5

THE PHYSIOLOGY OF TRANSCENDENCE

> I shall consider human actions and desires . . . as though
> I were concerned with lines, planes, and solids.
>
> *Baruch Spinoza*

In the last chapter, we considered the subjective experience of transcendence. The key question I will address in this chapter is, while a person is meditating, what changes can we measure in body and brain that might explain the quiet bliss of transcendence?

At this point, I should probably be explicit that—like most psychiatrists and neuroscientists—I regard mind and the brain as two aspects of the same set of phenomena. Whenever we feel, think, or act, specific neural circuits fire accordingly. We register phenomena of the mind as experiences originating either from within or from the world around us. We measure phenomena of the brain with specific instruments. We use different languages as we shuttle between the two domains of mind and brain, but all the while we understand that they represent one and the same entity.

Because people spend most of their lives experiencing themselves in the framework of the mind—thoughts, feelings, memories, and desires—it is these mind elements that cohere to create a sense of self. Every now and then, though, people become aware that there is a brain operating in parallel with the mind—for example, when you have an EEG or, more commonly, when something goes wrong with your brain and you realize that your sense of self is rooted in neurons, synapses, and circuits. With that in mind, let us examine what we know about the effects of TM on the body, brain, and mind.

LET'S START WITH THE BODY

The German philosopher Friedrich Nietzsche emphasized the wisdom of the body in helping us understand ourselves. William James, known to many as the father of psychology, would have agreed. In his famous essay "What Is an Emotion?" he postulated that when we see a bear in the woods, we run first!—and only then does fear follow. According to him, we are afraid because we run rather than the other way around. As you can imagine, there has been endless debate on this subject, which continues to this day. For present purposes, let us simply agree that measuring changes in the body during meditation may advance our understanding of *both* the physiological and psychological changes that result from the practice.

Besides the remarkable slowing and irregularity of the breath, the most noteworthy physical changes have emerged from measurements of electrical current conducted across the surface of the skin—the so-called galvanic skin response (GSR). The GSR is a sensitive measure of nervous system arousal that increases when a person is tense, anxious, or excited. It is a key measure employed in a polygraph or lie detector. A person afraid of being caught in a lie is likely to feel a spike of anxiety when a sensitive question is posed, and the GSR bounces up accordingly. Of course, the GSR could bounce up for other reasons, and the accuracy of lie detectors has been challenged.

You may wonder why the surface of the skin would be a good place to determine if someone is lying. Well, even though we generally consider sweating as a bimodal bodily function—that is, we're either drenched with sweat or bone dry—in fact the sweat glands on the skin's surface are very finely calibrated to our emotions. When our anxiety level rises even slightly, sweating increases enough to boost the current between two electrodes on the skin (part of the GSR apparatus) and register an upward blip. When we relax, the opposite occurs. In other words, changes in GSR current result from tiny moment-to-moment variations in sweating.

We might therefore expect that when a person meditates and transcends, the overall GSR drops. Oddly, however, just before people enter transcendence there is a clear *uptick* in the GSR. When Fred Travis (a preeminent EEG researcher, whom we will meet again soon) first noticed this paradoxical uptick, he wondered whether there was something wrong with his equipment. He repeated his studies and checked the machinery, but sure enough there it was again—a GSR increase just before a person settles into transcendence.[1]

Upon reflection, Travis's paradoxical finding (increased GSR at the start of a TM session) is not as strange as it may seem. In a parallel way, levels of wakefulness have been found to increase just before bedtime. It's as though the body and brain have evolved to get active and make sure your place of slumber is safe before you let yourself sleep. I often wonder whether something similar is happening as I watch dogs drawing sharp circles in the carpet before they nap. It's as though they are enacting an ancient ritual of digging a safe place where they can settle into the profound canine slumber that is the envy of many a human being.

PROLACTIN: A HORMONE TO TRANSCEND BY

Before we go on to what happens to the brain during transcendence, one other observation is worth mentioning—after meditation there is a rise in blood levels of the hormone prolactin. Prolactin is secreted by the pituitary gland, a structure located at the base of the brain. The hormone has many functions, but of particular interest here is its capacity to induce a state of calm alertness, like what people feel as they enter transcendence.

