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PART I

MIND, BRAIN, AND AWARENESS

Chapter One

A MINDFUL AWARENESS

Being aware of the fullness of our experience awakens us to the inner world of our mind and immerses us completely in our lives. This is a book about how the way we pay attention in the present moment can directly improve the functioning of body and brain, subjective mental life with its feelings and thoughts, and interpersonal relationships.

The essential proposal is that this ancient and useful form of awareness harnesses the social circuitry of the brain to enable us to develop an attuned relationship within our own minds. To explore this idea, we will be turning to the research on our social lives, examining the particular regions of the brain, including the mirror neuron system and related circuits, that participate in attunement and may be active when we resonate with our own intentional states.

The term *mindful brain* is used in this approach to embrace the notion that our awareness, our mindful “paying attention or taking care,” is intimately related to the dance between our mind and our brain. Being “mindful” has a range of definitions, from the common everyday notion of “bearing in mind or inclined to be aware” to the specific educational, clinical, and scientific definitions of the term we will explore. It is with this broad general common-usage definition that I will present a review of the new developments in science that have emerged regarding the more specific forms of mindfulness and one’s own subjective experience of the moment at the heart of one’s life.

FINDING THE MIND IN OUR EVERYDAY LIVES

Since the mid-1980s there has been growing attention to “mindfulness” in the Western world. This focus has been on a number of dimensions of daily life, from our personal lives to the experience of children in schools and patients in therapy. The busy lives people lead in the technologically driven culture that consumes our attention often produce a multitasking frenzy of activity that

leaves people constantly *doing*, with no space to breathe and just *be*. The adaptations to such a way of life often leaves youth accustomed to high levels of stimulus-bound attention, flitting from one activity to another, with little time for self-reflection or interpersonal connection of the direct, face-to-face sort that the brain needs for proper development. Little today in our hectic lives provides for opportunities to attune with one another.

In our personal lives, many of us have found this societal whirlwind deeply dissatisfying. We can adjust, responding to the drive to do, but often we cannot thrive in such a frenetic world. On this personal level people in modern cultures are often eager to learn about a new way of being that can help them flourish. Mindfulness in its most general conception offers a way of being aware that can serve as a gateway toward a more vital mode of being in the world: We become attuned to ourselves.

In a review, Paul Grossman (in press) has stated that the “colloquial use of mindfulness often connotes being heedful or taking care within a clearly evaluative context: A parent tells a child, mind your manners, or ‘mind your language,’ implying to take care to behave in a culturally prescribed manner. ‘Mindful of the poor road conditions, he drove slowly,’ ‘What is man, that thou art mindful of him?’ (Psalms, viii. 4), ‘I promise to be mindful of your admonitions,’ or ‘always mindful of family responsibilities.’ All these formulations reflect an emphasis on carefully paying attention so as to not reap the consequences of heedless behaviors.”

DEFINING THE MIND

I have found a useful definition of the mind, supported by scientists from various disciplines, to be “a process that regulates the flow of energy and information.”

Our human mind is both embodied—it involves a flow of energy and information that occurs within the body, including the brain—and relational, the dimension of the mind that involves the flow of energy and information occurring between people—from the writer to the reader, for example. Right now this flow from me as I type these words to you as you read them is shaping our minds—yours and mine. Even as I am imagining who you might be and your possible response, I am changing the flow of energy and information in my brain and body as a whole. As you absorb these words your mind is embodying this flow of energy and information as well.

BEING MINDFUL

Mindfulness in its most general sense is about waking up from a life on automatic, and being sensitive to novelty in our everyday experiences. With mindful awareness the flow of energy and information that is our mind enters our conscious attention and we can both appreciate its contents and also come to regulate its flow in a new way. Mindful awareness, as we will see, actually involves more than just simply being aware: It involves being aware of aspects of the mind itself. Instead of being on automatic and mindless, mindfulness helps us awaken, and by reflecting on the mind we are enabled to make choices and thus change becomes possible.

How we focus attention helps directly shape the mind. When we develop a certain form of attention to our here-and-now experiences and to the nature of our mind itself, we create the special form of awareness, mindfulness, which is the subject of this book.

SOME BENEFITS

Studies have shown that specific applications of mindful awareness improve the capacity to regulate emotion, to combat emotional dysfunction, to improve patterns of thinking, and to reduce negative mindsets.

Research on some dimensions of mindful awareness practices reveals that they greatly enhance the body's functioning: Healing, immune response, stress reactivity, and a general sense of physical well-being are improved with mindfulness (Davidson, Kabat-Zinn, Schumacher, Rosenkranz, Muller et al., 2003). Our relationships with others are also improved perhaps because the ability to perceive the nonverbal emotional signals from others may be enhanced and our ability to sense the internal worlds of others may be augmented (see Appendix III, Relationships and Mindfulness). In these ways we come to compassionately experience others' feelings and empathize with them as we understand another person's point of view.

We can see the power of mindful awareness to achieve these many and diverse beneficial changes in our lives when we consider that this form of awareness may directly shape the activity and growth of the parts of the brain responsible for our relationships, our emotional life, and our physiological response to stress.

MINDFULNESS IN LEARNING AND EDUCATION

In addition to such personal and health advantages of mindfulness, the concept of “mindful learning” has been proposed by Ellen Langer (1989, 1997, 2000), an approach which has been shown to make learning more effective, enjoyable, and stimulating. The essence of this approach is to offer learning material in a conditional format rather than as a series of absolute truths. The learner in this way is required to keep an “open mind” about the contexts in which this new information may be useful. Involving the learner in the active process of education also is created by having students consider that their own attitude will shape the direction of the learning. In these ways, this form of mindfulness can be seen to involve the learner’s active participation in the learning process itself. Langer suggests that the point of conditional learning is to leave us in a healthy state of uncertainty, which will result in our actively noticing new things.

Educator Robert J. Sternberg considered this educational mindfulness as something akin to a cognitive style (2000). Research on mindful learning (Langer, 1989) suggests that it consists of openness to novelty; alertness to distinction; sensitivity to different contexts; implicit, if not explicit, awareness of multiple perspectives; and orientation to the present. Taking these dimensions of mindfulness into account within the educational setting may permit students to deepen and broaden the nature of learning throughout their lifelong careers as learners. Teachers can use terms such as “may,” “might be,” or “sometimes” instead of “is” to promote conditional uncertainty. (See Chapter 12 for more on the role of mindfulness in education.)

Langer herself (1989) has suggested that we be careful about seeing her concept of mindfulness as having the same meaning as the historical and modern use of that term in contemplative practices. For the time being, we will use the qualifier, “mindful learning” to refer to Langer’s important conceptualizations regarding how the mind seems to disentangle itself from premature conclusions, categorizations and routinized ways of perceiving and thinking. When we are certain, Langer says, “we don’t feel the need to pay attention. Given that the world around us is always in flux, our certainty is an illusion” (Langer, August 2006, personal communication). Ultimately, this form of mindfulness is a flexible state of mind in which we actively notice new things, are sensitive to context, and engage in the present.

I could find no formal studies published that compare mindful learning with its goal-directed educational component to the more ancient contemplative form of what we will call “reflective mindfulness.” This reflective form of mindfulness, what we will also refer to as “mindful awareness” or just “mindfulness” in this text, has now begun to be intensively studied, with new

findings that will be discussed in the chapters ahead.

Finding similarities and differences between these two uses of the term *mindfulness* may help us elucidate the deeper nature of each version. Interestingly, research in both forms has revealed that, though achieved through differing means, they are independently associated with positive outcomes in people's lives, such as an enhanced sense of pleasure, internal awareness, and physiological health. In this book we will be exploring the possible neural mechanisms shared in common by these two important and on the surface distinct dimensions of how we shape our minds in the moment.

MINDFUL AWARENESS

Direct experience in the present moment has been described as a fundamental part of Buddhist, Christian, Hindu, Islamic, Jewish, and Taoist teaching (Armstrong, 1993; Goleman, 1988). In these religious traditions, from mystical Christianity with centering prayer (Fitzpatrick-Hopler, 2006; Keating, 2005) to Buddhist mindfulness meditation (Kornfield, 1993; Nhat Hahn, 1991; Wallace, 2006), one sees the use of the idea of being aware of the present moment in a different light from the cognitive aspect of mindfulness.

