

Consciousness-Based Education for Total Development of the Brain

in contrast to

Existing Education which Partially Develops the Brain

Summary of Scientific Research

Michael C. Dillbeck and Susan L. Dillbeck,
Maharishi University of Management, Fairfield, Iowa, USA

Introduction

Overview

The highest educational goal of every nation is to create ideal citizens, individuals capable of fulfilling their own goals while upholding the interests of others and the progress of the whole society. For this goal to become a living reality, education must actualize the full potential of the most precious resource of the country, the human brain of every citizen.

Research clearly indicates that education today is not realizing this immense potential, with the exception of universities and schools that are directly developing the consciousness of the students through the approach of Consciousness-Based Education.

Part One

Part One of this document reviews neuroscience research findings which show that the brain's development and functioning are influenced by experience. The research in this section further suggests that the type of experience most valuable for brain development after childhood is experience which fosters greater integration of brain functioning. Research also indicates that the experiences gained through the prevailing educational approach activate specific areas of the brain without fostering more integrated functioning of the brain as a whole.

The conclusion of this section is that such education, due to its exclusively segmented approach to knowledge, actually prevents the total development of brain functioning.

Part Two

Part Two presents evidence from decades of research that Consciousness-Based Education, developed by Maharishi Mahesh Yogi, does promote holistic brain functioning and expansion of mental capabilities.

Research studies show increased integration of cortical activity during the practice of Transcendental Meditation, as measured by increased synchrony and coherence of electroencephalographic

(EEG) activity; and also by greater use of the latent reserves of the brain.

Research also indicates that participants in the Transcendental Meditation Programme display, outside of the practice, greater integration and efficiency of brain processes that underly cognitive functioning, as well as a unique enhancement of the mental abilities associated with higher brain functioning. Transcendental Meditation also has been found to develop greater integration of diverse styles of brain functioning; and greater integration and effectiveness in the total functioning of the brain, the peripheral nervous system, and neuroendocrine processes, as reflected in improved performance on many physiological, cognitive, and behavioural variables.

Consciousness-Based Education

Transcendental Meditation is the fundamental technology used in Consciousness-Based Education. This approach adds study and research in consciousness to the traditional study of the academic disciplines, and includes the twice-daily practice of the Transcendental Meditation and TM-Sidhi Programme, including Yogic Flying, to directly develop full use of the brain's potential in higher states of consciousness.

Considering institutions as a whole, students at universities and schools using Consciousness-Based Education are found to be distinctly more committed academically, more alert, more healthy and balanced, more self-actualized, more satisfied with their education, more harmonious in their relationships, and more mature in moral judgment, compared to students at other educational institutions.

Amidst worldwide dissatisfaction with education today, Consciousness-Based Education has been shown by research and educational outcomes to be singularly effective in producing students who are steadily growing in the most cherished qualities of human life and the full expression of their creative powers.

Knowledge and Experience of Consciousness for Full Development of the Brain

For more than 50 years Maharishi brought to light detailed knowledge of the highest states of human development, and the Technologies of Consciousness, including the Transcendental Meditation and TM-Sidhi Programme, for systematically attaining these states.

The benefits of these Technologies of Consciousness for mind, body, behaviour, and society have been documented by over 600 scientific research studies, conducted at more than 250 universities and research institutes in 33 countries.

Maharishi formulated a complete science of consciousness—his Vedic Science—from the knowledge contained in the ancient Vedic Literature. This science describes the seven states of human consciousness, and gives the theoretical and practical knowledge for unfolding the full value of human consciousness. Maharishi Vedic Science includes descriptions of the quality of physiology, perception, and behaviour of individuals living higher states of consciousness.

For example, such individuals display the highest levels of creativity, intelligence, and organizing power. Their speech and actions are spontaneously most nourishing and evolutionary for others and for the environment. On the platform of inner fulfilment and enlightenment, their desires are always for the good of all humanity, and are achieved most effortlessly. They radiate an influence of vitality and harmony to the whole society, and are a source of joy and wisdom to all who know them.

Maharishi Vedic Science describes in detail the quality of human awareness that spontaneously gives rise to such behaviour. In higher states of consciousness, when the full potential of the brain is being utilized, the fundamental field of nature's intelligence—Transcendental Consciousness, the unified field of natural law¹—is fully enlivened in the individual's consciousness.

Maharishi Vedic Science describes this field as

¹ Over the last four decades, modern physics has discovered increasingly unified levels of natural law, culminating in the discovery of the unified field of natural law, whose self-interacting dynamics give rise to all forms and phenomena of nature. Leading quantum physicists have shown the properties of the unified field to be those of consciousness. Maharishi Vedic Science makes use of the Transcendental Meditation and TM-Sidhi Programme to enliven in human awareness this field of nature's total intelligence.

containing all the laws of nature in their most concentrated, abstract form, just as a seed contains the whole tree. The fundamental dynamics of this field are the Veda and Vedic Literature, whose reverberations give rise to all the laws of nature governing the orderly evolution of the universe.

When this total creative process of nature is enlivened in awareness, the individual spontaneously makes use of it, commanding the whole field of action, able to know anything, do anything right, and achieve any great goal, always supported by the totality of the laws of nature.

Under Maharishi's guidance, Professor Tony Nader, M.D., Ph.D., has discovered that the fundamental structures of the laws of nature expressed in the Vedic Literature are contained in human physiology. This discovery reveals that the physiology of everyone is the expression of the total intelligence of natural law—that the individual is cosmic. Functioning with cosmic intelligence becomes a living reality when the total potential of the brain is actualized.

This knowledge of human consciousness and how to awaken its unlimited potential has changed the concept of a university from 'all knowledge on one campus' to 'all knowledge in every brain'.

Inadequacy of Prevailing School and University Education

The inadequacy of education in the world today is acutely obvious. At the secondary level, the problems of school drop-outs, antisocial behaviour, lack of motivation, dullness, and even despair are symptomatic of the great frustration students experience when they are not educated to systematically unfold the unique creative possibilities latent within each of them.

Post-secondary education has its own particular weaknesses. The segmented and fragmented experience of studying separate disciplines and specializing in an academic field—*without the concomitant experience of the wholeness of knowledge and the wholeness of life*—not only fails to develop the brain's potential; it actually hinders the development of the mature intellect and personality by directing students' attention only to partial values of knowledge.

From the state of the world today, and from the quality of leadership in every area of national and international concern, it is clear that education is not offering the knowledge to actualize human potential. Educated people make as many

mistakes and create as many difficulties for themselves and others as uneducated people. Graduates are ill-prepared to eliminate the fundamental problems in their areas of expertise and to structure the steps for balanced progress—socially, economically, environmentally, technologically, politically. They lack the breadth and depth of comprehension to spontaneously make decisions that will serve the progress and well-being of everyone.

In light of the enormous possibilities for human life detailed in Maharishi Vedic Science, education everywhere today can be viewed as *miseducative*. Rather than giving students the knowledge and experience to live the full value of life, formal education restricts the students' awareness to narrow boundaries, and in so doing prevents the total development of the brain in higher states of consciousness.

Consciousness-Based Education to Fulfil the Goals of Education

Extensive research and decades of experience with Consciousness-Based Education have demonstrated that this approach, which adds study and research in consciousness to the existing curriculum in any country, eliminates the weaknesses of current education.

Research verifies that students at Consciousness-Based universities and schools improve significantly in mental capacity, academic achievement, health, and social behaviour, compared to students in other institutions. At the elementary and secondary levels, year after year classes of students at Consciousness-Based schools, who enter at an average level of performance, score among the highest in their nations on national standardized examinations by the time they graduate. They also distinguish themselves by winning top state and national prizes in an unusually wide range of subjects, including science, mathematics, speech, history, poetry, drama, art, music, and sports.

These scientific findings and educational outcomes give additional support to the research outlined in this document indicating that Consciousness-Based Education develops greater use of the brain's potential.

Experience and research also show that when any university or school adds to its curriculum a

Consciousness-Based course for all the students, the same desirable changes in academic performance and behaviour take place. Students grow in enthusiasm for knowledge, in alertness and creativity, and in exemplary citizenship—the ability to achieve their goals while promoting the interests of others. Increasingly they enjoy the 'fruit of all knowledge'—a problem-free, happy, healthy life, spontaneously in harmony with Natural Law.

