirty-six button presses occurred within 10 seconds of the offset of a breath suspension episode. The authors point out that “the probability that 36 or more of 87 randomly distributed event marks would occur within 10 seconds of the offset of 57 breath suspension episodes distributed over 249 minutes is 10^{-10} .” Given the low probability of random coincidence, episodes of breath suspension and the subjective experience of transcendental consciousness are probably related. Figure 4 shows the occurrence of breath suspension and button presses for one advanced meditator. This same individual, over three TM sessions, showed 96 breath suspension episodes immediately followed by 96 button presses, indicating a strong correlation between breath suspension and transcendental consciousness (4).

Figure 4. Periods of transcendental consciousness and breath suspension during the practice of Transcendental Meditation. The subject was asked to press a button after each subjective experience of transcendental consciousness. Button presses are indicated by triangles, and breath flow is indicated by the squiggly line.



To identify other physiological markers of transcendental consciousness, this single advanced meditator was studied in more detail. Basal skin resistance increases before and during episodes of transcendental consciousness and dropped at the offset (4). Phasic skin resistance was generally very stable during transcendental consciousness and typically burst into activity shortly after the episode. This extremely stable phasic skin resistance indicates increased stability of the branch of the nervous system that controls involuntary functions, the autonomic nervous system. Heart rate was lower during transcendental consciousness as compared to non-transcendental-consciousness periods. Average heart rate decreased from 82.5 bpm, to 72.8 during transcendental consciousness episodes, then increased to 85.4 after the episode. Finally, changes in EEG power and coherence accompany these episodes. Power means greater amplitude of wave. Coherence refers to waves from different areas of the brain being in phase with each other. That is, the waves go up at the same time and down at the same time. Theta and alpha EEG coherence increase; delta and beta EEG power decrease; theta EEG power increases. Some scientists believe this high EEG coherence indicates increased orderliness of brain function. A subsequent study on transcendental consciousness confirmed these results, finding a high correlation of transcendental consciousness experiences with increased bilateral (both hemispheres of the brain) and homolateral (within the same hemisphere) alpha coherence (13). Some scientists assert that this EEG pattern indicates more integrated or heightened awareness.

The subject described the experience of transcendental consciousness: “the awareness becomes fully expanded and locks into place. Everything feels synchronous and complete in that state--the mind stops thinking, the breath is very light, the body

seems to stop, yet awareness is full” (4). Maharishi says that transcendental consciousness is a state of inner silence and unbounded awareness in which consciousness becomes the object of its own awareness (14). He also says it is the direct experience of the unified field of all the laws of nature (14). The unified field is the home of all the laws of nature, “located” at the deepest level of nature’s functioning (15). It is self-sufficient and creates the entire universe from within itself. All the knowledge for the creation, maintenance, and evolution of the universe is contained within the unified field. When one transcends through TM, he/she refers back to the unified field and identifies his/her own consciousness with its source, the unified field of all the laws of nature (15).

Some scientists have deemed transcendental consciousness a fourth major state of consciousness, based on unique physiological phenomena accompanying TM (16). This fourth state of consciousness is in addition to waking consciousness, sleeping consciousness, and dreaming consciousness. Transcendental consciousness is distinguished from these three by EEG activity, degree of awareness, response threshold, eye movements, cellular metabolic rate, breathing pattern, skin resistance, blood concentrations of various hormones, paired H-reflex, and evoked potentials. Paired H-reflex measures the conduction velocity of cells in the nervous system responsible for rapidly conducting information. An evoked potential is the EEG recording taken during a specific sensory stimulation, such as a tone or flash of light. These ten physiological parameters indicate that transcendental consciousness is as different from waking, sleeping, and dreaming consciousness as the three are from each other. Each of these four states of consciousness appears to serve a specific function. Deep sleep and dreaming appear to restore psychophysiological balance. The waking state may serve “to support

activity for enhanced adaptation.” According to Maharishi, transcendental consciousness integrates the individual psyche with the cosmic psyche, the unified field of all the laws of nature. Further, he predicts that repeated experience of transcendental consciousness enables “realization of the total potential of natural law in daily life through the development of higher states of consciousness” (16).

PHYSIOLOGY IN THE DAILY LIFE OF THE TRANSCENDENTAL MEDITATOR

Before exploring the day to day physiology of the meditator, let us review one of the central dogmas of physiology, homeostasis. Each of the body's systems—the nervous system, the cardiovascular system, the digestive system, the endocrine system, and so on—has an ultimate goal guiding all its activity. That goal is homeostasis, the maintenance of a stable internal environment, which is necessary to ensure survival and progress of the organism. Homeostasis includes the maintenance of the fluid environment that bathes the cells. This fluid contains specific amounts of specific molecules in order for the cells to thrive. When all the body systems are functioning properly, the cells bathe in the appropriate environment and the individual is healthy. Health and homeostasis are probably also related to mental states. There is reason to believe that mental states such as well-being, happiness, and peacefulness are intimately related to the proper functioning of the body's systems and the fluid environment that bathes the cells. When one or more systems fails to function properly, however, homeostasis is disturbed and the cells no longer bathe in an optimal fluid environment. We all experience disruptions of homeostasis to varying degrees at varying times. Depending on the severity, homeostatic disruptions can be experienced as discomfort, sickness, disease, and/or death. Numerous studies with regular Transcendental Meditators suggest that TM favors homeostasis. That is, TM may confer more ideal functioning on the body's systems and a more ideal

fluid environment for the cells. As David Orme-Johnson proposes, “the state of restful alertness gained during the TM technique optimizes the efficiency of the innumerable intrinsic self-repair mechanisms of the body” (17).

Stressors hinder, or threaten to hinder, the body’s ability to maintain homeostasis; the effects of TM are distinctly opposite those of stress. Recall that cortisol is secreted by the adrenal gland as part of the fight-or-flight stress response. Chronic stress causes high baseline cortisol, and low cortisol response to acute stressors. High baseline cortisol is detrimental to homeostasis as it causes high blood glucose and protein shortage. Indeed, chronically elevated baseline cortisol increases susceptibility to many diseases. A low cortisol response to acute stressors is also unhealthy. (A good deal of evidence suggests that a strong cortisol response to acute stressors helps prevent stress-activated defense mechanisms from overshooting and thus damaging the body) (18, 19).