Many forms of prayer in different traditions require that the individual pause and participate in an intentional process of connecting with a state of mind or entity outside the day-to-day way of being. Prayer and religious affiliation in general have been demonstrated to be associated with increased longevity and well-being (Pargament, 1997). The common overlap of group belonging and prayer makes it hard to tease apart the internal from the interpersonal process, but in fact we may find that this is just the point: pausing to become mindful may indeed involve an internal sense of belonging.

The clinical application of the practice of mindfulness meditation derived from the Buddhist tradition has served as a focus of intensive study on the possible neural correlates of mindful awareness. Here we see the use of the term *mindfulness* in a way that numerous investigators have been trying to clearly define (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Bishop, Lau, Shapiro, Carlson, Anderson, Carmody et al., 2004). These studies, across a range of clinical situations, from medical illness with chronic pain to psychiatric populations with disturbances of mood or anxiety, have shown that effective application of secular mindfulness meditation skills can be taught outside of any particular religious practice or group membership.

In many ways, scholars see the nearly 2500-year-old practice of Buddhism as a form of study of the nature of mind (Germer, Siegel, & Fulton, 2005; Lutz,

Dunne, & Davidson, in press; Epstein, 1995; Waldon, 2006) rather than a theistic tradition. “Reading early Buddhist texts will convince the clinician that the Buddha was essentially a psychologist” (Germer, 2005, p. 13). It is possible to practice Buddhist-derived meditation, and ascribe to aspects of the psychological view of the mind from this perspective, for example, and maintain one’s beliefs and membership in other religious traditions. In contemplative mindful practice one focuses the mind in specific ways to develop a more rigorous form of present-moment awareness that can directly alleviate suffering in one’s life.

Jon Kabat-Zinn has devoted his professional life to bringing mindfulness into the mainstream of modern medicine. In Kabat-Zinn’s view, “An operational working definition of mindfulness is: the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” (Kabat-Zinn, 2003, pp. 145–146). This nonjudgmental view in many ways can be interpreted to mean something like “not grasping onto judgments,” as the mind seems to continually come up with reactions that assess and react. Being able to note those judgments and disengage from them may be what nonjudgmental behavior feels like in practice. “On purpose” implies that this state is created with the intention of focusing on the present moment. The InnerKids program, designed to teach young children to learn basic mindfulness skills, defines mindfulness as “Being aware of what’s happening as it’s happening” (Kaiser-Greenland, 2006a).

Kabat-Zinn (2003) went on to note that the Buddhist origins of this view of mindfulness and the natural laws of the mind reveal

a coherent phenomenological description of the nature of the mind, emotion, and suffering and its potential release, based on highly refined practices aimed at systematically training and cultivating various aspects of mind and heart via the faculty of mindful attention (the words for mind and heart are the same in Asian languages; thus “mindfulness” includes an affectionate, compassionate quality within the attending, a sense of openhearted, friendly presence and interest). And mindfulness, it should also be noted, being about attention, is also of necessity universal. There is nothing particularly Buddhist about it. We are all mindful to one degree or another, moment by moment. It is an inherent human capacity. The contribution of the Buddhist tradition has been in part to emphasize simple and effective ways to cultivate and refine this capacity and bring it to all aspects of life. (pp. 145–146)

Ultimately the practices that develop mindful ways of being enable the individual to perceive the deeper nature of how the mind functions. There are many ways of cultivating mindful awareness, each of which develops an awareness of the faculties of the mind, such as how we think, feel, and attend to stimuli. Mindfulness meditation, as one example, is thought to be especially important for training attention and letting go of a strict identification with the activities of the mind as being the full identity of the individual. One form of cultivation of the mind's awareness of itself is derived from the traditional Buddhist approach of Vipassana, or insight meditation (Kornfield, 1993), which we shall be exploring in depth in Part II.

Mindful awareness practices (MAPs) as we call them at the Mindful Awareness Research Center at UCLA (<http://www.marc.ucla.edu>, see Appendix I), can be found in a wide variety of human activities. Historically, various practices have been developed over thousands of years in the forms of mindfulness meditation, yoga, tai chi chuan, and qui quong. In each of these activities, the practitioner is focusing the mind in a very specific way on moment-to-moment experience.

In almost all contemplative practices, for example, there is an initial use of the breath as a focal point in which to center the mind's attention. Because of this commonality of breath use across cultural practices, we will be discussing the possible significance of breath awareness for the overall processes of the mindful brain.

Modern applications of the general concept of mindfulness have built on both traditional skills of meditation and have also developed unique nonmeditative approaches to this human process of being mindful. A useful fundamental view is that mindfulness can be seen to consist of the important dimensions of the self-regulation of attention and a certain orientation to experience, as Bishop and colleagues have proposed (Bishop et al., 2004): (1) "the self-regulation of attention so that it is maintained on immediate experience, thereby allowing for increased recognition of mental events in the present moment" and (2) "a particular orientation toward one's experiences in the present moment, an orientation that is characterized by curiosity, openness, and acceptance" (p. 232). In the Dialectical Behavior Therapy approach, mindfulness has been described as "(1) observing, noticing, bringing awareness, (2) describing, labeling, noting, and (3) participating, all of which are done (1) nonjudgmentally with acceptance, (2) in the present moment, and (3) effectively" (Dimidjian & Linehan, 2003, p. 166). Shapiro, Carlson, Astin, & Freedman (2006) have described the mechanisms of mindfulness as consisting of intention, attention, and an attitude that each contribute to a process of viewing

in a new way they term “re-perceiving.” These and other authors acknowledge that mindfulness also may result in common outcomes, such as patience, nonreactivity, self-compassion, and wisdom. In Acceptance and Commitment Therapy, mindfulness “can be understood as a collection of related processes that function to undermine the dominance of verbal networks, especially involving temporal and evaluative relations. These processes include acceptance, defusion, contact with the present moment, and the transcendent sense of self” (Fletcher & Hayes, 2006, p. 315).

A synthetic study of numerous existing questionnaires regarding mindfulness (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) reveals five factors that seemed to cluster from independently created surveys: (1) nonreactivity to inner experience (e.g., perceiving feelings and emotions without having to react to them); (2) observing/noticing/attending to sensations, perceptions, thoughts, feelings (e.g., remaining present with sensations and feelings even when they are unpleasant or painful); (3) acting with awareness/(not on) automatic pilot, concentration/nondistracton (e.g., breaking or spilling things because of carelessness, not paying attention, or thinking of something else; (4) describing/labeling with words (e.g., easily putting beliefs, opinions, and expectations into words); (5) nonjudgmental of experience (e.g., criticizing oneself for having irrational or appropriate emotions).

Except for observation, these were found to be the most statistically useful and reliable constructs in considering an operational definition of mindfulness. They seemed to reveal four relatively independent facets of mindfulness. Observation was found present more robustly in those subjects, who were college students, who meditated regularly. Observation was considered a learnable skill; future research needs to clarify it as an independent factor. For now we will discuss the five factors that Baer and colleagues (2006) delineated as we explore the nature of mindfulness and the brain.

At this point in the scientific endeavor to operationalize a clear definition for mindful awareness, the most parsimonious approach will be to build on the cumulative wisdom of the breadth of practitioners and researchers in the field. This will be our framework for exploring the ways in which this form of mindful awareness may involve the social neural circuitry of the brain as mindfulness is promoted by a form of internal attunement.

Reflection on the nature of one’s own mental processes is a form of “metacognition,” thinking about thinking in the broadest sense; when we have meta-awareness this indicates awareness of awareness. Whether we are engaging in yoga or centering prayer, sitting and sensing our breathing in the morning, or doing tai chi at night, each MAP develops this capacity to be aware of

awareness.

Awareness of awareness is one aspect of what we can consider a form of reflection. In this way, mindful awareness involves reflection on the inner nature of life, on the events of the mind that are emerging, moment by moment.

LIFE ON AUTOMATIC PILOT: MINDLESSNESS AND MINDFULNESS

The difference between jogging “mindlessly” versus jogging “mindfully” is that in the latter we are aware, each moment, of what we are doing as we are doing it. If we jog and daydream about what we will be doing that night, or what happened yesterday, then we are not engaged in mindful jogging. There is nothing wrong with daydreaming and letting the mind wander: In fact, as we’ll see, mindful practice can intentionally focus awareness on *whatever* arises, as it arises. If we intend to enable our minds to daydream and are aware of our awareness of our imagination, then that would be a mindful reverie, though perhaps not a mindful jog because we would be unaware of our feet and the path in front of us.