Furthermore, when large groups of students together practise the Transcendental Meditation and TM-Sidhi Programme, including Yogic Flying, an influence of coherence and harmony is generated in the whole society—in the city, state, or nation as a whole, depending upon the size of the group. This effect is documented by nearly 50 studies showing reduced negative trends and improved quality of life in society. This influence of coherence in society, known as the ***Maharishi Effect***, corresponds with increased brain wave coherence during the practice of Yogic Flying (please refer to Part Two). In this way, the growth of harmony in society is fundamentally connected with development of full brain potential.

PART ONE

Scientific Research Indicates that Current Education Fails to Develop the Full Potential of Brain Functioning

This first part of the document contains conclusions from neuroscience research, with details of selected studies given in the boxes below the main text.

1. The Relationship of Brain Development to Education

A large body of research reveals that the development and ongoing state of brain functioning is shaped by the nature of the individual's experience.

Research on brain development in a variety of species shows that specific types of experience are necessary for the brain to develop properly.

For example, in the early stages of life, sensory experiences are critical for the development of the corresponding sensory structures of the brain. It has also been found that enriched sensory and

motor environments in infancy contribute to significantly enhanced development of the brain. (Refer to insert *Influence of Experience on Brain Development—Selected Research Findings*.)

Brain development is thus intimately connected with experience. From this perspective, the purpose of education, including early education in the family, should be to provide the appropriate experiences, at every stage of growth, that develop the full potential of mind and body, based on fully developing the brain.

Analysing the process of human brain development is useful for suggesting the type of educational experiences that are especially important at different stages of growth.

Influence of Experience on Brain Development *Selected Research Findings*

Summary: Deficiency or enrichment of experience has a substantial influence on brain development in young animals.

Sample findings: Neurophysiological research indicates that there are critical periods of brain development in which certain types of experience are necessary for the proper development of specific brain structures.

For example, when cats were raised in an optical environment in which the visual stimulation of one eye was restricted to lines of only one orientation (vertical or horizontal), the brain cells corresponding to that eye were only able to be activated by lines of the previously experienced orientation (reference 1). Later research found this effect to be associated with lack of a full range of orientation of dendritic fields of pyramidal cells in the visual cortex (2).

Researchers also found that blindness can occur if visual input is disrupted in the early life of animals. The cells of the eye continue to function properly, but their corresponding areas of the brain do not respond, indicating lack of proper connections between eye and brain or within the brain. The same disruption of vision does not cause any long-term effect if it occurs later in life, after the associated cortical areas and their connections are already functional (3).

An important related finding is that when infant animals of a variety of species are raised in enriched environments that allow for a full range of sensory, motor, and social activity, in contrast to isolation in a cage, there is greater brain development (4). For example, animals raised in enriched environments show an increase of up to 10% in overall brain weight after 60 days, which represents increased glia, blood vessels, neuron soma size, dendritic elements, and synapses; the increase in synapses has been estimated as 20% in the cortex (5). Other studies also found that animals raised in enriched environments showed changes in brain chemistry that are associated with enhanced learning ability (increased cortical acetylcholinesterase) (6).

These studies establish the principle that experience is related to brain development, and that specific types of experience are essential for proper and complete development of the brain.

Brain Development in Childhood

As the human brain develops, the primary sensory and motor areas are the first to mature, within the first one or two years of life. The areas associated with higher brain functioning mature over a longer period of time, through late childhood. The maturation of language areas is complete by age 8. After age 10 development continues primarily in the integrative systems of the brain, which connect the various cortical areas. For example, among the last areas of the brain to mature, up to early adulthood, is the prefrontal cortex, which is associated with overall integrative control of body and mind. (Refer to insert *Sequence of Human Brain Development—Selected Research Findings*.)

The development of the brain in childhood is the foundation for the growth of the child's sensory, motor, and cognitive abilities. Education focuses on developing these abilities.

Educational Experiences Should Promote Brain Development

Even if educators do not attend to the process of brain development in childhood, they do select learning experiences that suit the state of sensory, motor, and cognitive development of school children. In so doing, they are in fact selecting experiences most suitable for the children's current state of brain development.

For example, preschool education and family interactions in the first years of a child's life naturally stimulate the development of sensory and mo-

tor competencies, and rudimentary language skills. This corresponds to the period when the sensory and motor areas of the brain have developed and the language areas are maturing.

Primary school education exercises language skills and the nascent reasoning abilities of the child. At this time, language areas of the brain are completing their development and cortical association areas involved in higher brain functioning are maturing.

What kind of educational experience is most valuable for students *after* the early grades? After age 10, as noted previously, the main locus of brain maturation is the integrative systems of the brain. Therefore, the type of experience most crucial for unfolding the individual's brain potential from middle school through higher education should be that which develops higher integration of brain functioning.

Unfortunately, education has not included a systematic means to directly promote integrated brain functioning. Rather, from middle school onwards, education primarily exercises the individual's logical reasoning ability in relation to specific bodies of knowledge.

It is true that reasoning ability depends on the maturation of the brain's integrative systems; however, limiting the educational experiences of students only to the continued exercise of their reasoning skills is not sufficient to further develop the brain's potential, and to unfold higher integration of brain functioning. This is elaborated in the following section.

Sequence of Human Brain Development *Selected Research Findings*

Summary: Human brain development begins with the maturation of sensory and motor areas, and proceeds to the maturation of the cortical areas that integrate various areas of the brain.

Sample findings: The cortical circuits that serve sensory functioning (e.g., the visual cortex) are established in humans by six to eighteen months of age. The development of areas outside of the visual cortex takes place over an extended period of time. Cells in the frontal cortex, which is associated with higher brain functioning, undergo the majority of their growth after two years of age (7); the extent of the postnatal development of these cells is also substantial, growing to more than thirty times their dendritic length at birth. Similarly, Broca's area (associated with speech) has a long period of dendritic development in which mature forms emerge only after six to eight years (8).

One index of brain maturation is myelination (development of a myelin sheath on the axons of neurons forming the brain's white matter). In humans, the axons of primary sensory areas and motor areas of the cortex are among the first to myelinate; axons of unimodal association areas myelinate next; and those of polymodal association areas of parietotemporal and prefrontal regions are last to myelinate, in adolescence and possibly later (9). The prefrontal cortex is the executive centre of global integrative control, and is a key area in development of higher states of consciousness through the Transcendental Meditation and TM-Sidhi Programme, as indicated by research in Part Two of this document.

2. Education's Failure to Promote Use of Full Brain Potential

Evidence that current education does not promote full development of the brain is found in research on human cognitive development (which, as noted above, reflects brain development). From infancy to adolescence, during the period when the brain is rapidly maturing, there is concomitant growth in general intelligence, ego development, field independence, and other related cognitive variables. However, after adolescence, when the initial maturation of brain processes is largely completed, these cognitive abilities do not continue to develop. (Refer to insert *Development of Cognitive Abilities—Selected Research Findings*.)

This indicates that despite all efforts of secondary and higher education, higher cognitive processes, and the corresponding higher potential of the brain, are not being developed.

Narrow Educational Experiences Limit Brain Development

Stagnation of development has been rationalized

as 'adulthood'; it is assumed that with the end of initial physical maturation comes the end of fundamental development of the brain and cognitive processes. Accordingly, secondary and higher education students apply their already developed intellectual skills to increasingly specialized bodies of knowledge. That is, education remains 'intellect-predominant'; and as students advance in their education, they focus on increasingly segregated or isolated areas of knowledge.

As educational experience continues to be restricted to narrow channels, the adult brain in fact continues to modify its functioning to accommodate to those specific narrow channels of activity. For example, when perceptual or motor skills are learned (e.g., playing the violin), the adult's brain modifies its functioning: the cortex has been found to reallocate the proportion of its area that is devoted to the sensory or motor inputs that are most used. (Refer to insert *Cortical Plasticity in Adulthood—Selected Research Findings*.)

Such modification of specific cortical connections presumably occurs not only with the devel-

Development of Cognitive Abilities *Selected Research Findings*

Summary: Research indicates that many aspects of cognitive development that are closely related to brain development do not continue to expand after late childhood, despite the efforts of current education. Examples are general intelligence, field independence, and ego development.