After four months of regular TM practice, baseline cortisol concentrations decline significantly and cortisol response to acute stressors increases significantly (18, 19). The comparison is made between the same subjects before learning TM and after four months of regular meditation, in addition to a comparison between these four-month meditators and non-meditating controls. These changes continue longitudinally with regular practice of TM (18, 19). These results suggest that, overall, the adrenal gland is not stimulated to secrete cortisol as frequently in a TM meditator.

Two ways to measure a person’s psychosomatic stability and related resistance to environmental stressors are through spontaneous galvanic skin resistance (GSR) and GSR habituation (20). GSR is defined as fluctuations in skin resistance. Spontaneous GSR is fluctuations in skin resistance that occur independently of an ambient stimulus.

Habituation is decreased responsiveness to repetitive presentations of a stimulus. GSR habituation, then, is decreased fluctuations in skin resistance in response to a repetitive stimulus. Spontaneous GSR and GSR habituation are very similar measures of psychosomatic stability. A high frequency of spontaneous GSR is correlated with high stress, anger, fear, increased levels of adrenaline and noradrenaline, and low scores on Barron's Ego-Strength scale, a measure of ability to cope with environmental pressures. As for GSR habituation, "rapid habituators tend to be more extroverted than introverted, and psychologically normal persons habituate more rapidly than schizophrenics" (20).

Spontaneous GSR and GSR habituation were measured in a group of short-term regular meditators (mean of 15 months practice), and a group of non-meditators (20). For both tests, subjects sat in a chair and had electrodes attached to them. To test GSR habituation, noxious tones were presented to the subjects. GSR habituated faster for meditators than for non-meditators. On average, meditators habituated in 11 trials, while non-meditators habituated in 26 trials. To test spontaneous GSR, subjects sat comfortably with the eyes open for 10 minutes, shut their eyes and rested or meditated for 5 minutes, then sat with the eyes open for 10 minutes. Meditators had a lower frequency of spontaneous GSR than controls in each of the periods. Meditators averaged 7.9 GSR per 10 minutes, while controls averaged 26.3 GSR per 10 minutes (20).

By these GSR measures, TM meditators are shown to have greater psychosomatic stability, or more specifically, autonomic stability. Autonomic stability refers to the autonomic nervous system, the involuntary portion of the central nervous system which controls endocrine glands, the heart, digestion, and other things. The autonomic nervous system has two subdivisions, the sympathetic nervous system and parasympathetic nervous

system. The sympathetic nervous system predominates in stressful situations and prepares the organism to fight or flee. The parasympathetic nervous system predominates in non-stressful situations and controls physiological “house-keeping” activities such as digestion. Autonomic stability means that the parasympathetic nervous system predominates and can carry out its house-keeping, or homeostasis-maintaining, functions without being thwarted by the sympathetic nervous system. Since autonomic stability favors homeostasis, it favors health.

Participants in TM and the TM-Sidhi program (an advanced TM technique) have a decreased probability of being hypertensive (21), a condition defined as sustained, above optimal mean blood pressure. TM’s effects on systolic and diastolic blood pressure account for this. Blood pressure is the force the blood exerts against a vessel wall (9). Systolic blood pressure refers to the maximum pressure, which occurs when blood is ejected into the vessels by the heart. Diastolic blood pressure refers to the minimum pressure, which occurs when the blood is draining off (9). Controlling for age and other variables, one study found that men practicing TM average a systolic blood pressure 17.9 mmHg lower than non-meditating men; systolic blood pressure of women practicing TM is 20.9 mmHg lower (21). The lower blood pressure in TM participants compared to the general population is due to hypertension in the general population rather than hypotension in meditators. Note that one of every three adult males in the US is hypertensive. Another study recorded systolic and diastolic blood pressure in hypertensive patients before and after beginning TM (22). After they practiced TM for 4-63 weeks, systolic and diastolic blood pressure decreased significantly. On average, systolic blood pressure decreased by 9 mm Hg while diastolic blood pressure decreased by

6 mm Hg (22). These findings indicate that TM is effective in the treatment of hypertension, and helps prevent hypertension in healthy individuals.

Another measure of the improved physiological functioning of the Transcendental Meditator is the plasma concentration of the adrenal androgens, dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulfate (DHEAS) (23). The role of DHEA and DHEAS is not well understood. *In vitro* (an experiment done outside of a living organism), DHEA inhibits the production of destructive chemicals called “radicals” in human white blood cells. This may be related to the observation that DHEA inhibits tumors and autoimmune diseases in mice. Furthermore, DHEA/DHEAS concentrations have been correlated with a number of mental and physical health measures in humans. In men over 50 (but not women), DHEAS concentrations are inversely correlated with death from ischemic heart disease, death from all cardiovascular diseases, and death from any cause. Subnormal DHEA and DHEAS concentrations are correlated with breast cancer. High DHEAS concentrations in late menopausal women are correlated with high bone density. DHEAS levels decline following burn trauma. DHEA levels increased in elderly individuals following improvement in social conditions. The upshot of all these observations is that higher DHEA and DHEAS levels are indicative of better health. Plasma DHEAS concentrations rise throughout childhood and adolescence, peak in mid-twenties, then decline logarithmically with age. DHEAS concentrations are 5% of peak levels in the last year of life (23).