Thomas Wehr, a psychiatrist and close friend since our time together at the National Institute of Mental Health, observed similar increases in prolactin levels when people were asked to lie in the dark for extended periods, spending the night as our ancestors did before the development of electric lights.[2] Under those circumstances, people experienced sleep not as one unbroken block (as we do in modern life), but as two separate blocks.[3] Between the first and second sleep period, Wehr's subjects lay in a state of calm attentiveness, which a few described as "crystal-clear consciousness." This phrase recalls descriptions of transcendence arising both during TM and in the course of day-to-day living.

What is the function of this calming hormone? Although we certainly don't have a complete answer, we do know that prolactin levels rise in nursing mothers and brooding chickens—both situations in which it is important to remain stationary and calm. There are also human data that suggest prolactin may offer psychological benefits—such as the calmness and clarity of thinking that some of Wehr's study participants reported.

THE BRAIN DURING TRANSCENDENCE

While changes take place in the body during TM sessions, especially during transcendence—slowing down of the breath, relaxation of the muscles, decreased GSR, and increased prolactin—what is happening in the brain? EEG recordings show an increase in the concentration of alpha waves, a slow wave form associated with calm self-reflection. The increased density of alpha waves during transcendence is most prominent in the prefrontal area of the cortex—that part of the brain just behind the forehead,[4] which is known to be important in regulating impulses and promoting good judgment. In the well-functioning brain, the prefrontal cortex operates smoothly in harmony with other brain centers. Indeed, given its central role in the brain's executive functions, the prefrontal cortex has often been called the CEO of the brain. By soothing the prefrontal cortex over time, the powerful fluxes of alpha rhythms may strengthen this important brain structure. We will return to this idea when we consider what happens when transcendent experiences—initially present only *during* TM sessions—begin to pervade a person's daily life.

In a recent imaging study, sixteen experienced TM practitioners were compared with sixteen control subjects using blood-oxygen-level-dependent magnetic resonance. While meditating, the meditators showed increased blood flow to portions of the prefrontal cortex (and elsewhere in the brain), a result consistent with the idea that TM strengthens this executive part of the brain.[5]

Another concept I'd like to introduce here is EEG coherence, which refers to the relationship between EEG patterns in different regions of the brain. The more that brain-wave patterns in different brain regions correlate with one another, the higher the level of coherence. During TM sessions, EEG coherence increases in the alpha range, especially in the prefrontal cortex. Studies in Norway conducted by Harald Harung (at the time, associate professor at Oslo University College) and Fred Travis have found that in both business[6] and athletics,[7] more accomplished individuals showed higher levels of EEG coherence in the frontal regions across several wavelengths.[8] In other words, this increased coherence was found when subjects had their eyes open and were performing tasks. Similar EEG findings occur during the waking state (with eyes open) in those who meditate consistently over time (as we will see in chapter 18).

In summary, the brain changes seen during meditation, in particular during transcendence, fall into two broad categories. First, there are body and brain changes that reflect deep relaxation. Such changes may be the basis of the stress

relief that meditators experience, which may begin within days of the first meditation session. This relief then builds in impact over years and probably accounts for the cardiovascular and other health benefits of TM. Second, there are changes in brain rhythms that occur during meditation—notably an increase in alpha-rhythm density in the prefrontal cortex and greater levels of alpha coherence throughout the cortex. These brain-wave changes may explain (at least in part) the many ways in which the brain appears to function better in those who regularly practice TM.

OFF TO SEE THE WIZARD

As I contemplated writing this book, it was clear to me that I would need to pay a visit to the laboratory of Fred Travis at Maharishi University of Management—the wizard in the title of this section, whose GSR research we have already considered. It is fair to say that nobody in the world knows more about the relationship between EEG patterns and Transcendental Meditation. I arrived at Fred's lab, which is housed in—of all things—a yellow-brick building. Fred had just arrived by bicycle and greeted me with his characteristic smile, more impish than wizard-like. He was casually dressed and wearing sandals, and his bicycle helmet was still in place, with bushy hair bursting out on both sides of it. He showed me into his lab and introduced me to his assistant, nicknamed Neo—a character from the movie *The Matrix*—all of which contributed to an exciting sense that I was entering an alternate universe.