Sample findings: Fundamental cognitive capabilities such as intelligence are closely associated with effectiveness of brain functioning. For example, an aspect of general intelligence called 'fluid intelligence', which is the ability to reason abstractly and perceive complex relations independent of past experience and education, is associated with the executive control functions of the frontal lobes; the frontal lobes are involved in managing attention in relation to task requirements that are understood and remembered (10,11).

Fluid intelligence increases developmentally up to age 17 but not thereafter (12,13). Similarly, psychometric research indicates that a related measure, the intelligence quotient (IQ), does not increase after adolescence. In addition, previous attempts to increase intellectual ability, particularly general intelligence, have been generally disappointing and inconclusive (14,15).

Field independence is a measure of 'psychological differentiation', a developmental process underlying

the ability to utilize one's internal frame of reference for comprehension of the perceptual and social environment (16); it enables one to maintain inner stability in a changing environment. Field independence is positively associated with intelligence, including fluid intelligence, and also positively correlated with cognitive developmental measures such as formal operational stage and moral reasoning stage (17,18). Field independence, like intelligence, increases developmentally up to about age 17, but does not increase after that time (19).

Cognitive-structural theorists similarly propose that cognitive development appears to terminate in a stage of abstract reasoning ability that is generally achieved by middle or late adolescence (20). A widely used cognitive-structural measure of ego (self) development has also been found to show little evidence of change after age 18–20 (21,22).

These findings indicate that secondary and higher education have failed to systematically develop the higher brain functioning that is associated with higher cognitive development. This is in striking contrast with the positive effects of Consciousness-Based Education, which include greater integration of brain functioning, improvement in brain processes associated with more effective cognitive functioning, and increased intelligence (please refer to Part Two).

ety. (Refer to insert *Brain Dysfunction Associated with Stress-Producing Behaviour—Selected Research Findings*.) Students are not taught how to awaken their natural capacity to think comprehensively, behave responsibly, and experience bliss in gaining knowledge.

Consciousness-Based Education offers a gratifying contrast to this unfortunate state of education worldwide. As described in Part Two, this approach gives every student the experience of unbounded awareness, which enlivens the total po-

tential of brain functioning, and thereby cultures the most complete expression of one's creative intelligence in daily life.

The implication of the findings cited in Part One is this: Prevailing educational systems, in which students spend their crucial formative years in narrow boundaries of knowledge, without gaining holistic awareness in higher states of consciousness, must be judged as detrimental to the development of the total potential of the brain.

Brain Activation in Specific Locations During Mental Processes *Selected Research Findings*

Summary: Studies using neuroimaging techniques have found that specific areas of knowledge and specific mental processes of memory and language are each associated with highly specific areas of activation in the brain.

Sample findings: Functional neuroimaging studies assess the metabolic or blood flow activity associated with neural activity by using positron emission tomography (PET) and functional magnetic resonance imaging (fMRI). These procedures produce three-dimensional images by using methods of computerized tomography. The PET procedure is based on the measurement of the spatial distribution of an injected radionucleotide that emits a positron, and fMRI is based on magnetic properties that depend on blood-oxygen level.

Neuroimaging studies in humans reveal great specificity in the cortical representation of long-term memories. For example, separate loci of activation

are found in the left-temporal lobe during naming of people, tools, and animals; this cortical specificity is further corroborated by category-specific memory deficits that occur if there are lesions in those specific areas (28). Cortical specificity is also found in the different ways that memories are processed, as indicated by cortical activation in different medial-temporal regions when memories are encoding and when they are retrieved (29). A similar specificity in terms of language processing has been found from PET studies, leading to a new understanding of language areas of the brain in terms of localized components of phonological input and output (30).

This research indicates that the type of experiences characteristic of the usual educational practice—reading, speaking, studying and memorizing specific areas of knowledge, or learning specific skills—activate only isolated areas of the brain rather than promoting integrated functioning of the brain as a whole.

opment of expertise in a specific activity, but also in a specific area of knowledge.

However, this modification of the brain's functioning is not a systematic unfoldment of the brain's potential. If specific expertise is not useful beyond a narrow channel of activity, then the corresponding specific cortical connections will also fail to have a broader life-promoting value. In practical terms, this means that the skill gained in playing the violin or in any academic discipline does not lead to skill in all the other activities of life—it does not develop life as a whole.

Another type of research indicating that educational experiences do not develop total brain functioning is the study of brain activity during mental operations. The conclusion of this research is that specific cognitive processes and specific domains of knowledge are associated with activity in specific localized areas of the brain.

For example, research indicates that the mental activities of *reading* words and of *speaking* those words each activate different and very specific cortical areas. Similar studies show that separate areas of the brain are activated by memory of different categories such as tools, animals, and names of people. These results are found by neuroimaging studies that measure changes in blood flow (representing changes in neural activity) during cognitive tasks. (Refer to insert *Brain Activation in Specific Locations During Mental Processes*—

Selected Research Findings.)

Thus, the educational experiences of mastering specific areas of knowledge or engaging in a variety of focused cognitive performances activate only very specific areas of the brain rather than develop higher integration of brain functioning.

Consequences of Limited Brain Development

The ineffectiveness of education today, therefore, can be viewed as resulting from focusing the brain's activity only in narrow channels without also developing holistic brain functioning, particularly greater integration of brain functioning.

The limitation of this approach, according to Maharishi's Vedic Science, is that students are deprived of the direct experience and understanding of the wholeness of knowledge and the wholeness of life; Natural Law in its totality remains beyond the range of their direct comprehension. Without this level of comprehension, individuals fail to develop the ability of spontaneous right thinking and action, abilities which Maharishi's Vedic Science identifies as characteristic of fully developed brain functioning.

Evidence of the failure of education is everywhere: under-achievement typifies the average classroom; most students do not wish to continue to higher levels of education; narrow thinking, stress, and antisocial behaviour are widespread in educational environments and expressed in soci-

Cortical Plasticity in Adulthood *Selected Research Findings*

Summary: Research during the past two decades has shown that the brain continues to modify its functioning based on experience—that accumulated experience in adulthood changes the way the cortex represents sensory input.

Sample findings: The sensory cortical areas for vision, touch, and hearing represent their sensory receptors on the surface of the body in a topographic manner; there is a mapping between neighbouring cortical areas and neighbouring skin sites. Changes in cortical map organization occur as a result of training animals on tasks that produce specific, differential patterns of activity in identified sectors of the cortex (23–25). These changes in cortical map organization resulting from experience are referred to as cortical map plasticity.

Comparable studies in humans using magnetoencephalography (MEG) showed a larger area of cortical activity associated with the scalp projections of

the finger used for Braille reading, and a smaller area for other fingers of Braille readers (26). This methodology also showed larger somatosensory representation of the digits of the left hand of string players, in comparison to other digits or to the comparable digits of control subjects (27).

Synaptic plasticity (changes in synaptic strength of neurons that fire together) has been studied for many years and is assumed to underlie the phenomenon of cortical map plasticity (25).

These findings indicate that the brain's functioning continues to accommodate itself based on one's specific experiences. An implication of this research is that it is vitally important for students to gain experiences that promote overall integration and effectiveness of brain functioning rather than being limited solely to isolated channels of skill or knowledge (please refer to Part Two).

Brain Dysfunction Associated with Stress-Producing Behaviour

Selected Research Findings

Summary: Studies using the neuroimaging technique of single photon emission computed tomography (SPECT) have revealed that brain functioning can be impaired by stress-producing behaviour to such an extent that ‘holes’ are evident in the functional pattern of brain activity (31).

Sample findings: SPECT analysis assesses the brain metabolism associated with neural activity, similar to positron emission tomography (PET) described earlier, but using a longer-lasting gamma-emitting tracer and less expensive equipment. SPECT procedures also create three-dimensional images using computerized tomography procedures.

Computer generated SPECT images show activity levels in the brain, not the actual brain itself. The areas of very low brain activity or functional lesions appear as functional ‘holes’ in the brain—parts of the brain that are no longer functioning properly.

In the ‘healthy’ or ‘normal’ brain (figure 1), the activity ‘shape’ looks nearly like the physical shape of the brain because most of the brain is active. Although the severest types of functional holes have been found for persons that expose themselves to harmful substances or habits (figures 2–4), notable holes can be seen even in the brains of so-called

healthy or normal people (figure 1). This supports the common understanding that average people are not using their full brain potential.