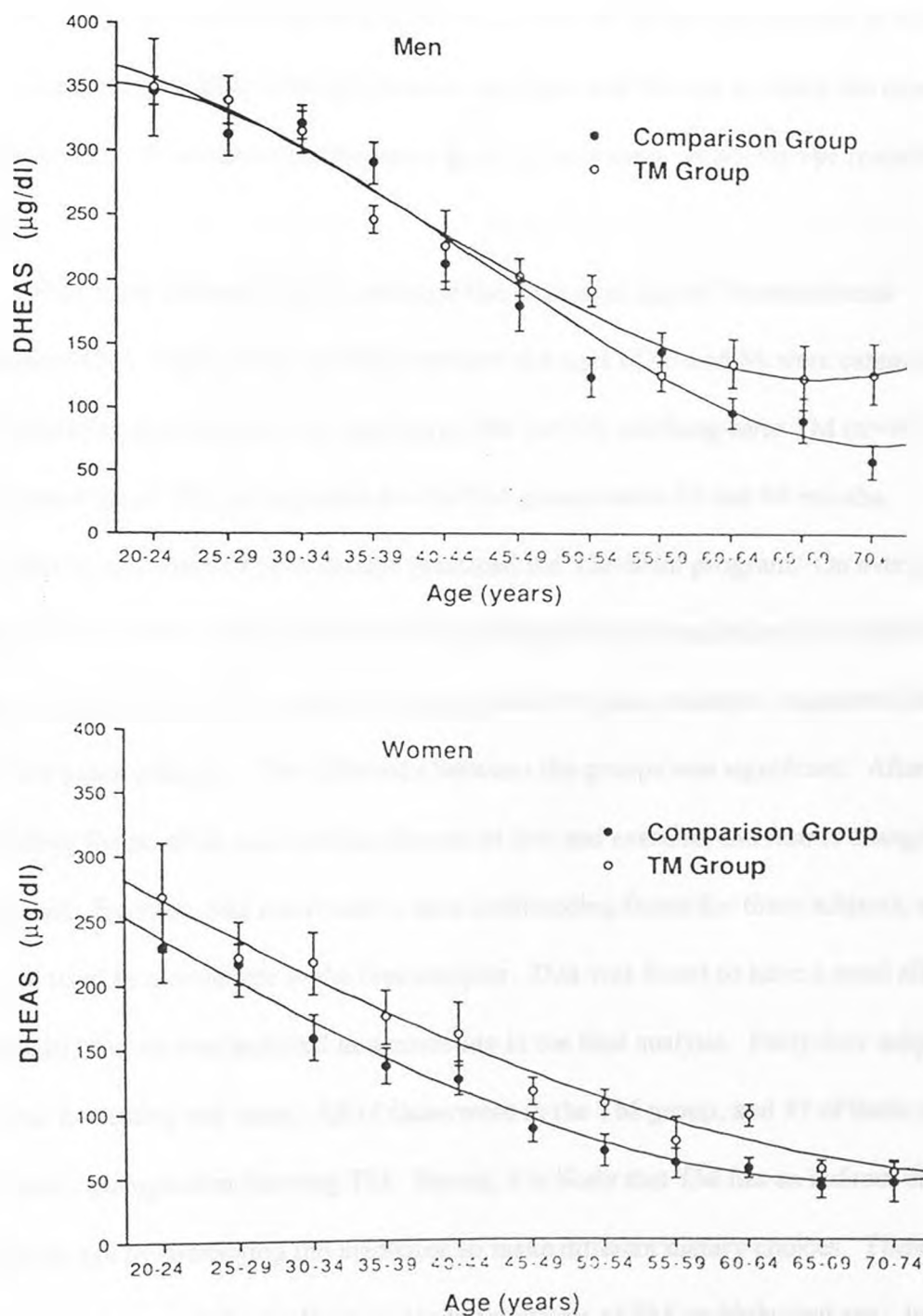
Those practicing TM and the TM-Sidhi program tend to experience higher DHEAS levels than controls matched for age and gender (23). Diet, exercise, and obesity were not found to be significant covariates and were therefore not included in the analysis.

The tendency toward higher DHEAS levels in TM meditators is particularly pronounced in older individuals. For individuals over 40, DHEAS levels are, on average, 37% higher for male meditators compared to male non-meditators, and 38% higher for female meditators compared to female non-meditators (figure 5). The study found no consistent differences between TM and non-TM men of ages 20-39. The overall data for all 11 age groups, ranging from 20 to 70+ years, showed TM men to have 23% higher DHEAS levels, and TM women to have 32% higher levels (23).

The age-related decline in DHEAS concentration is most likely due to decreased adrenal gland secretion (23). Investigators speculate that some mechanism of TM and the TM-Sidhi program reduces the decline in the biochemical process leading to production of DHEAS by the adrenal gland. Because TM participants have an attenuated autonomic response to stressors, the adrenal gland may be protected from over stimulation, and thus maintain the ability to secrete DHEAS. Recall the GSR study indicating increased autonomic stability, which means decreased sympathetic activation of endocrine glands involved in stress (20). Also recall the cortisol studies, which indicate less stimulation of the adrenal gland to secrete cortisol (10, 18, 19). Regardless of the mechanism, the suggestion remains that higher DHEAS concentrations reflect decreased physical deterioration due to age, stress, and illness (23). In addition to this indication of younger biological age in TM meditators, other measures have found similar results.

One of the challenges of aging research in general has been to construct a measure of biological age as distinct from chronological age. The Adult Growth Examination (AGE) (24) is reportedly reliable and includes a representative cross-sample of several thousand adults collected by the United States National Health Survey. The test measures

Figure 5. DHEAS concentrations in men and women of different age groups.



auditory threshold, near vision, and systolic blood pressure, which are said to be reliable measures of biological aging. Auditory threshold is the faintest sound that can be heard. As such, it measures the functioning of the structures within the ear involved in hearing. Near vision is the smallest distance between an object and the eye at which the object can be clearly seen. It measures the functioning of the structures within the eye responsible for vision.