Notice here that we can often perform behaviors, such as jogging down a trail, and be lost in thinking about something other than the physical activity. We have neural circuits that carry out this automatic behavior all the time, enabling us to do several things at once, like jog and daydream simultaneously. Yet fortunately, we don’t usually trip and fall or crash the car on the highway.

For some people, this “living on automatic” is a routine way of life. If our attention is on something other than what we are doing for most of our lives we can come to feel empty and numb. As automatic thinking dominates our subjective sense of the world, life becomes repetitive and dull. Instead of experience having an emergent feeling of fresh discovery, as a child sensing the world for the first time, we come to feel dead inside, “dead before we die.” Living on automatic also places us at risk of mindlessly reacting to situations without reflecting on various options of response. The result can often be knee-jerk reactions that in turn initiate similar mindless reflexes in others. A cascade of reinforcing mindlessness can create a world of thoughtless interactions, cruelty, and destruction.

Being mindful opens the doors not only to being aware of the moment in a fuller way, but by bringing the individual closer to a deep sense of his or her own inner world, it offers the opportunity to enhance compassion and empathy. Mindfulness is not “self-indulgent,” it is actually a set of skills that enhances the capacity for caring relationships with others.

Mindfulness heightens the capacity to become filled by the senses of the

moment and attuned to our own state of being. As we also become aware of our awareness, we can sharpen our focus on the present, enabling us to feel our feet as we travel the path of our lives. We engage with ourselves and with others, making a more authentic connection, with more reflection and consideration. Life becomes more enriched as we are aware of the extraordinary experience of being, of being alive, of living in this moment.

COAL AND KIND AWARENESS

In addition to this reflective awareness of awareness in the present moment, mindfulness has the following qualities that I describe for my patients and students: We approach our here-and-now experience with curiosity, openness, acceptance, and love (COAL). (See Appendix II for additional terms.)

Imagine this situation. Let's say one stubs one's toe badly and feels the intensity of the pain. Okay, one might say, I am "mindful" of that pain. Now if one said inside one's head, "What an idiot I was for stubbing my toe!" the mental suffering experienced will be greater than only the pain emanating from one's toe. In that eventuality, one is aware of the pain, but one is not filled with the COAL mindset. In this case, one's brain actually creates more suffering by amplifying the intensity of the pain with self-blame for having the accident. This is all the difference between intensifying the distress versus coming to feel the pain without suffering.

The essayist, naturalist, and poet Diane Ackerman told the story at our Mind and Moment gathering of poets, practitioners, and psychotherapists about a time when she had an accident in Japan and nearly died (see Appendix I for an explanation of this and other conferences and organizations on mindfulness). She had been climbing down a cliff to study some rare birds on a small island and fell, breaking several ribs and painfully struggling to breathe. Her description of the event (Ackerman, Kabat-Zinn, O'Donohue, & Siegel, 2006) revealed how she approached the moment-to-moment encounter with curiosity, openness, acceptance, and love. This mindset enabled her to learn from the event, to gather the internal strength she needed to hold on, literally, and to not only survive in spite of the accident, but to thrive because of it.

This distinction between awareness with COAL and just paying attention with preconceived ideas that imprison the mind, ("I shouldn't have hit my foot, I'm so clumsy" "Why did I fall off this cliff? What is wrong with me!") is the difference that makes all the difference. This is the difference between being aware, and being mindfully aware.

Cultivating mindful awareness requires that we become aware of awareness

and that we be able to notice when those “top-down” preconceptions of shoulds and ought-to’s are choking us from living mindfully, of being kind to ourselves. The term *top-down* refers to the way that our memories, beliefs, and emotions shape our “bottom-up” direct sensation of experience. Kindness to ourselves is what gives us the strength and resolve to break out of that top-down prison and approach life’s events, planned or unplanned, with curiosity, openness, acceptance, and love.

Research into mindful awareness suggests that we can indeed cultivate such love for ourselves. Our approach to mindfulness as a form of relationship with oneself may hold a clue as to how this is accomplished. With mindfulness seen as a form of intrapersonal attunement, it may be possible to reveal the mechanisms by which we become our own best friend with mindful practice. We would treat our best friend with kindness, after all. Attunement is at the heart of caring relationships of all sorts: between parent and child, teacher and student, therapist and patient/client, lovers, friends, and close professional colleagues.

With mindful awareness, we can propose, the mind enters a state of being in which one’s here-and-now experiences are sensed directly, accepted for what they are, and acknowledged with kindness and respect. This is the kind of interpersonal attunement that promotes love. And this is, I believe, the intrapersonal attunement that helps us see how mindful awareness can promote love for oneself.

Interpersonal relationships have been shown to promote emotional longevity, helping us achieve states of well-being and medical health (Anderson & Anderson, 2003). I am proposing here that mindful awareness is a form of self-relationship, an internal form of attunement, that creates similar states of health. This may be the as yet unidentified mechanism by which mindfulness promotes well-being.

MEDICAL APPLICATIONS

Sensing the profound importance of the power of mindfulness, Jon Kabat-Zinn, in the late 1970s, began a project to apply these ancient ideas in a modern medical setting. What began as an inspiration during a silent retreat led to Kabat-Zinn’s approach to the medical faculty at the University of Massachusetts Medical Center where he taught. Could he take on patients whose situations could no longer be helped by conventional medical interventions? Could he add anything at all to the recovery of those patients who were treated by conventional means? Glad to have a place where these individuals might find some relief, the medical faculty agreed and the beginnings of the Mindfulness-

Based Stress Reduction (MBSR) clinic were initiated (Kabat-Zinn, 1990).

The MBSR program brought the ancient practice of mindfulness to individuals with a wide range of chronic medical conditions from back pain to psoriasis. Kabat-Zinn and colleagues, including his collaborator Richard Davidson at the University of Wisconsin in Madison, were ultimately able to demonstrate that MBSR training could help reduce subjective states of suffering and improve immune function, accelerate rates of healing, and nurture interpersonal relationships and an overall sense of well-being (Davidson et al., 2003).

MBSR has now been adopted by hundreds of programs around the world, and research has demonstrated that its use has brought about physiological, psychological, and interpersonal improvements in a variety of patient populations (Grossman et al., 2004). With these consistent findings being so robust, and a rising interest in mindful awareness practices, it wasn't surprising that my own field of mental health would take note and integrate the essence of mindfulness as a basis for approaching individuals with psychiatric disorders.

DISCERNMENT & MENTAL HEALTH IMPLICATIONS

Mindfulness has influenced a wide range of approaches to psychotherapy with new research revealing significant improvements in various disorders with reduction in symptoms and prevention of relapse (Hayes, Follette, & Linehan, 2004; Hayes, Strosahl, & Wilson, 1999; Linehan, 1993; Marlatt & Gordon, 1985; Parks, Anderson, & Marlatt, 2001). Mindfulness can also prevent relapse in cases of chronic depression via cognitive therapy (Segal, Williams, & Teasdale, 2002). Similarly, mindfulness has been used as an essential part of the treatment of borderline personality disorder in dialogical behavior therapy (DBT; Linehan, 1993). Relapse prevention in individuals with substance abuse is also a part of the skills taught by Marlatt and colleagues (2001). The principles of mindfulness are also inherent in the application of contemporary behavior analysis in acceptance and commitment therapy (ACT; Hayes, 2004). One of the first studies to demonstrate that psychotherapy can alter the function of the brain utilized mindfulness principles in the treatment of individuals with obsessive-compulsive disorder (Baxter, Schwartz, Bergman, Szuba, Guze, Mazziotta, et al., 1992). Several books have now been published that review the use of mindfulness and acceptance in the psychotherapy of a wide range of conditions from eating disorders to anxiety, posttraumatic stress disorder, and obsessive-compulsive disorders (Hayes, Folette, & Linehan, 2004; Germer, Siegel, & Fulton, 2005; Segal, Williams, & Teasdale, 2002).

The general idea of the clinical benefit of mindfulness is that the acceptance of one's situation can alleviate the internal battle that may emerge when expectations of how life should be do not match how life is (Brach, 2003; Hayes, 2004; Linehan, 1993a). Being mindful entails sensing what is, even sensing your judgments, and noticing that these sensations, these images, feelings, and thoughts, come and go. If you have a COAL stance, the rest takes care of itself. There is no particular goal, no effort to "get rid" of something, just the intention to be, and specifically, to experience being in the moment as one lets go of grasping onto judgments and goals.

Emerging from this reflective COAL mindful way of being is a fundamental process called "discernment" in which it becomes possible to be aware that your mind's activities are not the totality of who you are.