Much larger functional holes are seen in the SPECT images of people who abuse alcohol (figure 2) or drugs (figure 3).

Very strong effects of functional lesions are seen in the case of violent behaviour—SPECT images reveal a dramatic image of major brain dysfunction in aggressive, violent individuals. Brain metabolism of a violent individual is strikingly reduced in many areas (figure 4), especially in the crucial prefrontal lobes that normally provide executive control and thus an effective filter against impulsive, aggressive, and violent behaviour.

This research demonstrates that the inability of the present educational systems to prevent self-damaging or violent behaviour in turn contributes to further degradation of brain functioning and anti-social behaviour. Moreover, this research, by indicating that functional holes exist even in normal subjects, points to the need for every child to take advantage of a system of complete education that can develop the total functioning of the brain.



Figure 1. Underside of a ‘healthy’ brain



Figure 2. Alcohol abuse

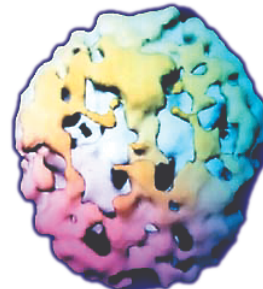


Figure 3. Drug abuse

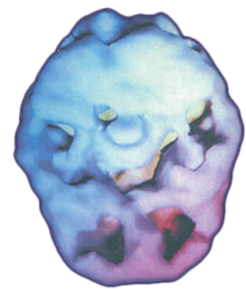


Figure 4. Violent subject

SPECT images courtesy of the Amen Clinic.

<http://www.amenclinics.com/brain-science/spect-image-gallery/>

PART TWO

Scientific Research Verifies that Consciousness-Based Education Promotes Development Towards the Full Potential of Brain Functioning

The Consciousness-Based educational approach makes use of the Transcendental Meditation and TM-Sidhi Programme to develop higher integration of brain functioning and associated higher cognitive capabilities, as the basis for increasingly effective and rewarding thought and action.

Transcendental Meditation provides the experience of wholeness of awareness, unbounded awareness, in Transcendental Consciousness. Physiological research has established Transcendental Consciousness as a fourth major state of consciousness, a unique state of restful alertness distinct from waking, dreaming, and deep sleep, and characterized by enhanced integration of brain functioning.

This and other research summarized below indicate that the experience of Transcendental Consciousness is essential for the total development of brain functioning. Maharishi's Vedic Science brings to light that development of total brain potential is experienced as the development of higher states of consciousness.

This enlivening of total brain functioning, and the corresponding actualization of mental potential, are the crucial missing elements in education today, and are provided by Consciousness-Based Education.

Overview of Part Two

The research findings that directly pertain to increased integration and effectiveness of brain functioning can be summarized in four categories:

Measured during the practice of Transcendental Meditation:

1. Greater integration of all cortical areas during the practice of Transcendental Meditation—measured by greater use of the latent reserves of the brain; increased synchrony and coherence of electroencephalographic activity at diverse frequencies and cortical areas; and increased cerebral blood flow widely throughout the cortex.

Measured Outside the Practice of Transcendental Meditation:

2. Greater integration of diverse styles of brain functioning—as measured by greater activation of each brain hemisphere; and by the unique integration of EEG associated with the experience of higher states of consciousness.

3. Greater integration and efficiency of brain functioning underlying cognitive processes—as measured by faster brain processing of cognitive and sensory stimuli; and by development of cognitive abilities that are associated with more integrated brain functioning, including increased intelligence, field independence, and ego development, all of which were previously thought to stop developing after the initial maturation of the brain in late childhood.

4. Greater integration and effectiveness in the total functioning of the brain, peripheral nervous system, and neuroendocrine processes—measured by more adaptive responses to stress by the autonomic nervous system and the endocrine system; and by reversal of the detrimental effects of the ageing process, shown in a wide variety of physiological, cognitive, and behavioural variables.

Findings in each of these four categories are described below in Sections 1 to 4.

1.

Greater Integration of All Cortical Areas During Transcendental Meditation

(1) Use of the hidden reserves of the brain

Professor N. N. Lyubimov of the Moscow Brain Research Institute of the Russian Academy of Medical Sciences found that during Transcendental Meditation, when a light somatosensory stimulus was given to the skin, then the early components (less than 100 milliseconds) of the somatosensory evoked potentials of the brain, which are associated with sensory input, are more widely distributed in the brain structures—both in the brain hemisphere where the response usually occurs, as well as in the opposite hemisphere. (Please refer to Figure 5.)

This finding indicates that during Transcendental Meditation ‘there is an increase in the area of the cortex taking part in the perception of specific information and an increase in the functional relationship between the two hemispheres’ (32).

(2) Greater synchrony of brain functioning, measured at a full range of EEG frequencies of wakefulness and in all cortical areas

Synchrony of electroencephalographic (EEG) activity reflects integrated functioning of large groups of neurons. EEG studies have found that during the practice of Transcendental Meditation, EEG activity is highly synchronized over almost all cortical areas; this synchrony was measured at all the categories of EEG frequencies associated with wakeful awareness (theta, alpha, and beta).

At alpha frequencies (8–14 cycles per second) a stable alpha rhythm often spreads to the whole cortical surface; at theta frequencies (4–7 cps) occasional hypersynchronous theta bursts are found over all cortical areas, as well as rhythmic theta trains; and at beta frequencies (15–50 cps) generalized fast frequencies occur with a dominant beta rhythm of about 20 cps, as well as smaller amplitude at 40 cps (33,34). Synchronous EEG activity at all these frequencies and cortical areas reflects a global integration of brain functioning.

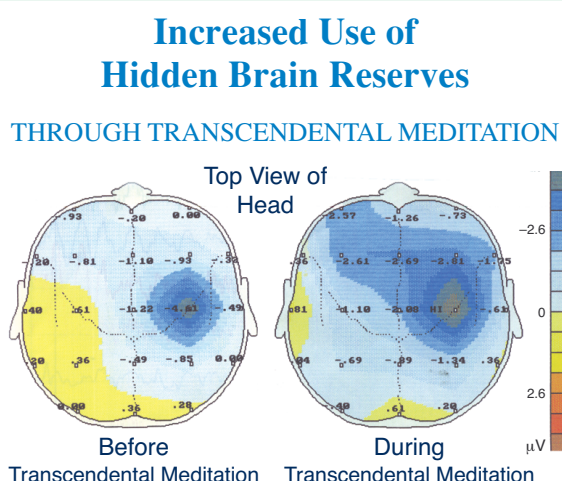


FIGURE 5. During the Transcendental Meditation Programme, early (sensory) components of the brain’s response to somatosensory stimuli are more widely distributed across the cortex, indicating greater participation of the whole brain in the response to stimuli. Reference: *Human Physiology* 25: 171–180, 1999.

In addition, individuals practising Transcendental Meditation showed increased alpha phase synchrony (reduced millisecond phase lag) between frontal and occipital-parietal areas in contrast to resting with eyes closed, while control subjects showed no change over the same period (35). This finding also indicates increased functional integration of the brain that may be fundamental to higher-order cognitive processes, as evidenced by the fact that decreased alpha brain synchrony associated with brain pathology is correlated with declines in cognitive functioning (35).

(3) Increased EEG coherence at all frequencies and all cortical areas during Transcendental Consciousness

EEG coherence measures the relationship between the EEG activity at two different locations on the scalp; it quantifies the consistency of phase relationship of the two EEG signals at a given frequency. Higher EEG coherence thus indicates greater integration of brain functioning in the measured areas.

Research has found that during the practice of Transcendental Meditation, periods of time identified by respiratory changes as periods of Transcendental Consciousness displayed a significant increase in EEG coherence, averaged over all the measured frequencies (1–50 cps) and cortical locations (nine pairs of electrodes) (36). (Please refer Figure 6.)