Fred left me with Neo, who attached electrodes to various places on my skull and hooked them up to an EEG monitor. First, he asked me to perform a set of computerized tasks while he recorded my EEG responses. Then he had me close my eyes and meditate for ten minutes. In this segment, I was to press a button when I was completely lost in thought before coming back to the mantra. This allowed me to mark specific experiences during the meditation practice.

During that TM session, I had what was for me a unique experience. I felt suffused by light—as though I could see the light of the room shining brightly despite having my eyes closed. After the test was over, I became skeptical of the experience, quizzing myself as to whether I was fabricating it in order to produce a better story for the book. I smiled, however, to think of what a poor job I had done had I intended to be theatrical. How much better, I thought, if the lights had been colored, vivid, flashing, sinuous! But, no, they looked like ordinary fluorescent office lights.

When I reported my experience and the train of thoughts that followed, Fred responded in a matter-of-fact way: “If you saw light, you saw light,” he said, and had no further questions. On reflection, I understand why he was uninterested in the exact phenomena of my transcendent experience. As I pointed out earlier, there is little or no correlation between people’s sensory illusions during transcendence and the changes TM will produce in their lives.

After completing Fred’s research protocol, I looked over my data with Neo and found that my EEG response to meditation was exactly what it was supposed to be: During TM, alpha rhythms predominated in the frontal areas of my brain, and there was an increase in alpha coherence. As expected, of course —but nonetheless I was pleased. I have done and seen many studies in which the data don’t turn out as predicted, so when they do, it is always a happy event.

THE ALPHA, BETA, AND GAMMA OF EEG RHYTHMS

Now may be as good a time as any to tell you a bit about different brain rhythms and their corresponding states of awareness. The correspondences are not rigid, however. Few things in nature are. EEG rhythms may vary across different brain regions at any particular time. So when we say a certain rhythm is associated with a certain state, we do not mean a perfect correspondence. Instead, we are referring to a preponderance of a certain type of rhythm in the majority of people studied.

During my visit to Fred Travis’s lab, I had the treat of a private lecture on brain waves by a world-class electrophysiologist. In table 3 (below), I’m delighted to share with you what I learned from him about different brain rhythms and the states of awareness and subjective experiences with which they are most often associated.

The pairings of EEG rhythms with the subjective states shown in this table tell only a fragmentary story, as there are many other subjective states not covered here (such as anxiety, ecstasy, and dissociation, to name just a few). Also, EEG rhythms may be shared by different subjective states.

Table 3

NAME OF RHYTHM	WAVELENGTH (CYCLES PER SECOND)	SUBJECTIVE STATE
delta	0–4	sleep (deep sleep mostly)
theta 1	4–6	drowsiness/dreaming

theta 2	6–8	internal mental processes, open monitoring
alpha 1	8–10	TM (paradoxical alpha)
alpha 2	10–12	eyes-closed rest
beta	16–20	attending
gamma	20–50	focused attention

As the table shows, the alpha rhythm is divided into two bands: alpha 1 or "paradoxical alpha," is associated with TM, whereas alpha 2 is seen when a person is at rest with eyes closed. Because both types of alpha occur during resting states, you might expect that both would be associated with decreased brain metabolism. Such a drop, however, occurs only when alpha 2 predominates. When alpha 1 predominates, as occurs during TM, brain metabolism actually increases—hence the term "paradoxical alpha." This paradoxical state may reflect the mixed experience so common during TM, in which active thoughts and quiet transcendence may occur at various times—or even simultaneously—during a single session.

Different forms of meditation are characterized by different predominant brain-wave patterns, as one might expect (see table 3 above). After all, each one requires a different type of task. Loving-kindness meditation, for example, is predominantly associated with higher levels of gamma waves, a fast frequency associated with active attention—as expected, given that the meditator concentrates on sending messages of loving kindness toward self and others. Loving-kindness meditation, which derives from the Buddhist tradition, falls into the broad category of focused-attention meditation. In other examples of this type, attention might focus on a mental image—such as a flower, a flame, or a point of light between the eyebrows.