Discernment is a form of disidentification from the activity of your own mind: As you become aware of sensations, images, feelings, and thoughts (SIFT) you come to see these activities of the mind as waves at the surface of the mental sea. From this deeper place within your mind, this internal space of mindful awareness, you can just notice the brain waves at the surface as they come and go. This capacity to disentangle oneself from the chatter of the mind, to discern that these are "just activities of the mind," is liberating and for many, revolutionary. At its essence, this discernment is how mindfulness may help alleviate suffering.

Discernment also gives us the wisdom of how to interact with each other with more thoughtfulness and compassion. As we develop kindness toward ourselves, we can be kind to others. By getting beneath our automatic mental habits, we are freed to engage with each other with a deeper sense of connection and empathy.

MINDFUL TEACHING AND THERAPY

A mindful approach to therapy and to education involves a shift in our attitude toward the individuals with whom we work. The active involvement of the student in the learning process enables the teacher to join as a collaborative explorer in the journey of discovery that teaching can be: We can embrace both knowledge and uncertainty with curiosity, openness, acceptance, and kind regard. The teacher does not have to be a source of the illusion of absolute knowledge. Together, educator and student can face the exciting challenge of developing a scaffold of knowledge that embraces the nature of knowing and its inherent context dependence and subtle sources of novelty and distinction.

Viewing an individual in psychotherapy in similar terms may seem new for

some therapists. In wrestling with what terms to use in their book on mindfulness and psychotherapy, Germer, Siegel, and Fulton (2005) wrote, “Part of stitching this book together was to arrive at a consistent use of the word ‘client’ or ‘patient.’ Our profession has not settled that discussion yet, and we will not either. However, after some exploration, we decided upon ‘patient.’ Etymologically, patient means ‘one who bears suffering,’ while client means ‘one who puts himself under the protection of a patron.’ Since doctor means ‘teacher,’ it can be said that we are doctoring patients, or ‘teaching people who bear suffering.’ This meaning is parallel to the original use of mindfulness 2,500 years ago: It is a teaching that alleviates suffering” (p. xv).

With this in mind, we shall also use the term “patient” in this text. This discussion also leads us to the ways in which we’ll be addressing both psychotherapy and education as two areas of application of these ideas about the mindful brain. Mindfulness has direct implications for improving people’s lives in the classroom and in the clinical setting in addressing various medical and psychological stressors and illnesses.

In their journey to discover an effective approach to treat the important and widespread condition of chronic depression, the renowned cognitive therapists Zindel Segal, Mark Williams, and John Teasdale became intrigued with mindfulness as a skill that might be useful in their efforts (Segal, Williams, & Teasdale, 2002). Initially seeing the benefits of this approach as being a part of attentional skill training, they soon found that the mindful presence of the therapist played a crucial role in the efficacy of the treatment. Their consultations with Kabat-Zinn’s Mindfulness Based Stress Reduction (MBSR) clinic led to the ultimate shifting of their emphasis and the creation of Mindfulness Based Cognitive Therapy (MBCT), which proved to be the first demonstration of a form of psychotherapy that could prevent relapse in those with chronic depressive episodes. Their description of this shift is illuminating:

In our own training, we had been taught that when faced with a difficult clinical problem, we should collaborate with the patient on how best to solve it by seeing what thoughts, interpretations, and assumptions might be causing or exacerbating the problem. We anticipated taking the same approach in developing attentional control training, bolting mindfulness techniques onto this basic therapy framework. However, it became clear from our later visits to the Stress Reduction Clinic that unless we changed the basic structure of our treatment, we would continually revert to dealing with the most difficult problems by searching for more

elaborate ways to fix them. Instead, it now appeared to us that the overarching structure of our treatment program needed to change from a mode in which we were therapists to a mode in which we were instructors. What was the difference? As therapists, coming as we did from the cognitive-behavioral tradition, we felt a responsibility to help patients solve their problems, “untie the knots” of their thinking and feeling, and reduce their distress, staying with a problem until it was resolved. By contrast, we saw that the MBSR instructors left responsibility clearly with the patients themselves, and saw their primary role as empowering patients to relate mindfully to their experience on a moment-by-moment basis. (p. 59)

Embracing the acceptance and discernment of mindfulness as a therapist enables us to become a fellow traveler on this uncertain path of life. Similarly, as a teacher we can join with the student in viewing the world through the lens of creative uncertainty that deeply acknowledges the ever-changing landscape of both the external and internal worlds of our dynamic lives.

WHY THE MINDFUL BRAIN?

By exploring potential mechanisms in the brain that correlate with mindfulness, it becomes possible to see the connection among our common everyday view of mindfulness, the educational use of cognitive mindfulness concepts, and the clinical use in medical and mental health practices of reflective mindful awareness. These sometimes intermixed uses of the term *mindfulness*, while quite distinct in practice, may actually share common neural pathways. Illuminating these neural mechanisms associated with cognitive and reflective mindfulness might then assist us in expanding our scientific understanding further, opening the doors for asking specific, testable questions. Such neural insights may also shed light on how to design and implement practical applications of mindfulness in ways we have not yet imagined. By revealing how mindfulness harnesses our social neural circuitry, we may be able to extend our understanding of its impact on physiological and psychological well-being.

Another important dimension of looking toward the mindful brain is that by understanding the neural mechanisms associated with mindful awareness, we may be in a better position to identify its universal human qualities and make it more accessible and acceptable to a broader audience. We all share the brain in common. Can you imagine a world in which this health-promoting, empathy-

enhancing, executive-attention developing, self-compassion nurturing, affordable, and adaptable mental practice was made available in everyone's life?

HOW DO WE KNOW?

In preparing to explore these issues, I have become involved in two ways of knowing: experiential and experimental. I have participated in a number of intensive and direct immersions in mindful awareness in order to sense the power of this important way of being in life. That aspect of the journey, which I will discuss, enables us to view the inner dimension of mindfulness from the inside out. The second way of knowing is equally as powerful, but different: This is the scientific perspective on mindful awareness.

I was invited to teach at a summer research program sponsored by the Mind and Life Institute, which has been pursuing the integration of science and meditation under the leadership of the Dalai Lama. Representatives of other practices, including Christian centering prayer, Taoist tai chi, and yoga attended the Institute: There are many ways to pursue the training of mindful awareness. I was on a panel discussing the clinical applications of mindfulness and the transformation of affect by means of meditation. Before starting, I wanted to get a sense of how much basic neuroanatomy the audience knew so that I could gear the details of my remarks. When I asked, "Who here knows how the brain works?" one of my panel partners, the renowned researcher of affective neuroscience, Richie Davidson, replied "None of us!" We all laughed and realized how correct he was.

The brain is a complex system, and we really don't "know" fully how it works, or indeed how exactly its functions relate to the subjective nature of mind, much less how mindful awareness works. But we do have many fascinating hints as to the interplay of mental experience and brain structure and function. Brain function and mental life are not identical entities. When it comes to exploring mindful awareness, we need to be very humble about saying what we know about the brain's role. But turning with an open mind to the neural aspects of mindfulness can only help shed light onto the associated processes and means of cultivating this important dimension of our subjective lives, an illumination that might further enhance the objective nature of our bodies, relationships, and psychological well-being.

We can say that mind and brain correlate their functions, but we actually don't know the exact ways in which brain activity and mind function mutually create each other. It is too simplistic to say merely that the "brain creates the mind" as we now know that the mind can activate the brain. The process that

regulates the flow of energy and information, our definition of the mind, can directly stimulate brain firing and ultimately change the structural connections in the brain.

We can look to the brain for correlations with mental processes, like mindful awareness. These associations are just that: not causal proofs, but two dimensions of reality that ultimately cannot be reduced to each other. For example, Davidson et al. (2003) have demonstrated a shift of brain function to *left* frontal dominance in response to emotion triggers that are associated with an approach state of mind with more positive emotion, as we'll explore in detail in Chapter 10. This left shift in emotion-regulating circuits was directly correlated with the degree of improved immune function. Another study by Lazar, Kerr, Wasserman, Gray, Greve, & Treadway (2005) revealed an increased thickness of two parts of the brain: (1) the middle prefrontal area, bilaterally, and (2) a related neural circuit, the insula, which was particularly thicker on the right side of the brain. The degree of thickness in these areas was correlated with length of time spent practicing mindfulness meditation. Here we see both a left-sided and a right-sided correlation with mindful awareness practices (see Appendix III on laterality). Studies of other forms of meditation, such as focusing on compassion, reveal yet other changes, such as increased coordination of firing, especially in the prefrontal areas on both sides of the brain (Lutz, Greischar, Rawlings, Ricard, & Davidson, 2004). An extensive review of many studies (Cahn & Polich, 2006) reveals a range of activations, especially in middle prefrontal areas (anterior cingulate), with mindfulness meditation.