This finding indicates that during Transcendental

Increased EEG Coherence During Transcendental Consciousness

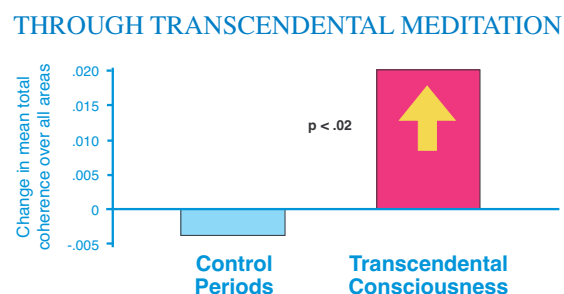


FIGURE 6. This study found that many experiences of Transcendental Consciousness were associated with periods of natural respiratory suspension; and that during these respiratory suspension periods, individuals displayed higher mean EEG coherence over all frequencies and brain areas, in contrast to control periods where subjects voluntarily held their breath. Reference: *Psychosomatic Medicine* 46: 267–276, 1984.

Increased EEG Coherence during Transcendental Consciousness and during Yogic Flying

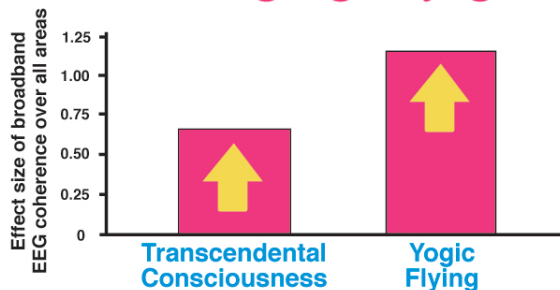


FIGURE 7. This chart compares the effect size of increased broadband EEG coherence across all measured scalp locations in two conditions: (1) during periods of respiratory suspension, which were often associated with the experience of Transcendental Consciousness, and (2) during Yogic Flying. In the case of Transcendental Consciousness (first reference), the effect size was calculated from the t-test on the change in EEG coherence from the time period immediately before the respiratory suspension; during a control condition of voluntary breath holding there was no corresponding change. In the case of Yogic Flying (second reference), the effect size was calculated from means and average standard deviations of the EEG coherence in the 2.12 second period immediately before liftoff of Yogic Flying, in contrast to voluntary jumping among controls.

References: *Psychosomatic Medicine* 46: 267–276, 1984; *International Journal of Neuroscience* 54: 1–12, 1990.

Consciousness there is increased integration of brain functioning, as reflected in the full range of EEG frequencies and cortical areas measured.

(4) Maximum coherence of brain functioning during the Transcendental Meditation Sidhi Programme and Yogic Flying

EEG coherence over all measured scalp areas and over a broad band of frequencies (4.7–17.9 cps) increased significantly immediately before the body lifted off the ground in TM-Sidhi Yogic Flying (37), to a degree even greater than found during the experience of Transcendental Consciousness during Transcendental Meditation (36). (Please refer to Figure 7.) This finding indicates that stabilization of Transcendental Consciousness in activity through the TM-Sidhi Programme further enlivens overall coherence of brain functioning.

(5) Increased cerebral blood flow

Research reviewed in Part One has shown that during specific cognitive processes such as reading, speaking, and memory encoding or retrieval, blood flow increases only in very isolated parts of the cortex (29,30). However, research on Transcendental Meditation has found that during this practice there is increased cerebral blood flow in both frontal and occipital parts of the cortex (38), reflecting an integrated state of cortical activity extending over large areas of the brain. (Please refer to Figure 8.) This finding of increased cerebral blood flow also indicates a state of inner alertness during Transcendental Meditation, because in contrast, during light sleep, there is a decrease in relative cerebral blood flow.

This finding also contrasts to the long-term effects of the ageing process; cerebral blood flow usually decreases with ageing (39).

All the findings described above—greater use of the hidden or latent reserves of the brain, increased synchrony and coherence of electroencephalographic activity at diverse frequencies and cortical locations, and increased cerebral blood flow widely throughout the cortex—all reflect greater integration of brain functioning during Transcendental Meditation.

Increased Cerebral Blood Flow

THROUGH TRANSCENDENTAL MEDITATION

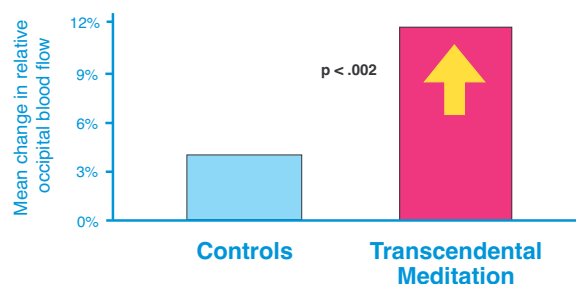


FIGURE 8. Individuals who practise the Transcendental Meditation Technique displayed significantly increased cerebral blood flow during the practice, in contrast to controls sitting with eyes closed. Increased blood flow was found widely throughout the brain during the practice of Transcendental Meditation, both in the occipital (back) area of the brain, charted above, and also in the frontal area of the brain. Reference: *Physiology & Behavior* 59: 399–402, 1996.

2. Greater Integration of Diverse Styles of Brain Functioning

(1) Greater lateralization of brain activity— Greater activation of each brain hemisphere

Tasks that require analytic cognitive skills (verbal and mathematical tasks) involve greater activity of the left hemisphere of the brain; tasks that require spatial ability involve greater activity of the right hemisphere of the brain. Electroencephalographic research shows that those who practise Transcendental Meditation display, outside of the meditation period, greater lateralization (hemisphere-appropriate activation) of brain functioning suitable to the given task. When performing analytic tasks, participants in Maharishi's Transcendental Meditation Programme show a greater ratio of activation of the left hemisphere than controls; and for spatial tasks, they show a greater ratio of activation of the right hemisphere (40). (Please refer to Figure 9.)

These findings indicate more flexible functioning of the whole cortex, in which diverse cortical areas are more capable of active involvement, as required by the task.

(2) Integration of diverse styles of brain functioning associated with experience of higher states of consciousness

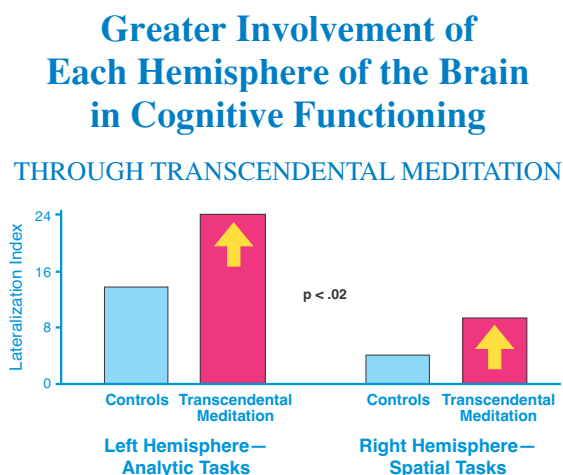


FIGURE 9. Participants in the Transcendental Meditation Programme showed greater activation of the appropriate hemisphere of the brain (lateralization) for both analytic tasks (left hemisphere) and for spatial tasks (right hemisphere). This means that among those who practise Transcendental Meditation both hemispheres of the brain respond more flexibly and dynamically to tasks, as needed. Reference: *Psychophysiology* 14: 293–296, 1977.

A characteristic of higher states of consciousness developed through Maharishi's Transcendental Meditation and TM-Sidhi Programme is the experience of Transcendental Consciousness maintained outside of the meditation period, including during deep sleep.

Individuals reporting the experience of Transcendental Consciousness during night sleep displayed EEG activity in theta/alpha frequencies, which is associated with restful alertness, *together with* delta frequency EEG activity, which is characteristic of deep sleep (41). This finding indicates a profound natural integration of diverse styles of brain functioning.