In open-monitoring meditation, people predominantly show increased theta 2 waves in the frontal part of their brains. This makes sense: it reflects the internal processing required to pay close attention to internal experiences—such as the breath—that are central to this form of meditation. Open monitoring and focused attention are often considered to be forms of mindfulness meditation.

The different brain-wave signatures associated with each type of meditation are just one of several elements that distinguish one type from another, and that suggest they are not interchangeable in their effects upon particular people.

LET'S SUMMARIZE WHAT SCIENCE CAN TELL US ABOUT CHANGES IN THE BODY AND BRAIN DURING TM:

- There is an increase in levels of the soothing hormone prolactin in the bloodstream.
- EEG studies show (1) an increase in alpha 1 power in the frontal parts of the brain, and (2) an increase in alpha coherence in the prefrontal cortex.
- There is an increase in blood flow in the prefrontal cortex and elsewhere in the brain.

Just as there are specific EEG changes associated with transcendence, so there are with Cosmic Consciousness—the continuous experience of the Super Mind—which I will discuss in chapter 18. For now, however, let's examine the development of the Super Mind in greater depth.

6

FROM TRANSCENDENCE TO SUPER MIND: AN EXTRAORDINARY TRANSFORMATION

> The key to growth is the introduction of higher dimensions of consciousness.
>
> *Lao-Tzu*

Over the years that I have meditated, changes have occurred in me that were so subtle that often I couldn't detect them at all—though I did, of course, notice that everyday stresses seemed to bother me less. If someone offended me or was rude, instead of having it out—as I might have done in the past—I instinctively adopted an attitude that the matter could wait till the next day, and in most cases by then the issue didn't seem worth pursuing. People were nicer to me and everything came more easily. But all that felt like no big deal. It took the observations of others—family, friends, and colleagues—to show me how dramatically I had changed.

Before going any further, I feel obliged to say that I have hardly reached some lofty summit of enlightenment. Like everyone else, I'm a work in progress. However, unbeknownst to me, I've made significant gains along the axis of happiness and self-fulfillment. Over time it became clear to me that I meditate for much more than simply stress relief. I meditate also to sustain and advance the changes I have learned to associate with the Super Mind.

I had been encouraging many of my patients to meditate—and a fair proportion followed through with good results. At times we would discuss their meditation experiences during sessions, and I saw in them, as in myself, changes that went beyond relief of stress. Instead, they were more like the progress I was used to seeing from psychotherapy—a growth in what therapists call "ego

strengths," by which they mean positive personality attributes. It became apparent that TM was not merely relaxing my patients but also helping them change for the better. Curiously, it was in discussing their experiences of transcendence that I first became aware of mirroring the states they were describing. Specifically, I would begin to slip into a transcendent state during our discussions—a sort of silence during wakefulness. There I was, actively engaged in listening, thinking about what my patient was saying, offering responses when appropriate, but at the same time experiencing stillness. This was, I realized one day, the beginning of my personal awareness of transcendence and wakefulness mingling together *outside of a TM session*—my first awareness of the dawning Super Mind—and an enormous excitement came over me at the experience of this new state of consciousness.

The joy I felt then—and now as I write about it—reminds me of that novel state of feverish bliss mixed with quiet confidence that I experienced when I first became aware of transcending *during* meditation. Allow me to repeat how I described that feeling in *Transcendence*.

> It was a threshold experience, much like the ecstatic day when I realized I could swim, that I could actually take my feet off the bottom of the shallow end and paddle around without sinking; or when I realized—this was before the era of training wheels—that I had pedaled half a block with no one holding on to the bike. In all these cases I needed to persevere before I saw any payoff.

And so it was with the first experience of the Super Mind: I had that same feeling of ecstatic discovery—in the sense, of course, that one might "discover" any natural wonder or work of genius on experiencing it for the first time. Keats expressed that inner state beautifully in his poem "On First Looking into Chapman's Homer."

> Then felt I like some watcher of the skies
> When a new planet swims into his ken;
> Or like stout Cortez when with eagle eyes
>
> He star'd at the Pacific—and all his men
> Look'd at each other with a wild surmise—
> Silent, upon a peak in Darien.