One benefit of turning to the brain for correlations with the mind is that we can actually learn more about the mind itself. In examining the mindful brain, we'll not only review these and other studies of emotion, attention, and executive functions, but we'll be diving into the new territory of social neuroscience. Seeing mindful awareness also as a self-relationship that harnesses the neural circuitry of our social lives may shed new light on the fundamental processes within the experience of mindfulness.

Preliminary research involving brain function hints at the view that mindfulness changes the brain. Why would the way you pay attention in the present moment change your brain? How we pay attention promotes neural plasticity, the change of neural connections in response to experience. What we'll examine are the possible mechanisms of how the various dimensions of mindful awareness emerge within the activity of the brain and then stimulate the growth of connections in those areas. By diving deeply into direct experience, we will be able to shed some light on why research might reveal left-sided changes, right-sided changes, and global impacts on integrative functioning in

the brain as a whole.

MINDFULNESS AS A RELATIONSHIP THAT PROMOTES INTEGRATION

Long before we spent time cultivating our minds with reflection, we evolved as social creatures. A great deal of the process of our brains at rest, in default mode, appears to be neural circuitry correlated with understanding others (Gusnard & Raichle, 2001). It is the social circuits of the brain that we first used to understand the mind, the feelings and intentions and attitudes of others. When we view mindful awareness as a way of cultivating the mind's awareness of itself, it seems likely that it is harnessing aspects of the original neural mechanisms for being aware of other minds. As we become aware of our own intentions and attentional focus, we may be utilizing the very circuits of the brain that first created maps of the intention and attention of others. COAL is exactly what parents who provide secure attachment to their children have as a mental stance toward them. We can propose that the interpersonal attunement of secure attachment between parent and child is paralleled by an intrapersonal form of attunement in mindful awareness. Both forms of attunement promote the capacity for intimate relationships, resilience, and well-being (see Chapter 9 for further discussion of attachment).

The outcome measures for studies of secure attachment, and those for mindful awareness practices, have markedly overlapping findings (Kabat-Zinn, 2003b; Sroufe, Egeland, Carlson, & Collins, 2005). I found, too, that many of the basic functions that emerged in these two seemingly different entities were associated with the prefrontal cortex. These functions include regulation of body systems, balancing emotions, attuning to others, modulating fear, responding flexibly, and exhibiting insight and empathy. Two other functions of this prefrontal region, being in touch with intuition and morality, had not been studied in attachment work but did seem to be an outcome of mindful awareness practices (see Appendix III, Middle Prefrontal Region).

The proposal that my colleagues and I had made earlier (see Cozolino, 2002; Schore, 2003a, 2003b; Siegel, 1999, 2001b; Siegel & Hartzell, 2003; Solomon & Siegel, 2003) was that the relationships of secure attachment between parent and child, and the effective therapeutic relationship between clinician and patient each promoted the growth of the fibers in this prefrontal area.

Prefrontal function is integrative. What this means is that the long strands of the prefrontal neurons reach out to distant and differentiated areas of the brain and body. This linkage of differentiated elements is the literal definition of a

fundamental process, *integration*. For many reasons, discussed elsewhere, integration can be seen as the underlying common mechanism beneath various pathways leading to well-being (Siegel, 1999, 2001b, 2006, in press).

How Does Attunement Promote Integration?

When relationships between parent and child are attuned, a child is able to feel felt by a caregiver and has a sense of stability in the present moment. During that here-and-now interaction, the child feels good, connected, and loved. The child's internal world is seen with clarity by the parent, and the parent comes to resonate with the child's state. This is attunement.

Over time, this attuned communication enables the child to develop the regulatory circuits in the brain—including the integrative prefrontal fibers—that give the individual a source of resilience as he or she grows. This resilience takes the forms of the capacity for self-regulation and engagement with others in empathic relationships. Here we see that interpersonal attunement—the fundamental characteristic of a secure attachment—leads to the empirically proven outcome measures we described above.

This list of nine prefrontal functions also seemed to overlap with what I was coming to learn about mindfulness practice. I presented this idea to Jon Kabat-Zinn on a discussion panel (Ackerman, Kabat-Zinn, & Siegel, 2005) and he confirmed the accuracy of the observation of these as outcome measures. He went on to extend the idea that this list is not just about research-verified outcomes, but it is about the process of mindful living itself.

The excitement of finding a convergence between research in attachment and in mindfulness has driven me to explore this overlap further. Since that first meeting I have come to learn more about mindful practice from direct experience and my own clinical applications as well as by immersing myself in a series of retreats and research institutes as a participant and as a faculty member. The journey to learn about these ways of cultivating the mind and well-being has been thrilling and mind-opening.

In the chapters ahead we'll explore this journey into the mind and examine what mindful awareness, secure attachment, and prefrontal brain function could have in common.

Chapter Two

BRAIN BASICS

DEVELOPMENT

The nervous system begins in the embryo as the ectoderm, the outer layer of cells that will become the skin. Certain clusters of these outer cells then fold inward to form a neural tube, the spinal cord. This origin of neurons, the basic cells of the brain, on the “outside” and their journey “inside” the body developmentally reveals a philosophical point that the brain originates at the interface of the inner and outer worlds of our bodily defined selves. When we think of the mindful brain, it is helpful to keep this inner/outer interface in mind.

Our brain is the top-most part of an extensive nervous system distributed throughout the body. Whenever we see the word *brain*, it is important to keep this embodied nature as a part of our perspective. The whole nervous system sets up its basic scaffolding, its core architecture, during development in the womb. Genetics are important for determining how neurons will migrate and then connect to each other. In fact, half of our genetic material is either directly or indirectly responsible for neural structure, making genes very important in neural development. As the fetus nears the time to leave the uterus, the connections among neurons are also influenced by experience.

“Experience” for the nervous system involves the activation of neural firing in response to a stimulus. When neurons become active, their connections to each other grow and supportive cells and vasculature proliferate. This is how experience shapes neural structure. Neural firing is the activation of the equivalent of an electrical flow, an *action potential*, down the long axonal length of the cell to the end where it releases either an activating or inhibiting neurotransmitter at the connecting space, the synapse. The downstream “receiving” neuron will either fire off or not, depending on the balance of stimulating or inhibiting transmitters released at that time.

One hundred billion neurons are, on average, linked to each other via 10,000 synaptic connections, which are created by genes and sculpted by experience:

Nature needs nurture. These two important dimensions of human development and neural function are not in opposition.

Neurons fire when we have an experience. With neural firing the potential is created to alter synapses by growing new ones, strengthening existing ones, or even stimulating the growth of new neurons that create new synaptic linkages. Synaptogenesis and neurogenesis are the ways in which the brain grows new connections. This growth harnesses both genes and experience to produce changes in the connectivity of neurons: *Neuroplasticity* is the term used when connections change in response to experience.

Experience means neural firing, which can, in some situations, promote the activation of genes, which then leads to the production of proteins that enable new synapses to form and old ones to be strengthened. Research also reveals that experience may stimulate the growth of new neurons. Neurogenesis occurs in which new neurons grow, even in adults. Uncommitted cells in the brain, neural stem cells, divide regularly and have one product of that division continue the stem cell line and the other, “daughter cell,” which can be stimulated to grow into a fully integrative neuron in the brain. We know that in adults neurogenesis occurs at least in the hippocampus, and these daughter cells may be stimulated over a period of several months to grow into fully functional integrated neurons (Kempermann, Gast, & Gage, 2002).

NEUROPLASTICITY

Experience can create structural changes in the brain. Often these changes take place at the finely tuned microarchitectural level; for example, when we make new associations within memory. A scanner would be hard pressed to actually detect such changes unless they were quite robust. When Sara Lazar published work (Lazar et al., 2005) revealing structural changes, we need to be aware that this finding would involve significant growth of neural tissue in the brain. If this was a result of experience, then we could see that neuroplasticity could be at the heart of that finding: repeated firing of neurons in specific areas would result in markedly increased synaptic densities in those regions that were activated with mindful practice. The growth of supportive cells and vasculature could also contribute to both the function of those areas and the increased thickness. Mindful awareness is a form of experience that seems to promote neural plasticity.