3. Greater Integration and Efficiency of Brain Functioning Underlying Cognitive Processes

(1) Faster response of the brain (shorter latency) in cognitive processing of stimuli

Cognitive processing involves a sequence of responses in a variety of neural structures; faster processing thus reflects more integrated and efficient brain functioning. Those who practise Transcendental Meditation show faster response (shorter

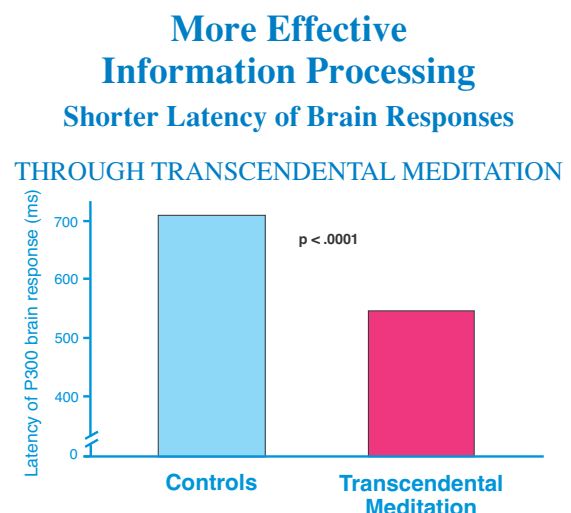


FIGURE 10. Elderly individuals who practise Maharishi's Transcendental Meditation Programme, in comparison to controls of the same age, showed shorter latency of brain response (faster response) in the cognitive processing of visual information. This faster response of the brain contrasts with the usual decline associated with ageing, and is an indicator of greater integration of brain functioning among those who practise Transcendental Meditation. Reference: *Psychophysiology* 26: S29 (Abstract), 1989.

latency) of brain evoked potentials in the cognitive processing of stimuli (P300 response) (42–45). (Please refer to Figure 10.) This finding contrasts with what usually occurs due to the ageing process: The brain typically responds more slowly in processing stimuli, as measured by longer latency of brain evoked potentials (46).

(2) Faster response of the brain (shorter latency) in sensory processing of stimuli

Individuals who practise Transcendental Meditation also show faster response of the brain evoked potentials that are associated with sensory perception of stimuli (47). Again, faster processing reflects more integrated brain functioning.

(3) Greater efficiency of preparatory brain responses

Individuals reporting greater frequency and also stable experience of Transcendental Consciousness during daily activity and during night sleep were found to have a more efficient style of brain responses in preparation for response to a stimulus (48,49). That is, in simple reaction time tasks, in which the response is set but only requires a stimulus to activate the response, these subjects had greater preparatory responses prior to the stimulus. In contrast, in choice reaction time tasks, in which the response cannot be determined until the stimulus occurs, these subjects had lower preparatory responses prior to the stimulus. These find-

ings indicate greater efficiency of response, in which activation is not evident before it is necessary, and in which activation is greater when it is required.

This same style of functioning of preparatory brain responses was found to develop longitudinally over a 10-week period among those instructed in the Transcendental Meditation Technique, in contrast to control subjects who did not learn the practice (50).

(4) Brain Integration Scale associated with stabilized Transcendental Consciousness and developing longitudinally

A Brain Integration Scale was successful in distinguishing the brain functioning during task performance of subjects reporting higher frequency of, or stabilized experience of, Transcendental Consciousness; this scale consisted of broadband frontal EEG coherence (alpha, beta, and gamma frequencies), higher alpha/beta absolute power ratios, and more efficient brain preparatory responses (as outlined in the previous finding above) (48,49). Longitudinal research also confirmed increases in this brain integration scale among individuals who learned Transcendental Meditation, in contrast to controls (50).

(5) Greater integration of brain functioning correlated with improved cognitive abilities

Many cognitive abilities that improve with regular practice of the Transcendental Meditation Programme—creativity, concept learning ability, intelligence, moral reasoning—are positively correlated with higher levels of EEG coherence, particularly in frontal cortical areas (51–53). (Please refer to Figure 11.) As noted previously, increased EEG coherence, including coherence in frontal areas, is found during practice of the Transcendental Meditation and TM-Sidhi Programme.

(6) Continued improvement of mental abilities that usually stop developing in late childhood

Individuals who learn the Transcendental Meditation and TM-Sidhi Programme, in contrast to controls, show continuing development of cognitive abilities that usually stop growing in late childhood, including fluid intelligence (54–56), ego development (57), and field independence (56,58). (Please refer to Figures 12–14.) As noted in Part One of this document, these measures are related to one another; one of them, fluid intelligence, has been found to be associated with the higher control functions of the frontal lobes (please refer to

Integration of Brain Functioning THROUGH TRANSCENDENTAL MEDITATION

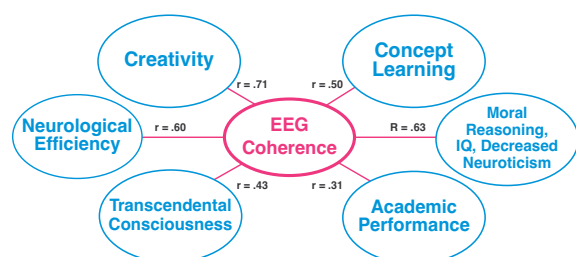


FIGURE 11. Higher levels of EEG coherence measured during Transcendental Meditation are significantly correlated with higher creativity, greater efficiency in learning new concepts, more principled moral reasoning, higher verbal IQ, less neuroticism, higher academic achievement, clearer experiences of Transcendental Consciousness, and greater neurological efficiency (faster spinal reflex recovery). References: *International Journal of Neuroscience* 13: 211–217, 1981; 15: 151–157, 1981; *Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Programme: Collected Papers, Volume 1*: 208–212, 1977; *Volume 4*: 2245–2266, 1989.

Development of Intelligence Increased IQ in University Students

THROUGH TRANSCENDENTAL MEDITATION

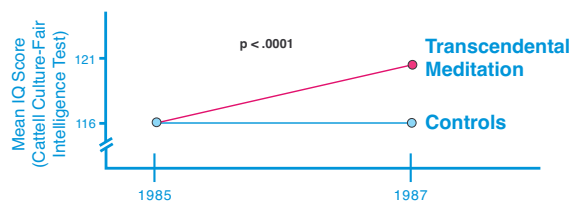


FIGURE 12. University students who were practising the Transcendental Meditation and TM-Sidhi Programme increased significantly on intelligence during their education in contrast to students at a control university. This measure of fluid intelligence is related to the functioning of the frontal cortex, and thus reflects more effective brain functioning. Reference: *Personality and Individual Differences* 12: 1105–1116, 1991.

Increased Self-Development

THROUGH TRANSCENDENTAL MEDITATION

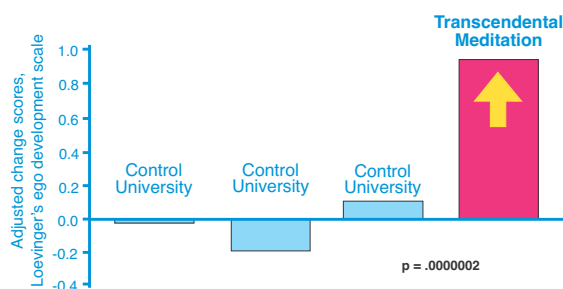


FIGURE 13. University students practising the Transcendental Meditation Programme increased significantly on self-development (ego development) in a longitudinal study after graduation, in contrast to control students who were not participating in this programme. The Transcendental Meditation participants showed, as a group, growth to uniquely high levels of development. Reference: *Journal of Social Behavior and Personality* 17: 93–121, 2005.

Development of Cognitive Abilities—Selected Research Findings). It is likely that this unprecedented development of global cognitive abilities after childhood, which is promoted by the practice of Transcendental Meditation, is the expression of greater integration and effectiveness of brain functioning.

The findings in this section thus indicate greater integration and effectiveness of the brain processes that underlie cognitive functions; and correspondingly, a unique improvement in cognitive abilities.

Increased Field Independence Broader Comprehension and Greater Ability to Focus

THROUGH TRANSCENDENTAL MEDITATION

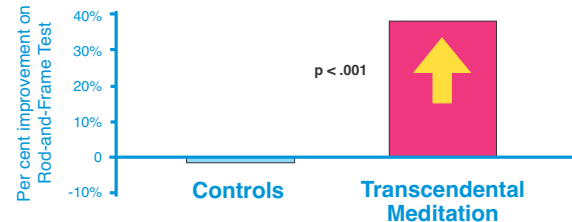


FIGURE 14. Individuals randomly assigned to learn the Transcendental Meditation Programme displayed a significant increase, in comparison to controls, on measures of field independence, indicating broader comprehension with increasing ability to focus. Field independence was previously found to stop developing after about age 17. Reference: *Perceptual and Motor Skills* 39: 1031–1034, 1974.

4.