One study utilized AGE to measure the biological age of Transcendental Meditators (24). Eighty-four subjects between the ages of 40 and 64 were categorized as non-meditating controls (n=11), short-term TM (n=33), and long-term TM (n=40). The mean durations of TM participation for the TM groups were 34 and 84 months, respectively, and some of both groups practiced the TM-Sidhi program. On average, all groups were found to have a younger biological age than chronological age: control group was 2.2 years younger, short-term TM group was 5.0 years younger, long-term TM group was 12.0 years younger. The difference between the groups was significant. After controlling for possible confounding factors of diet and exercise, the results changed somewhat. Exercise was not found to be a confounding factor for these subjects, and so was not used as a covariate in the final analysis. Diet was found to have a small effect on the results, and so was included as a covariate in the final analysis. Forty-four subjects reported not eating red meat. All of these were in the TM group, and 37 of these made this dietary change after learning TM. Hence, it is likely that TM has an indirect effect on biological age by prompting the meditator to make different dietary choices. Therefore, the first results may indicate direct and indirect effects of TM on biological age. In an effort to observe only direct effects of TM on aging, however, diet was included as a

covariate in the final results. The final results indicated that non-meditating controls, short-term meditators, and long-term meditators averaged a biological age 4.73, 5.46, and 10.91 years younger than their chronological age, respectively. The long-term meditators differed significantly from short-term meditators and controls, while short-term meditators and controls did not differ significantly. (Nevertheless, short-term meditators exhibited a biological age 5.46 years younger than chronological age as determined by AGE and the US National Health Survey.) The results of this study suggest that long-term participation in the TM and TM-Sidhi programs reduces the deterioration of certain autonomic and sensory processes that mark the aging process (24). More investigation is required to further elucidate the mechanisms through which this occurs.

Red blood cell sedimentation rate (ESR) is commonly used to indicate numerous inflammatory, malignant, and stress-related diseases (25). Furthermore, ESR is correlated with aging and premature mortality. For over 80 years, physicians have used ESR to detect disease and monitor therapeutic outcomes. Elevated ESR indicates illness and lower ESR indicates health. In a large sample of TM participants and controls with many lifestyle similarities, ESRs were significantly lower in TM participants. ESR values of zero are rare. Twenty percent of TM subjects had 0 ESR, compared to 3% of control subjects (25).

Of the many long-term changes associated the TM-Sidhi program, some are extensions of the changes associated with TM, and some are specific to the TM-Sidhi program. Marked endocrinologic changes are seen in TM-Sidhi practitioners (Sidhas) compared to pre-Sidhi instruction (26). Serum levels of six hormones were measured in nine males prior to learning the TM-Sidhi program and over a three-year period after

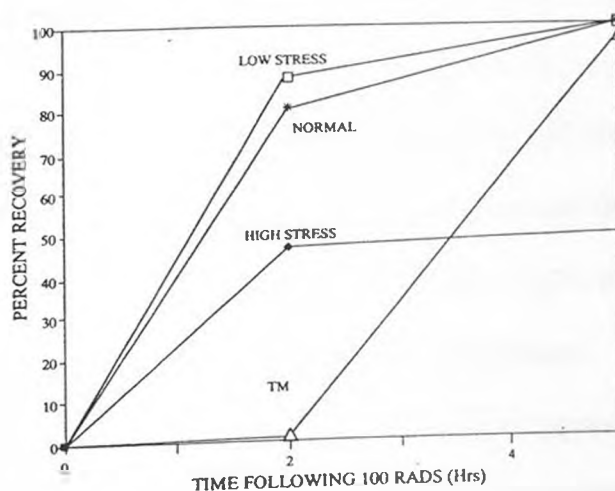
starting the program. Over the three year period, there was a gradual yet dramatic decline in thyroid stimulating hormone (TSH), growth hormone (GH), and prolactin, while there were no consistent changes in levels of cortisol, and thyroid hormones triiodothyronine (T3) and thyroxine (T4) (25). TSH, GH, and prolactin are hormones secreted by the anterior pituitary gland (9). With the exception of prolactin, which stimulates milk secretion, the anterior pituitary gland secretes hormones that stimulate and maintain other endocrine glands. The function of TSH is to stimulate the thyroid gland to secrete thyroid hormones. The function of GH is to indirectly promote growth by stimulating the liver to produce somatomedins, which directly cause growth by acting on bone and soft tissues (9).

The dramatic drop in these anterior pituitary hormones suggests a change in neuro-endocrine function, and while the mechanism is not known, a number of speculative mechanisms have been proposed. TSH rises in many elderly subjects; this may indicate decreased biological effectiveness of TSH, thyroid hormones, or impaired functioning of the thyroid itself (27). The TSH decline in TM-Sidhas, conversely, could indicate increased biological effectiveness of TSH, thyroid hormones, or the thyroid itself (26). That is, the pituitary-thyroid axis could be functioning more efficiently because of increased effectiveness of TSH and/or improved functioning of the thyroid itself. The observation that levels of thyroid hormones remain unchanged is consistent with a model of increased effectiveness of the pituitary-thyroid axis, since the sole function of TSH is to stimulate secretion of thyroid hormones. Another potential mechanism for the decrease in TSH, which may compliment the above mechanism, is that control of thyroid gland secretion may shift towards more nervous system control and that the “set point” for

feedback control of TSH secretion becomes altered (26). A similar mechanism of increased effectiveness might be invoked for GH, but perhaps not prolactin. Whatever the mechanism, the suggestion remains that the TM-Sidhi program may drastically affect anterior pituitary hormone secretion and neuro-endocrine function.

In an attempt to better understand TM's wide variety of physiological effects, one group studied DNA, the fundamental controller of cellular activity (28). They examined whether TM affected the repair mechanism of DNA and found some interesting results. The subjects were five healthy males aged 26-32 years who had been practicing the TM and TM-Sidhi program for 8-14 years. The TM subjects were compared to high-stress, low stress, and normal stress individuals whose data were obtained in a previous study. Blood was taken from all subjects and lymphocytes (white blood cells) were isolated and x-irradiated. The percent recovery of chromatin (the complex of DNA and its associated proteins) and lymphocytes was measured as a function of time (figure 6).

Figure 6. Recovery of DNA and cellular structure after exposure to irradiation. Cells were taken from low stress individuals, high stress individuals, normal stress individuals, and TM individuals.