When we focus our attention in specific ways, we are activating the brain’s circuitry. This activation can strengthen the synaptic linkages in those areas. By exploring the notion that mindfulness, as a form of relationship with yourself,

may involve not just attentional circuits, but also social circuitry, we can then explore new dimensions of the brain aspect of our mindful experience. (For reviews of social neuroscience, see Cozolino, 2006 and Goleman, 2006.)

In studying changes in the brain in response to experience we can also look toward data from functional scanners (such as fMRI) or electrical monitoring devices (such as EEGs or related tests). Here we would be looking at not just the brain's physical structure, but also the ways in which the brain actually works as a system, revealing how these neuroplastic alterations might produce functional changes. Richard Davidson's finding, that there was a left anterior shift in *function* during emotion-provoking stimuli tests, reveals that mindfulness practice enables individuals to regulate their emotions in a more positive manner with approach rather than withdrawal (Davidson, 2004). The finding that the degree of left brain shift correlated with the degree of positive immune function, enables us to see how mindfulness not only helps us feel good and recover from negative feelings more quickly, but it can actually improve our medical health.

Neuroplastic changes not only reveal structural alterations, but they are accompanied by changes in brain function, mental experience (such as feelings and emotional balance), and bodily states (such as response to stress and immune function).

How would our focus of attention and internal attunement lead to alterations in the circuits of the brain that mediated these functions with mindful awareness? How we pay attention will stimulate neural firing in specific areas, and they will become activated and change their connections within the integrated circuits of the brain.

We will examine how mental activities, such as purposely paying attention to the present moment, actually stimulate the brain to become active in specific ways that then promote growth in those regions. Here we see the notion that the mind is using the brain to create itself. It is this growth, these neuroplastic changes created by the focus of our own minds, that help us see the link between the practice of mindful awareness and the creation of well-being.

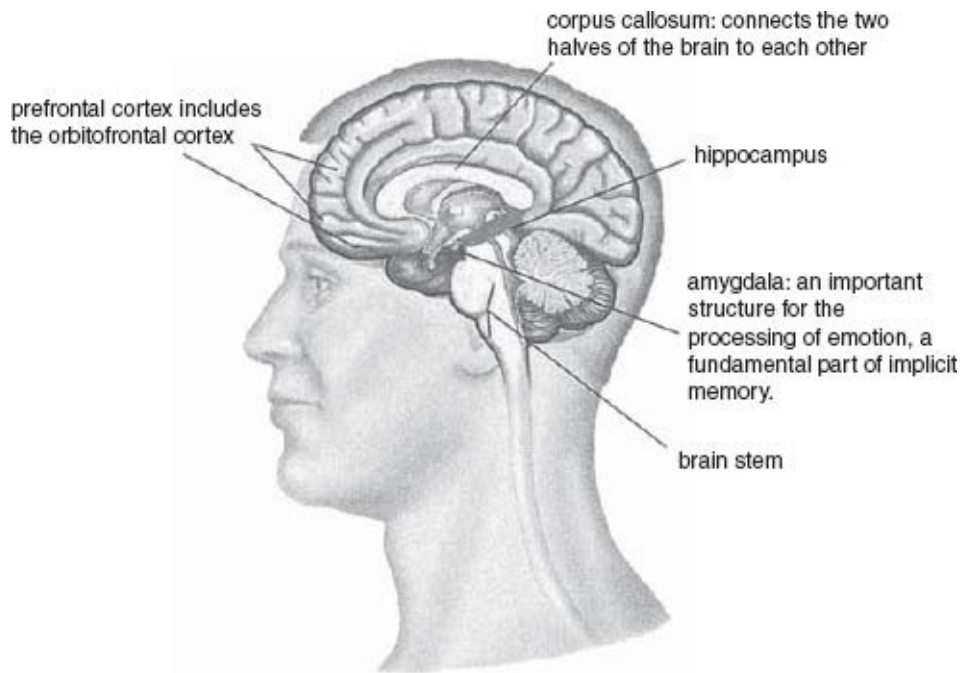
THE BRAIN IN THE PALM OF YOUR HAND

Getting to know the brain can feel overwhelming. Recent discoveries in the function of the brain, however, reveal basic principles that actually make it not only understandable, but even accessible and useful, and, if I may go even further, actually fun to get to know your brain.

We have simple diagrams of the brain, complicated maps of neural circuitry, and actual scan images. These pictorial details of brain anatomy can be quite

useful. For our explorations of the mindful brain, we need a basic sense of neural locations: the bare bones maps of the brain in Figures 2.1 and 2.2 are a useful place to start.

Another useful tool for viewing the brain is your hand. If you take your hand and put your thumb in the middle and curl your fingers over the top, you'll have a readily accessible and fairly accurate model of the brain. This hand model is oriented such that your wrist represents the spinal cord in your back, the face of the person is in front of your fingernails, and the top of your hand is the top of the head.



***Figure 2.1* Diagram of the human brain looking from the middle to the right side. Some of the major areas of the brain are indicated, including the brainstem, the limbic areas (with the amygdala, hippocampus, and anterior cingulate), and the cerebral cortex (with the prefrontal regions including the orbitofrontal cortex, which, along with the anterior cingulate and other medial and ventral areas, is a part of the “middle prefrontal cortex”). (Siegel & Hartzell, 2003; reprinted with permission.)**

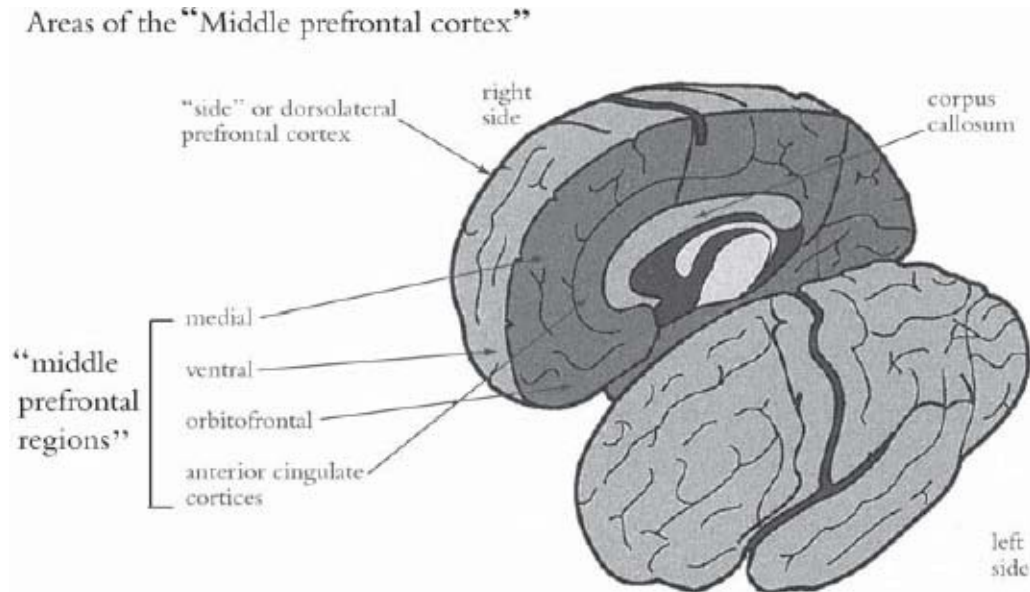


Figure 2.2 The two halves of the brain. This figure also reveals the locations of the areas of the “middle prefrontal cortex,” which include the medial and ventral regions of the prefrontal cortex, the orbitofrontal cortex, and the anterior cingulate cortex on both sides of the brain. The corpus callosum connects the two halves of the brain to each other.

The brainstem is your palm, the limbic areas are your thumb (you’d have a left and right thumb, ideally), and your cortex is symbolized by your curved fingers. Let’s take them briefly, one by one.

The brainstem carries out important basic processes, such as regulating heart rate and respiration, states of alertness and sleepiness, and aspects of the fight-flight-freeze response. Well developed by birth, the brainstem is the evolutionarily oldest area and is sometimes referred to as the reptilian brain.

The limbic region evolved when reptiles developed into mammals. Limbic zones are involved in attachment (our connections to our caregivers), memory (especially processing events into factual and autobiographical forms), the appraisal of meaning and the creation of affect, and our inner sensations of emotion. The limbic regions also contain the master hormone regulator, the hypothalamus, enabling direct influences to the body proper.