Even now, as I remember those first Super Mind experiences, a stillness comes over me, but along with the stillness, an energy, a focus, a sense of being able to tackle whatever might come my way. My friend Ray Dalio, a decades-long TM practitioner and founder of the hedge fund Bridgewater Associates, describes such feelings well in chapter 15. As Ray puts it, TM has helped him feel like a ninja in the midst of battle, who experiences things coming at him in slow motion so they are easier to tackle one by one.

The thrust of the present book, therefore, is to explore the benefits of TM that go beyond promoting physical well-being and handling stress. Rather (or in addition), my new focus is on the development of consciousness and the many fruits it yields—collectively what I am calling the Super Mind. I'm intrigued to see what happens next, because it is now clear to me that consciousness can keep on expanding. I am convinced that many others share this fascination, and hope that this book will provide a sort of road map to this curious and thrilling journey.

Much of what I am sharing with you is not new. In fact, it comes from Vedic teachings that are thousands of years old. But, as with many great texts, their meaning is not immediately apparent. Some time ago, for example, I came across the following quote from the Maitri Upanishad, one of the Upanishads, a series of foundation texts in Vedic literature.

> There is something beyond our mind which abides in silence within our mind. It is the supreme mystery beyond thought. Let one's mind . . . rest on that and not rest on anything else.[1]

When I first encountered this passage, I immediately fell in love with the description of transcendence embedded in the words "something beyond our mind which abides in silence within our mind." What a subtle portrayal of how it feels to pass through some mysterious portal into another world! It was therefore no surprise that the text should enjoin us to rest on that something. But not to rest on anything else? There I got stuck.

How could that be? I wondered. Surely only a professional pundit or guru could afford such a luxury as resting on transcendence—not a busy person who had a job to do, a family to care for, a living to make. But over time, whenever I reencounter these words, I have come to experience that curious pleasure one

gets on rereading a classic as a mature adult that they last read years before. Has that ever happened to you? As a result of life experience, you are now able to appreciate the writing in an entirely new way.

So it was for me with the above quote. I have now grasped that it is possible for the transcendent to be present throughout the day—or parts of the day—even in the midst of ordinary life. So it seems that the Upanishad is referring to Cosmic Consciousness—the fully established Super Mind—and in the course of writing this book I have encountered people who enjoy transcendence throughout each day, even while going about their busy and successful lives.

The progression from transcendence—a state experienced initially only during TM sessions—to the Super Mind, with its many facets, is highly variable from person to person. In some people there is clear evidence of Super Mind development even within the first four days of training. Often these involve changes in perception or profound psychological attitudes that seem difficult to explain purely in terms of stress relief. One ER doctor, for example, was convinced that the critical care unit where she worked had been brightened in some way, either with new lighting or a fresh paint job, neither of which had occurred. After people start to meditate, the world often appears brighter, both literally and figuratively. Such early changes are the exception, however. For most people, the changes associated with the Super Mind occur slowly, subtly, and incrementally. Ultimately, however, their cumulative effect can be powerful and even transformative.

As consciousness continues to develop, some meditators experience the state of stillness during waking, along with its benefits—in other words, the Super Mind—continuously. This far end of the development of consciousness is the subject of chapter 18.

*

As you will see in the next chapter, which presents the results of a survey of over six hundred TM practitioners, the longer and more regularly a person meditates, the more steadily and progressively the Super Mind develops. This progression has led some meditators to compare the growth of the Super Mind to compound interest: It tends to grow geometrically over time. Certainly that is how it has been for me.

BEFORE PROCEEDING TO THE NEXT CHAPTER, LET'S SUMMARIZE WHAT WE'VE COVERED HERE:

- With regular meditation, people experience transcendence entering their waking hours.
- The result is an intermingling (coexistence) of transcendence and wakefulness that can be a source of bliss in itself, as well as yielding numerous tangible gifts that we will discuss in subsequent chapters.
- Collectively, the combination of changes in consciousness and the benefits that accrue constitute the Super Mind.
- When a person's consciousness develops to the point where transcendence is present continuously, that person is said to be in a state of Cosmic Consciousness.