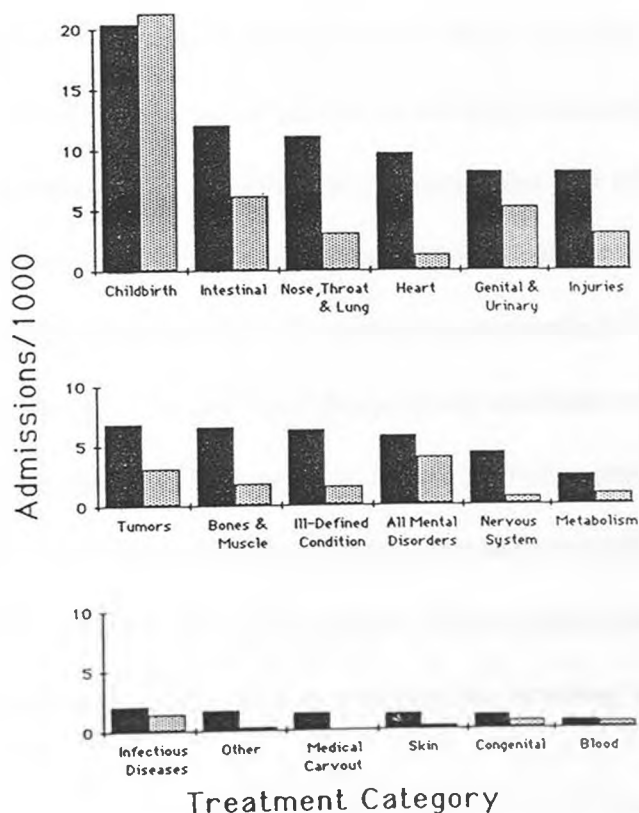
The process of repair starts immediately in low-stress, high-stress, and normal-stress individuals. After five hours, repair is 100% complete in normal and low-stress individuals. In high-stress individuals, repair is typically 50% complete at five hours, and never exceeds 80% at five hours. Interestingly, in the TM meditators, the repair of chromatin structure and lymphocytes does not begin until two hours after irradiation, but is 100% complete at five hours (28).

The significance of this altered DNA-repair mechanism is not straightforward, but the authors propose a speculative explanation (28). Repeated stresses on physiological systems cause induction of certain enzymes. For example, alcohol dehydrogenase, the enzyme that breaks down alcohol, is induced (and therefore present in higher concentrations) in the livers of alcoholics. Such inductions are designed to protect the cell from insults. The immediate initiation of DNA repair in non-TM groups may result from the induction of DNA-repair enzymes. That is, the cells of non-TM individuals may experience more insults than the cells of TM practitioners, hence the difference in repair enzyme concentrations. If this explanation is true, the data indicates less stress at the DNA and cellular level in Sidhas (practitioners of the TM-Sidhi program) (28). One might invoke an alternative explanation, that TM-Sidhas are less resilient to stress at the DNA level. In light of other studies indicating improved health of TM meditators and Sidhas, and the observation that repair was complete at the same time in TM, low-stress, and normal-stress individuals, this explanation seems unlikely. More research is required to elucidate the different mechanisms of repair and their significance.

One way to judge whether TM confers more optimal physiological functioning is to ask how often meditators require medical attention. A study collected five years of

medical insurance statistics for 2000 regular Transcendental Meditators and 600,000 non-meditating members of the same insurance carrier (16). Both groups had similar benefits, deductible, and coinsurance terms, yet Transcendental Meditators utilized medical attention about half as often. Inpatient and outpatient visits were 49% less than the norm for children, 52% fewer for young adults, and 72% fewer for older adults. Admissions were lower for all 18 major medical treatment categories except childbirth, in which case Transcendental Meditators were similar to the norm (figure 7).

Figure 7. Levels of medical care utilization in 18 treatment categories for Transcendental Meditators:  non-meditators: 



There is a limitation to this medical usage study (16). The TM group was self-selected, which raises the question of whether those who learn and continue to practice the technique have healthier life-styles anyway. Although this explanation may be true to some degree, it is unlikely that it fully explains the data. Many people learn the technique because they are having health problems, and research using random assignment and other such measures has shown the technique to be beneficial to people who begin with serious problems. The healthier life-style explanation is more valid when modified by the observation that those who practice TM gradually adopt healthier life-styles. As the author of the study, Orme-Johnson explains, “(TM) influences the health directly and indirectly. Direct effects would occur through preventing the accumulation of physiologic stress. Indirect effects would occur through improved life-style due to becoming a ‘better chooser’ on the basis of stabler, more balanced physiologic functioning, which increases one’s sense of coherence” (16). To exemplify the point that TM meditators become “better choosers,” consider that they reduce their intake of alcohol, drugs, and tobacco. In a study of TM and addictions (29), TM meditators were asked why they reduced their intake of these substances. The principal reason given was increased sensitivity to the ill physiological effects produced by these substances. The better choices made by TM meditators may very well extend to diet, exercise, and sleep behaviors. Unfortunately, such data were not available in the present study. More studies are needed to further elucidate the relationships between TM practice, healthy behavior, and health (16).

COMPARISON OF TECHNIQUES AIMED AT RELAXATION AND STRESS MITIGATION

Mounting evidence indicates that Transcendental Meditation elicits a distinct physiological state that is not achieved during other relaxation techniques, and that the regular TM meditator enjoys distinctively good health. It would be erroneous to assume that all approaches to relaxation and stress mitigation are similarly effective. In their recent study entitled “All Approaches to Preventing or Reversing the Effects of Stress Are Not the Same,” David Orme-Johnson and Kenneth Walton explain, “Meditation, relaxation, and other techniques used to reduce or prevent effects of stress differ widely with regard to what the person actually does during these techniques, as well as their respective outcomes” (30). Orme-Johnson and Walton compiled the results of 597 studies involving approximately 20,000 subjects using a tool called “meta-analysis.” Meta-analysis enables a wide variety of research designs and measurement scales to be compared by applying a standardized measure to the studies. The authors constructed a table comparing roughly 25 techniques (30).

This essay will discuss the following three physiological variables: physiological relaxation, reduced hypertension, and substance use. There were five variables grouped as physiological relaxation measures (30). For three of these measures—basal galvanic skin resistance, respiration rate, and plasma lactate—TM was found to be a superior technique

to unstylized relaxation. For two of these measures—spontaneous galvanic skin resistance, and heart rate—no significant difference was found between TM and unstylized relaxation (30).