This endocrine connection, along with the brain’s influence on the immune system and our bodily states by way of the autonomic nervous system with its brakes/accelerator divisions (the parasympathetic and sympathetic branches) are the direct ways in which the brain and body are intimately interconnected. The limbic zones and the brainstem, the subcortical areas, combine to influence our

motivational drives and the activation of our basic needs for survival and for affiliation and meaning.

The cortex is the outer part of the brain, enlarged in mammals. It enables us to mediate more complex processes, such as perception, planning, and attention. With many lobes carrying out different functions, there are varied ways of describing the complex capacities of this region, which is not highly developed at birth and thus is very open to being shaped by experience (Figure 2.3).

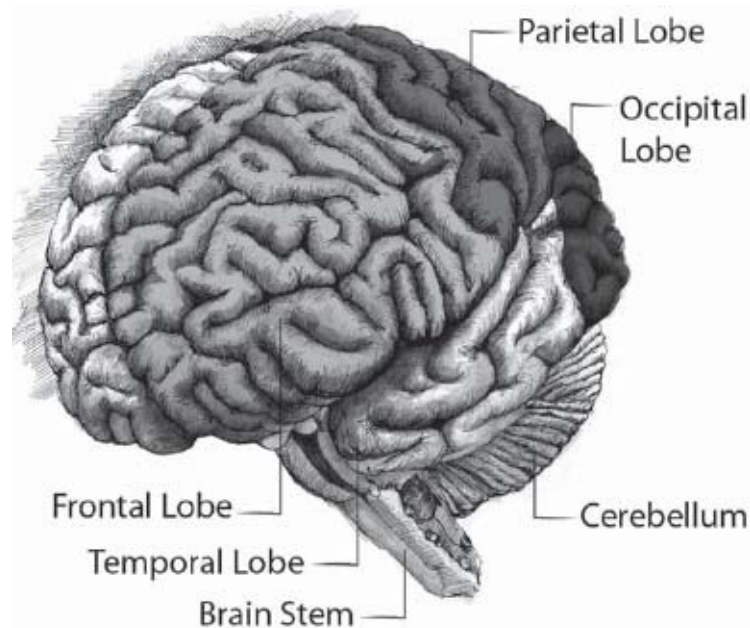


Figure 2.3 The traditional view of the brain: the cortical lobes.
(Cozolino, 2006; reprinted with permission.)

The cortex is primarily a six-layer thick folded area made up of gray and white matter. These layers are composed of vertically arranged sets of cortical columns with different clusters of columns often processing a particular mode of activity, such as vision or hearing. These vertical columns are connected to each other with horizontally distributed interneurons that enable cross-talk, the integration of separate modes (hearing, seeing) into a “cross-modal” set of neural firing. It is this linkage of separate areas that creates the important complexity that is our crowning cortical capacity.

In general, the back of the cortex, from your second knuckles backward, carries out perception from the outside world, except for smell and awareness of positions of the limbs. These posterior regions enable human beings to get a sense of the outside world as perceptions.

The front of the brain carries out motor, attentional, and thought-based processes. Our frontal lobes evolved as we became primates. Studies suggest that in mammals, the higher the degree of social living, the more frontal cortical architecture there will be.

The frontal area from your second knuckles to your last knuckles is a region where the first zone carries out motor action, the next zone forward mediates motor planning—the premotor cortex (Figure 2.4). This premotor area was the first region that revealed the finding of the mirror neuron system that enables us to take in the intentions and emotions of others and create those states in ourselves as part of a larger “resonance circuit” (see Appendix III, Resonance Circuitry). We’ll be exploring the possibility that this resonance circuitry of our social brain plays an important role in mindful awareness.

Just forward of these motor and premotor areas is the prefrontal cortex. Most highly developed in humans, this prefrontal region mediates many of the functions we consider unique to our species. The prefrontal regions can be divided in various ways that mediate different functions (Figure 2.5). For now, we’ll just divide these into two areas: the side and middle prefrontal regions. The areas of the prefrontal cortex generally work as a team, and seeing their function as a system in this way can be quite useful.

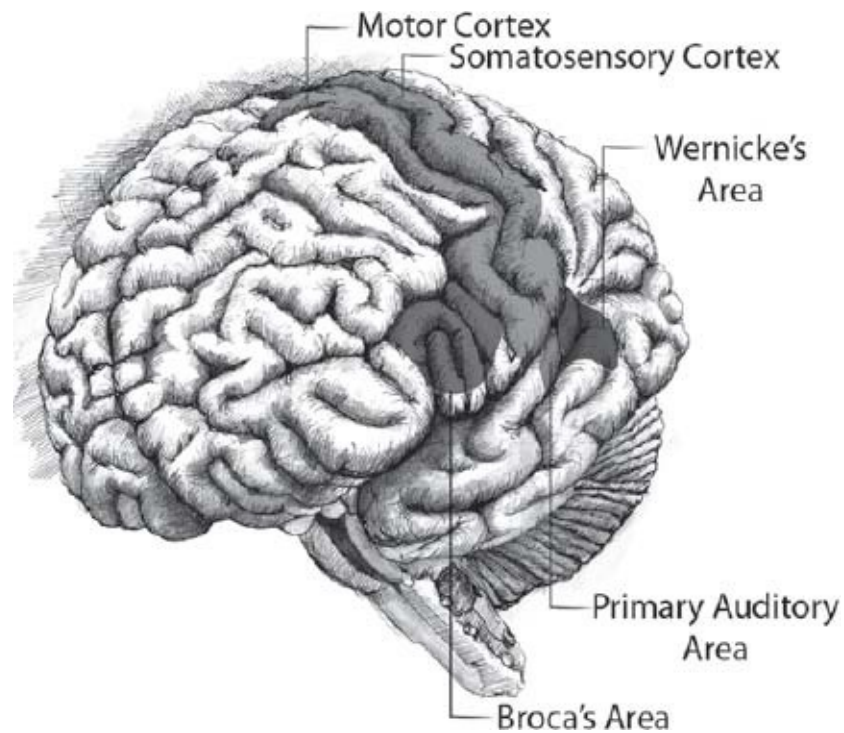


Figure 2.4 The traditional view of the brain: regions of interest. (Cozolino, 2006; reprinted with permission.)

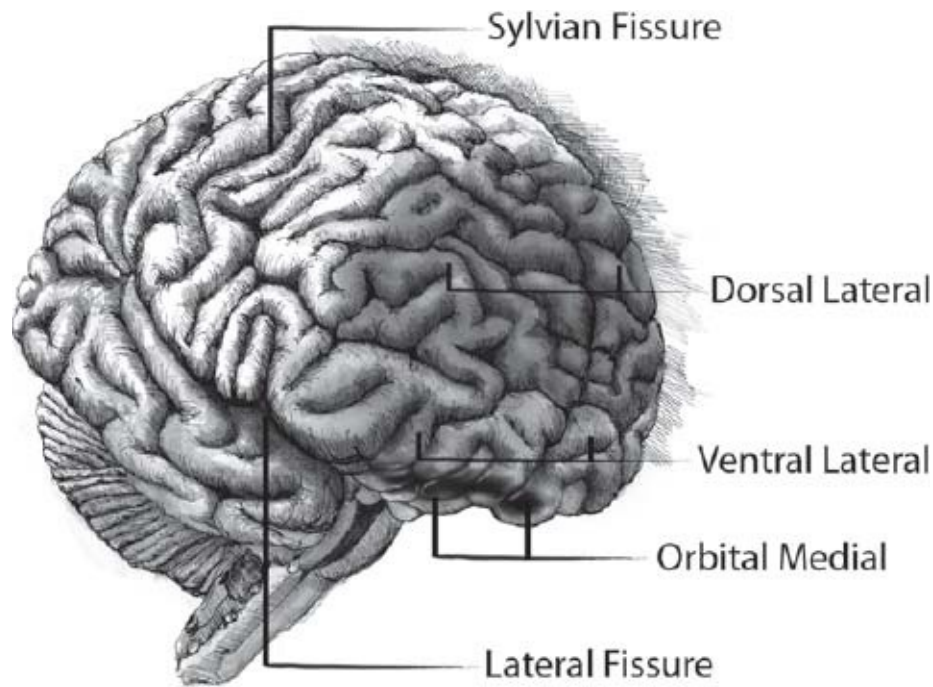


Figure 2.5 Regions of the prefrontal cortex. (Cozolino, 2006; reprinted with permission.)

The side area of the prefrontal region, the dorsolateral prefrontal cortex (DLPFC), is important for mediating working memory, the chalkboard of the mind, in which we can put something “in the front of our minds.” This side area carries out important executive functions that enable self-regulation of our behaviors and help influence the flow of our attention in the moment.