Greater Integration and Effectiveness in the Total Functioning of the Brain, Peripheral Nervous System, and Neuroendocrine Processes

Higher integration of brain functioning is naturally associated with more integrated functioning of the physiology as a whole. Among the aspects of the nervous system that are most intimately connected with brain functioning are the peripheral nervous system, including the autonomic nervous system; and endocrine processes, which are under direct influence of the brain through the hypothalamus. Integration in the total functioning of brain, peripheral nervous system, and neuroendocrine processes has been found to develop through the practice of the Transcendental Meditation Programme, as indicated by the following sample research findings.

(1) Faster recovery of the autonomic nervous system from stress

Individuals practising the Transcendental Meditation Programme, in contrast to controls, show more rapid recovery of the autonomic nervous system from stress, as measured by habituation of skin resistance responses (59). The Transcendental Meditation participants also showed a more stable physiological response to the stressful stimulus (fewer multiple responses), and had fewer spontaneous skin resistance responses (independent of the stressful stimulus) than control subjects,

indicating more stable as well as more flexible functioning of the autonomic nervous system.

(2) More adaptive neuroendocrine response to stress

Individuals who learned the Transcendental Meditation Programme, in contrast to controls, showed after four months a more adaptive response to

stress as measured by the following variables: decreased baseline cortisol and decreased overall cortisol during stress session; enhanced cortisol response during a stressful challenge, with rapid return to baseline; and decreased plasma serotonin during a baseline period and in response to stress (60). Low baseline cortisol and enhanced cortisol response to stress have been found by

Reversal of Ageing THROUGH TRANSCENDENTAL MEDITATION

PHYSIOLOGY	Through Ageing	Through the TM Programme
Blood pressure—systolic	↑	↓
Blood pressure—diastolic	↑	↓
Cardiovascular efficiency	↓	↑
Cerebral blood flow	↓	↑
Vital capacity	↓	↑
Temperature homeostasis	↓	↑
EEG alpha power	↓	↑
Visual evoked potentials—P300 latency	↑	↓
Reflex latency (monosynaptic reflex)	↑	↓
Reflex recovery time (paired H-reflex)	↑	↓
Muscle contraction time (fast and mixed muscles)	↑	↓
Neuromuscular coordination	↓	↑
Insomnia (time to fall asleep)	↑	↓
Sleep disturbance (awakenings per night)	↑	↓
Daytime sleep	↑	↓
Susceptibility to stress	↑	↓
Periodontal health	↓	↑
Erythrocyte sedimentation rate	↑	↓
BIOCHEMISTRY		
Serum cholesterol	↑	↓
Serum DHEAS (dehydroepiandrosterone sulphate)	↓	↑
Efficiency of endocrine control (pituitary-thyroid axis)	↓	↑
Glucose tolerance	↓	↑
PERCEPTION AND MIND-BODY COORDINATION	Through Ageing	Through the TM Programme
Visual acuity	↓	↑
Auditory threshold	↑	↓
Dichotic listening	↓	↑
Field independence	↓	↑
Perceptual flexibility	↓	↑
Behavioural rigidity	↑	↓
Perceptual-motor performance	↓	↑
Reaction time—simple	↑	↓
Reaction time—choice	↑	↓
Complex sensory-motor performance	↓	↑
PSYCHOLOGY		
Fluid intelligence	↓	↑
Creativity	↓	↑
Learning ability (paired associate learning)	↓	↑
Memory—verbal	↓	↑
Memory—visual	↓	↑
Organization of memory	↓	↑
Cognitive flexibility	↓	↑
Depression	↑	↓
Self-evaluation of health and well-being	↓	↑
REQUIREMENTS FOR MEDICAL CARE		
Patient days in hospital (medical and surgical)	↑	↓
Outpatient visits (medical and surgical)	↑	↓
Health care costs	↑	↓

FIGURE 15. Each of the factors listed above generally deteriorate due to ageing. The opposite change on each factor—indicating a reversal of the ageing process—has been measured in research studies on

the Transcendental Meditation and TM-Sidhi Programme. Reference: *Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Programme: Collected Papers, Volumes 1–6.*

previous research to be a more stable and adaptive physiological profile; low plasma serotonin indicates decreased stress and decreased risk of high blood pressure. These results signify more adaptive and efficient response of neuroendocrine processes to stress.

(3) Improvement in physiological, cognitive, and behavioural abilities that usually decline with ageing

Decline in cognitive functioning with ageing is assumed to be associated with neuronal loss (5).

Research has shown, however, that Transcendental Meditation improves many physiological, cognitive, and behavioural variables that usually decline with ageing. These include changes in the following variables most closely related to brain functioning: increased cerebral blood flow (38), increased EEG alpha power (33,34), faster response (shorter latency) of P300 evoked brain potentials (42–45), increased learning ability and improved memory (61), increased creativity (62), increased intelligence (54–56), faster reaction time (54), increased field independence (56,58), and increased behavioural flexibility (61).

These developments, opposite in direction from the ageing process, suggest continued brain development and increased integration of cortical functioning in adulthood through the experience of Transcendental Meditation.

In addition, a wide range of other developments opposite in direction to the ageing process occur through regular practice of Transcendental Meditation, including decreased susceptibility to stress (59), reduction of high blood pressure (63–65), reduced cardiovascular disease (66), increased serum DHEA-S (dehydroepiandrosterone sulfate, an adrenal hormone related to good health in the elderly) (67), increased efficiency of endocrine control (60), and reduced depression (68,69). (Please refer to Figure 15.)

These results indicate greater integration and effectiveness in the total functioning of the brain and related physiological processes; that is, greater integration and effectiveness in the interrelationship among the cerebral cortex, the subcortical structures of the brain, the autonomic nervous system, and neuroendocrine processes.

(4) Reversal of previous decline in physiological, cognitive, and behavioural abilities among the elderly

Research also shows that previous losses in ability due to ageing can also be reversed. Individuals in homes for the elderly who learned the Tran-

Decreased Mortality Rate

THROUGH TRANSCENDENTAL MEDITATION

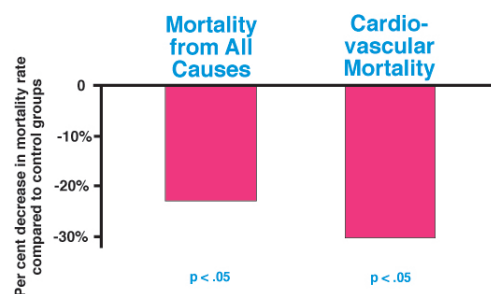


FIGURE 16. This study followed the mortality pattern up to 19 years after adults with high blood pressure learned the Transcendental Meditation Technique or participated in control interventions. The results showed a 23% decrease in mortality due to all causes, and a 30% decrease in the rate of cardiovascular mortality, among those who learned the Transcendental Meditation Technique, in comparison to controls. Reference: *American Journal of Cardiology* 95: 1060–1064, 2005.

scendental Meditation Programme (average age 81 years) showed improved learning ability, increased cognitive flexibility, increased behavioural flexibility, reduced systolic blood pressure, improved mental health, and increased longevity, in contrast to those assigned to various control groups (61, 70). (Please refer to Figure 16.) These results suggest that previous age-related decline in brain functioning, or reduction in the integration and balance of cortical, subcortical, and peripheral structures, can be reversed through the practice of Transcendental Meditation.

The broad array of findings in this section thus demonstrate improvement in the total functioning of brain, peripheral nervous system, and neuroendocrine processes through the Transcendental Meditation Programme.

Summary and Conclusion

The neurological and neurocognitive research reviewed in Part One of this document indicates that the prevailing systems of education are failing to develop the full brain potential of every student; as a result education everywhere is unable to realize its highest goals.

Research shows that experience directly shapes the development and modification of brain functioning. Research also suggests that the type of experience most valuable for brain development after childhood is greater integration of brain functioning, which is not systematically provided by education.

Many aspects of cognitive functioning have their basis in the growth of higher, or more integrated, brain functioning. Despite the efforts of educators applying a variety of teaching and curriculum approaches, these cognitive abilities have been found to stop developing after adolescence. This lack of continued growth of cognitive abilities is compelling evidence that education fails to continue unfolding the full brain potential of each student.

Research also shows that the brain continues to adapt its functioning to specific channels of learning and behaviour. The cognitive activities typically exercised in education (reading, speaking, memorizing and recall), as well as specific categories of knowledge, activate highly specific areas of the brain, rather than promote more holistic or integrated brain functioning.