For reduced hypertension, TM was found to be superior to mindfulness meditation, relaxation response techniques, progressive muscle relaxation, diet and exercise control, and cognitive techniques (30). No technique was found to be more effective in reducing hypertension than TM. For reducing substance use, no technique was found to be superior to TM. For reduced cigarette use, TM was superior to unconventional treatment (such as acupuncture), pharmacological treatment, individual counseling, and self-help kits. TM was found to be more effective at reducing alcohol intake than peer pressure resistance programs, relaxation, driving under the influence programs, and preventative education programs. Finally, for reducing illicit drug use, TM was found to be superior to peer pressure resistance programs and preventative education programs (30).

PSYCHOLOGICAL AND SOCIOLOGICAL STUDIES

Some researchers have hypothesized that the correlates and positive outcomes of Transcendental Meditation are simply due to resting with the eyes closed and/or expectation of a positive result (that is, the placebo effect). Many well-controlled studies have invalidated this hypothesis, including a study that set out to evaluate physiological health, psychological health, longevity, and this hypothesis (31). Seventy-three volunteers from eight homes for the elderly were randomly assigned to either no-treatment or one of three treatments. The three treatments--TM, mindfulness training, and mental relaxation--were presented in the same way, including the same expectation-fostering features, and were all practiced while sitting comfortably with the eyes closed. The treatments differed virtually only in the precise mental technique used while sitting with the eyes closed. The mindfulness-training treatment comprised two tasks. The first was a word production task in which subjects thought of a word, then took its last letter and thought of a new word beginning with that letter. The second mindfulness task dealt with creative mental activity; subjects were asked to think about any topic in new ways, such as imagining familiar objects being used in different ways (a rainbow used to brush one's hair?). The mental relaxation treatment required subjects to repeat to themselves a short poem, verse, or phrase that they found pleasant (31).

After three months, TM subjects had improved most, followed by mindfulness subjects, on the following cognitive, health, and personality measures: paired associate learning; a behavioral measure of cognitive flexibility; the Stroop Color-Word interference test; systolic blood pressure; self-rating of feeling less old; ability to cope with inconvenience; less impatience with others; self-rating of relaxation after the practice; and mental health rating by nursing staff (after 18 months) (31). The mindfulness group improved most, followed by TM, on perceived control and word fluency. Additionally, the TM group survival rate after three years was 100%, which was significantly higher than each of the other three groups. The mindfulness group survival rate was 87.5%, and untested elderly in the same homes had a survival rate of 63% (31).

These data indicate that regular practice of TM causes noticeable enhancements of health, mental functioning, and longevity that are not attributable to self-selection, resting with the eyes closed, or the placebo effect. Also note that these findings are consistent with previously discussed markers of younger biological age in TM meditators.

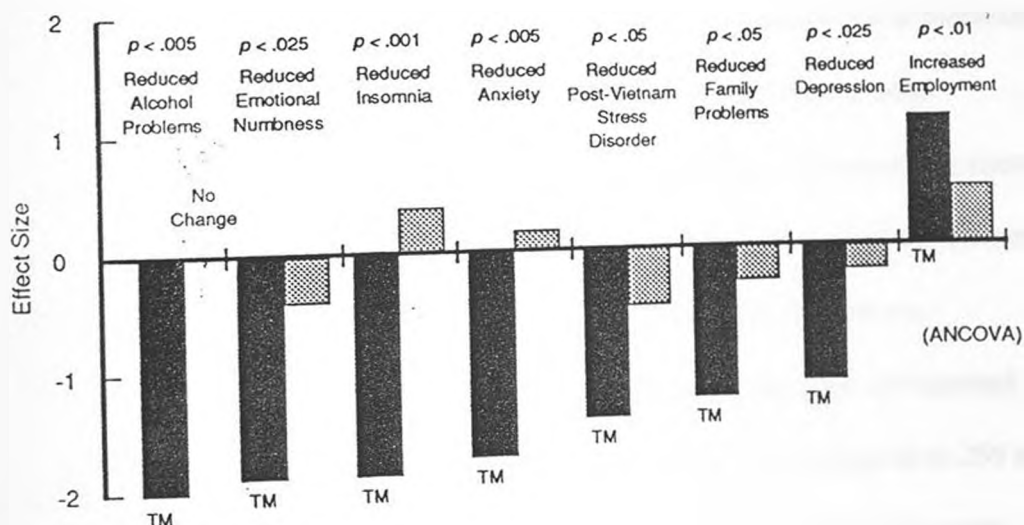
Transcendental Meditation has been found to be an effective treatment for Vietnam veterans suffering from Post-Vietnam Adjustment, a condition characterized by some or all of the following: difficulty readjusting to civilian life, insomnia, depression, anger outbursts, emotional numbness, anxiety, substance abuse, difficulties maintaining employment, and difficulties in relationships (32). Eighteen veterans seeking treatment at the Denver Vietnam Veterans Outreach program (“Vet Center”) were randomly assigned one of two treatments, TM or psychotherapy. Neither group knew of the existence of the other for the duration of the study. A comparison made prior to treatment found no significant difference between the two groups on demographic variables: age (mean was

33 years), sex (all male), marital status, income, time in military, degree of combat, race, location of service. Additionally, there was no significant difference between the two groups prior to treatment for any of the variables being studied, with the exception of insomnia. The psychotherapy group reported greater difficulty sleeping. This should not greatly affect the results, however, since the researchers were measuring change in the variables. After a three month treatment period, the TM group had improved significantly on the following variables: severity of delayed stress syndrome, anxiety, depression, alcohol use, insomnia, employment status, family problems, and GSR habituation (figure 8). The psychotherapy group did not change significantly on any measure (32).

Figure 8. Reduced symptoms of post-traumatic stress disorder in Vietnam Veterans practicing Transcendental Meditation.

TM group: ■

Psychotherapy group: ▨



It is possible that the psychotherapy group experienced no significant change because perhaps the detectable benefits of psychotherapy manifest after a longer period of time than three months (32). As to why the TM group improved drastically, the authors propose that the process of transcending and gaining deep rest during TM “allows the body to spontaneously heal itself, or rid itself of deep impressions incurred from past stressful experiences.” The TM vets commonly reported this type of experience, as one said, “I feel after I meditate that I no longer have the same intensity of tension, rage, and guilt inside—it’s as if a huge burden has been lifted” (32). Whatever the mechanism, the dramatic improvements experienced by vets practicing TM indicate that TM deserves consideration to be a standard therapeutic modality for those suffering from trauma.

TM has been shown to reduce criminal behavior. Maharishi says that any mistake, from a small moral error to a criminal offense, is caused by tension, stress, and weakness of mind (13). The mind can be freed from such stress by experiencing transcendental consciousness. According to Maharishi, regular practice of Transcendental Meditation gradually leads the meditator to enlightenment, a state in which, among other characteristics, a person does not make mistakes. Unusual as these claims may seem, they appear to be supported by a number of TM-recidivism studies. Recidivism is how many inmates return to prison after release or parole, and how quickly they return.

In one study done at the California Department of Corrections, 259 paroled felons who learned TM while incarcerated exhibited reduced recidivism compared to 259 non-meditating controls (33). The controls were closely matched for parole year, race, offense, prior commitment record, age, and drug use history. One year after parole, the TM group had 7.4% new prison terms compared to 13.8% for controls. This is a 45%

relative reduction in new terms for the TM group. Six years after parole, the TM group had 19.8% new prison terms compared to 34.5% for controls. This amounts to a relative reduction of 40% for the TM parolees. (33)

In addition to this comparative analysis of TM recidivism and control recidivism, the researchers fine-tuned the data by applying a regression analysis using a number of recidivism predictor variables (33). Some of the recidivism predictor variables were participation in prison self-improvement programs, married, separated, school grade, and IQ. After applying the regression, the two groups were slightly closer in their amount of new prison terms, but still significantly different. One year after parole, there was a 40% relative reduction in new prison terms for the TM group. After six years, there was a 30% relative reduction for the TM group (33).

Meditators paroled within five months of learning TM exhibited a greater recidivism rate than those paroled more than five months after learning (33). Hence, TM probably had a greater impact on inmates who had more time to practice it within the support of the institution before having the opportunity to commit crime again. Also, TM recidivists were significantly less regular in meditation than not-yet-released meditators. This suggests that the effects of TM on reducing recidivism are dependent on regular practice of the technique, not just learning it (33).

This evidence that there may be a way to reduce recidivism and crime is encouraging. Crime takes a toll on society—it costs money and reduces quality of life. Recidivism accounts for a significant portion of crime. Over 60% of all inmates released or paroled from US maximum-security prisons return (14). To the extent that crime can be reduced through reducing recidivism, society will benefit. Thus far, TM is the most

effective method found for reducing recidivism. No consistent effects have been shown for prison education, vocational training, and psychotherapy. The possibility of implementing the TM program in prisons deserves consideration for public sponsorship.

Twenty-four studies (and maybe more) have shown Transcendental Meditation to be highly effective in treating and preventing substance misuse (34). The studies were conducted on non-institutionalized users, participants in treatment programs, and prisoners with histories of extensive misuse. These substance abuse studies, as well as a plethora of psychology studies not directly evaluating substance abuse, indicate that TM addresses many factors underlying substance abuse. TM provides immediate relief from distress, improvements in well-being, self-esteem, personal empowerment, and sense of meaning in life. Furthermore, TM decreases rebelliousness, anxiety, and depression (34). This essay describes work from a few of the substance abuse studies.

One study surveyed 1,862 TM participants, 80% of whom had misused drugs within 6 months before learning TM (35). TM decreased drug use in all categories: marijuana, hallucinogens, narcotics, amphetamines, barbiturates, hard liquor, cigarettes, and prescribed medication. After 21 months of meditating, 90% of subjects that used drugs prior to TM had entirely stopped using and selling drugs, including prescribed drugs. Reduction of drug use increased with length of time practicing TM (35).

Recognizing that social environment is a variable that affects drug use, 2 studies evaluated drug use in TM participants and their peers (34). The studies suggest that reduction in drug use is related to practice of TM rather than a trend in the social environment. One of these studies surveyed 263 TM meditators and 158 controls in the Philadelphia area (36). The surveyees were predominately professionals and college

students. Regular TM participants had significantly reduced use of marijuana, prescription medication, stimulants, tranquilizers, illegal drugs, alcohol, tobacco, and caffeine relative to controls (36).

Another study evaluated alcohol and cigarette use as a function of length of time practicing TM (37). In an effort to reduce the likelihood of responder bias, this study used deceptive procedures to disguise the TM aspect of the study. The study found length of TM participation to be negatively correlated with beer, mixed drink, and cigarette consumption (37).

Some of the above studies were unable to eliminate the possibility of self-selection or responder biases (34). The evidence that reduction of drug use is an inverse function of length of TM practice, however, suggests that TM *per se* is the cause of decreased use. Furthermore, a number of studies using random assignment show reduced substance misuse with TM. Recall the Vietnam vets study, for example, in which TM subjects significantly reduced alcohol intake compared to their pre-TM consumption and compared to psychotherapy subjects (32).

In another study, 180 young, male, community-college students were randomly assigned to Transcendental Meditation, karate, or no-treatment controls (38). After four months, TM participants showed a significant drop in one or more categories of substance abuse relative to controls. The effect was largest for hard drugs, psychedelics, uppers, and downers. The karate group and the control group experienced no improvements in drug use. The authors of this study propose that people who learn TM become less dependent on drugs than do equally motivated controls (38).

One study was conducted on 120 skid-row chronic alcoholic inpatients at a rehabilitation center (39). The inpatients were randomly assigned to one of four treatment groups: TM, two relaxation programs, or standard treatment. The subjects received three months of inpatient treatment, and were then followed for 18 months. After 18 months, 65% of the TM subjects were completely abstinent from alcohol, whereas 25% of patients receiving standard treatment were completely abstinent. Also, the psychological health of TM subjects improved most. The authors of the study conclude that TM is an effective treatment for disadvantaged, chronic alcoholics (39).

These substance abuse studies suggest that the simple, easy mental technique known as TM has powerful and far-reaching effects. It is also interesting that TM is not a substance abuse treatment *per se*, but a technique for developing one's full potential and enhancing one's ability to enjoy life. As such, TM addresses many factors underlying chemical dependence. As the authors of the review point out, "TM provides a natural way to achieve the experiences substance users are looking for: relief from distress, increased self-esteem, enhancement of well-being, and self-efficacy, and a sense of personal power and meaning in life" (34).