The conclusion from the research reviewed in Part One is that the segmented approach to knowledge that characterizes education today restricts the awareness and brain functioning to narrow channels of activity. Restricted awareness leads to problems, mistakes, and the inability to evaluate the environment and act in a way that consistently favours progress and happiness.

The research reviewed in Part Two summarizes findings in neuroscience, physiology, and psychology that verify the development of higher integration of brain functioning, and correspondingly, the progressive unfoldment of mental potential, through the technologies of Consciousness-Based Education, the Transcendental Meditation and TM-Sidhi Programme.

Research shows greater integration of all cortical areas during the practice of these Technologies of Consciousness, as measured by synchrony and coherence of EEG activity at diverse frequencies, by greater use of the latent reserves of the brain,

and by increased cerebral blood flow throughout large areas of the cortex.

Participants in the Transcendental Meditation and TM-Sidhi Programme also show, outside the practice, an integration of different styles of brain functioning, including greater activation of each brain hemisphere; and a unique integration of EEG, associated with the experience of higher states of consciousness. They also display greater efficiency and integration of brain functioning at the basis of cognitive processes, as measured by faster brain processing of cognitive and sensory stimuli; and by development of cognitive abilities that are associated with more integrated brain functioning—abilities previously found to stop developing in adolescence, after the initial maturation of the brain. These findings show that the development of brain potential and of mental potential are simultaneous through the practice of Technologies of Consciousness.

The research on the Transcendental Meditation and TM-Sidhi Programme also indicates greater integration and effectiveness in the total functioning of the brain, the peripheral nervous system, and neuroendocrine processes. This is evident from more adaptive responses to stress by the autonomic nervous system and the endocrine system; as well as by reversal of the detrimental effects of the ageing process, as measured in a broad spectrum of physiological, cognitive, and behavioural variables.

The conclusion of this research, supported by more than 600 research studies on the Transcendental Meditation and TM-Sidhi Programme and 40 years of educational experience, is that it is now possible to develop brain functioning in its totality, for the enrichment of all aspects of life—mental potential, health, behaviour, and the society as a whole. (Please refer to *Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Programme: Collected Papers, Volumes 1–7*.)

Educators who are sincere in their desire to do the most for their students and to eliminate the weaknesses of education will avail themselves of this knowledge and offer Consciousness-Based courses through their educational systems. The result will be generations of students who are enlivening their total brain functioning, on the basis of which they will lead increasingly problem-free, productive, and fulfilling lives, directly contributing to progress in every area of national life.

References

- (1) *Physiologist* 10: 17–45, 1967.
- (2) *Journal of Comparative Neurology* 211: 353–362, 1982.
- (3) *Harvey Lectures* 72: 1–51, 1978.
- (4) *Enriched and Impoverished Environments: Effects on Brain and Behavior*. New York: Springer-Verlag, 1987.
- (5) *Annual Reviews of Psychology* 49: 43–64, 1998.
- (6) *Journal of Comparative Physiological Psychology* 53: 509–519, 1960.
- (7) *Acta Anatomica* 47: 72–111, 1961.
- (8) Dendritic structure and language development. In *Developmental Neurocognition: Speech and Face Processing in the First Year of Life*. Kluwer Academic Publishers, 1993.
- (9) The myelogenic cycles of regional maturation of the brain. In *Regional Development of the Brain in Early Life*. Oxford: Blackwell & Mott, 1967.
- (10) *Cognitive Psychology* 30: 257–303, 1996.
- (11) *International Journal of Aging & Human Development* 45: 99–109, 1997.
- (12) *Acta Psychologica* 26: 107–129, 1967.
- (13) *Multivariate Behavioral Research* 6: 503–514, 1971.
- (14) Intelligence research and intelligent policy. In *How and How Much Can Intelligence Be Increased?* Norwood, NJ: Ablex, 1982.
- (15) *Harvard Educational Review* 39: 1–29, 1969.
- (16) *Psychological Differentiation*. New York: Wiley, 1962.
- (17) *Child Study Journal* 2: 67–76, 1980.
- (18) *Dissertation Abstracts International* 32: 2190A, 1971.
- (19) *Journal of Personality and Social Psychology* 7: 291–300, 1967.
- (20) *The Psychology of the Child*. New York: Basic Books, 1969.
- (21) *Journal of Personality and Social Psychology* 48: 947–962, 1985.
- (22) *Journal of Youth and Adolescence* 8: 1–20, 1979.
- (23) *Annual Reviews of Neuroscience* 14: 137–167, 1991.
- (24) *Annual Reviews of Neuroscience* 19: 129–158, 1995.
- (25) *Annual Reviews of Neuroscience* 21: 149–186, 1998.
- (26) *Brain* 116: 39–52, 1993.
- (27) *Science* 270: 305–307, 1995.
- (28) *Nature* 380: 499–505, 1996.
- (29) *Science* 276: 264–266, 1997.
- (30) *Clinical Neuroscience* 4: 78–86, 1997.
- (31) <http://www.amenclinics.com/brain-science/spect-research/spect-abstracts/>
- (32) *Human Physiology* 25: 171–180, 1999.
- (33) *Electroencephalography and Clinical Neurophysiology* 35: 143–151, 1973.
- (34) *Revue d'Electroencephalographie et de Neurophysiologie Clinique* 4: 445–453, 1974.
- (35) *Signal Processing* 85: 2213–2232, 2005.
- (36) *Psychosomatic Medicine* 46: 267–276, 1984.
- (37) *International Journal of Neuroscience* 54: 1–12, 1990.
- (38) *Physiology & Behavior* 59: 399–402, 1996.
- (39) Kohn, R. R. In *Handbook of the Biology of Aging*. New York: Van Nostrand Reinhold, 1977.
- (40) *Psychophysiology* 14: 293–296, 1977.
- (41) *Sleep* 20: 102–110, 1997.
- (42) *Psychophysiology* 26: S29 (Abstract), 1989.
- (43) *Psychophysiology* 27: S23 (Abstract), 1990.
- (44) *Dissertation Abstracts International* 53(6): 3189B, 1992.
- (45) *Psychophysiology* 31: S98 (Abstract), 1994.
- (46) *Evoked Potential in Clinical Neurology* (2nd Edition). New York: Raven Press, 1989.
- (47) *Zeitschrift für Elektroencephalographie und Elektromyographie EEG-EMG* 7: 99–103, 1976.
- (48) *Biological Psychology* 55: 41–55, 2000.
- (49) *Biological Psychology* 61: 293–319, 2005.
- (50) *International Journal of Psychophysiology* 71: 170–176, 2009.
- (51) *International Journal of Neuroscience* 13: 211–217, 1981.
- (52) *International Journal of Neuroscience* 15: 151–157, 1981.
- (53) *Scientific Research on Maharishi's Transcendental Meditation and TM-Sidhi Programme: Collected Papers, Volume 4*: 2245–2266, 1989.
- (54) *Personality and Individual Differences* 12: 1105–1116, 1991.
- (55) *Higher Education Research and Development* 15: 73–82, 1995.
- (56) *Intelligence* 29: 419–440, 2001.
- (57) *Journal of Social Behavior and Personality* 17: 93–121, 2005.
- (58) *Perceptual and Motor Skills* 39: 1031–1034, 1974.
- (59) *Psychosomatic Medicine* 35: 341–349, 1973.
- (60) *Psychoneuroendocrinology* 22: 277–295, 1997.
- (61) *Journal of Personality and Social Psychology* 57: 950–964, 1989.
- (62) *Journal of Creative Behavior* 13: 169–180, 1979.
- (63) *Hypertension* 26: 820–827, 1995.
- (64) *Current Hypertension Reports* 9: 520–528, 2007.
- (65) *American Journal of Hypertension* 21: 310–316, 2008.
- (66) *Psychosomatic Medicine* 49: 493–507, 1987.
- (67) *Journal of Behavioral Medicine* 15: 327–341, 1992.
- (68) *Zeitschrift für klinische Psychologie* 7: 235–255, 1978.
- (69) *Ethnicity & Disease* 17: 72–77, 2007.
- (70) *American Journal of Cardiology* 95: 1060–1064, 2005.