Many studies show an increase in intelligence and academic achievement for those practicing TM. Percentile rankings on the Iowa Test of Basic Skills (ITBS) for students at the Maharishi School of the Age of Enlightenment (MSAE) demonstrates this high level of academic achievement (40). MSAE is a private, non-sectarian school offering instruction for kindergarten through twelfth grade. MSAE has an open admissions policy, and is located in Fairfield, Iowa. Students, teachers and administrators at MSAE practice Transcendental Meditation. In addition to the standard academic curriculum and TM,

students take a course in the Science of Creative Intelligence, "the study of qualities and principles of order, creativity, and intelligence that are found in nature and in the life of the student" (40).

Average ITBS percentile ranks at MSAE are consistently in the 90s (40). (Percentile ranks are based national statistics.) On the ITBS of Fall 1983, for example, 100 MSAE students took the exam and scored, on average, 96 percentile (figure 9).

Figure 9. Percentile ranks for 100 MSAE students taking the ITBS in Fall 1983.

Grade	Vocab.	Rdg.	Total Lang.	Work Study	Total Math	Composite
Grade 3	94	99	90	86	68	94
Grade 4	99	99	93	98	98	98
Grade 5	97	96	94	94	85	95
Grade 6	93	90	86	90	79	90
Grade 7	99	99	96	98	87	99
Grade 8	98	98	99	94	96	98

Furthermore, 37 students taking the ITBS that fall were new students whose mean score was 51 percentile, indicating average ability upon entering the school. These 37 new students improved their percentile ranking by 15 points upon taking the test in spring of the same academic year. By spring, their average score was 66 percentile. Continuing students, who were already at a high level of academic achievement, also improved significantly from fall to spring (40).

The findings of this study indicate that MSAE fosters academic excellence in its students. Authors of the study assert that TM is the "main factor responsible for the effectiveness of MSAE" (40). I feel this study does not isolate the variable of TM enough

to *conclude* that TM is the main factor for success on the ITBS. Quality of teaching, class size, nutrition, and other factors, all influence academic performance. These variables, however, are no doubt influenced by TM at MSAE. In my opinion, it safe to say that high academic achievement at MSAE appears to be enhanced directly and indirectly by the practice of TM. This view is supported by other research, which has shown that TM *per se* improves academic performance, intelligence, creativity, and self-concept in students (40).

DISCUSSION AND CONCLUSION

The simple, easy mental technique known as Transcendental Meditation is remarkably powerful. TM produces a unique state of hypometabolic wakefulness, and this state is distinct from waking, sleeping, and dreaming states. Indeed, some scientists have identified transcendental consciousness a fourth major state of consciousness. Regular transcending through TM benefits the meditator physiologically and psychologically. Regular meditators experience illness and disease about half as often as non-meditators, are less prone to hypertension, are more resistant to physiological deterioration over time, and live longer. TM's far-reaching effects are not merely due to the placebo effect or sitting comfortably with the eyes closed. The psychological improvements associated with regular TM practice appear to be as far-reaching as the physiological improvements. TM surpasses all other known techniques in terms of reducing substance misuse, overcoming the effects of trauma, reducing recidivism, increasing intelligence, and many other psychological factors.

Given these remarkable physiological and psychological benefits, TM should be considered to be a standard therapeutic modality in medicine and psychology. More than ten thousand doctors have learned TM, and many recommend it to their patients. Indeed, some doctors already prescribe TM, and the results are promising. As Nancy Lonsdorf, M.D. explains, "Hundreds of my patients have learned the TM technique with excellent

results. It is the most effective prescription for improving overall health” (41). Barry Charles, M.D. concurs, “Transcendental Meditation can benefit everyone whether they are healthy or ill. It is of proven value in a wide range of disease conditions and in prevention. Patients find that it markedly enhances their ability to make health-promoting choices” (41). Moreover, when one considers the medical crisis we are now facing, with costs rising uncontrollably, one sees the value of implementing this practical technology for preventing disease and reducing health care costs.

For such a simple technique to have such remarkably positive, far-reaching benefits, one would expect its mechanism of action to go far beyond what has been commonly available to people in the past. This is indeed the case. Several scientists assert that transcendental consciousness is the direct experience of the unified field, the home of all the laws of nature. My own experience with TM has convinced me that as we reconnect with our source through regular transcending, life becomes more blissful, meaningful, peaceful, and exhilarating; all forms of pain and suffering gradually fade away. Maharishi comments on how TM will fulfill the needs and desires of humankind (42):

... Science has been successful in expanding [man's] influence in outward directions and giving him command over certain laws of nature, but he has nevertheless remained uncomfortable within himself, and society has remained uncomfortable as a whole, beset with problems, continual mistakes, and their unfortunate consequences. With all its gains in knowledge and power, science to date has not discovered the secret of making man happy.

How satisfying it is to be able to say today that this lack has now been fully remedied, and moreover that the solution for man as it has emerged is not to ignore the evolutionary direction of scientific progress but simply to take it to fulfillment in its ultimate value. The fulfillment of science and of man lies in the expansion of consciousness . . . to the direct experience of that infinite, unbounded, eternal reality which alone can fulfill the natural direction of man's growth and which is the ultimate aim and goal of scientific progress.

The technique to achieve this goal of ultimate expansion of awareness is Transcendental Meditation. It is simple and natural, just because it is the nature of the human mind to flow towards unboundedness. And once the goal is achieved and the mind is established in its own unboundedness in the state of least excitation, its natural seat of absolute stability and perfect flexibility, then man becomes established in naturalness of activity as well, for this state of pure consciousness is the “home of all the Laws of Nature.” This state, in which pure consciousness is fully established and stabilized in the individual, is said to be the state of enlightenment.

Thus, the Age of Science, which has sometimes seemed to take man far away from Nature, has found as its ultimate achievement Transcendental Meditation, a method for establishing man’s mind, heart, and behavior deep in the source of Nature’s impulses within himself. Rapidly and inevitably Transcendental Meditation is raising the scientific age to be the Age of Enlightenment. . . .

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