The middle area, from your middle two fingernails up to the knuckles, includes several interlinked regions that mediate those nine middle prefrontal functions, which we will discuss further in the next section. These are the orbitofrontal cortex (OFC), the anterior cingulate cortex (ACC), and the ventral lateral (vlPFC) and medial prefrontal cortex (mPFC). In Figure 2.5 the orbitofrontal and medial prefrontal are combined and labeled orbital-medial prefrontal cortex. In Figure 2.6 their proximity to the anterior portions of the cingulate cortex is revealed.

These midline ventral and medial structures receive direct input from the entire brain and body-proper, especially with contributions from the insula cortex (IC). The insula is the conduit through which information is transferred to and from the outer cortex and the inner limbic (amygdala, hippocampus, hypothalamus) and bodily areas (by way of the brainstem and spinal cord). The middle prefrontal areas appear to utilize the insular data about our emotions and

primary bodily state to then create representations of others' minds. The middle prefrontal areas are essential for social communication as well as for self-observation. This region is an important central hub in the social circuitry of the brain (see Appendix III, Middle Prefrontal Function).

Notice how the middle prefrontal region links the body, brainstem, limbic, cortical, and social processes into one functional whole. If you lift your fingers up and put them back down, you may notice that indeed the middle prefrontal areas (represented by the ends of the two middle fingers) touch everything in the brain anatomically, and that is the nature of neural integration: body-wide synaptic connections that even link us to each other.

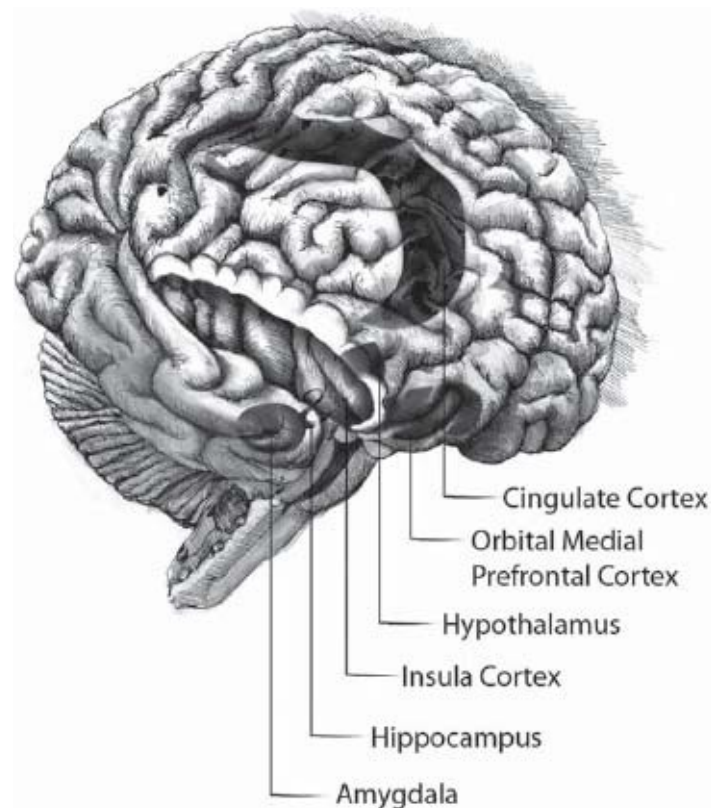


Figure 2.6 Structures of the social brain. The structures represented here are hidden beneath the surface of the brain. (Cozolino, 2006; reprinted with permission.)

An interpersonal neurobiology approach to the ways our social lives help promote well-being views neural integration as the outcome of attuned relationships. Neural integration, the coordination and balance of the brain as separate areas are linked together to form a functional whole, seems to be

promoted with the attunement of secure attachments. The proposal here is that perhaps we are gathering some preliminary data to point in the direction that mindful awareness may also promote such neural integration, through a form of intrapersonal attunement.

Awareness of one's moment-to-moment experience creates the opportunity to sense and accept one's own mental experience directly. This state of awareness may harness various regions of the brain, including the important frontal areas of the cortex and subcortical limbic and brainstem areas into an integrated coherent state. Neural integration, carried out in part by these frontal regions, may be essential for creating self-regulational balance. We should keep these prefrontal areas in the front of our minds as we explore how these integrative pathways may serve a crucial role in this important movement toward well-being.

NEURAL INTEGRATION, MINDFULNESS, AND SELF-REGULATION

The concept of neural integration is a very broad, large-system view of how the brain functions. In neuroscience, it is possible to be more microanalytically focused, examining the membranes of neurons, studying neurotransmitters and their receptors, investigating clusters of neurons and their immediately linked neighboring cells. This deep and finely tuned research is important and intriguing. In addition to these crucial microviews, we also can move outward to examine the brain as a whole system. This macroview enables us to not only see the entire brain and body as one functional whole, but to move out further and examine the ways in which signals from one brain/body interact with others within relationships, families, and societies. This is the focus of our work at the Center for Culture, Brain, and Development at UCLA (see Appendix I).

It is always a matter of translation to try to speak at both micro-and macrolevels of analysis. At the Center we must embrace the reality of this spectrum of knowing in order to compile the pieces of the puzzle that can only be assembled when you humbly and respectfully acknowledge the value of these differing points of view. My sense of a whole system view of how two minds become linked within attunement is that this large-system connectivity, neural integration, is at the heart of relational well-being. When we take that neural perspective on interpersonal attunement and consider mindfulness as an intrapersonal form, it is natural to have the sense that neural integration may play a crucial role in mindful states. Neural integration is the linkage of anatomically or functionally differentiated neural regions into an interconnection of widely distributed areas of the brain and body proper. These interconnections take the

form of synaptic linkages structurally, and create a form of coordination and balance functionally.

Neural integration likely creates optimal functioning by way of this coordination and balance of neural activation. Coordination means that we monitor and then influence the firing patterns of various disparate regions into a well-functioning whole. Balance implies the activation, deactivation, and reactivation of coupled areas.

One illustrative example would be the balance of such functions as the brakes and accelerator branches of the autonomic nervous system. Here we see that the middle prefrontal regions must monitor the activity of these two inputs (sympathetic and parasympathetic activity) and then be able to actually alter it (shut it down or rev it up).

This is the mechanism of “bodily regulation,” the first of our nine middle prefrontal functions. Recall that this is a list of outcomes for secure attuned attachment (the first seven) and also a list for the outcome and process of mindful awareness, what we are proposing as a form of internal attunement. I generated this list while caring for a family in which the mother had sustained an injury, following an automobile collision, to the part of the brain behind her forehead. The family was struggling with the profound changes in her personality and I was hoping to help them make sense of this experience and adjust to their new life. I turned to the basic research literature and asked the question, What functions correlate with the activity of the middle areas of the prefrontal cortex? (See Appendix III, Middle Prefrontal Functions.)

1. Body regulation, as described above, emerges as the brakes and accelerator functions are coordinated and balanced.
2. Attuned communication involves the coordination of the input from another mind with the activity of one’s own, a resonance process involving these middle prefrontal areas.
3. Emotional balance implies the capacity of the affect-generating limbic areas to be allowed to have enough activation so that life has meaning and vitality but not so much that life becomes chaotic. The middle prefrontal regions have the capacity to monitor and inhibit limbic firing with high levels of bidirectional flow from the subcortical limbic to the middle prefrontal regions.
4. Response flexibility is the capacity to pause before action. Such a process requires the assessment of ongoing stimuli, the delay of reaction, selection from a variety of possible options, and the initiation of action. The middle

prefrontal regions work in conjunction with the side areas to carry out this function.

5. Empathy appears to build on the internal shifts carried out by the resonance circuits in which limbic and bodily changes are first initiated as we perceive another person's signals. Next, the middle prefrontal regions appear to use interoception, the input of these subcortical and bodily states into the middle prefrontal region by way of the insula. The data are then proposed to be interpreted and that assessment attributed to another as a form of empathic imagination of what might be going on inside someone else.
6. Insight, or self-knowing awareness, links the past, present, and future. The middle prefrontal cortex has input and output fibers to many areas, in this case regarding cortical representations of autobiographical memory stores and limbic firing that gives emotional texture to the emerging themes of our present awareness, life story, and images of the future.
7. Fear modulation may be carried out via the release of the inhibitory neurotransmitter gamma amino butyric acid (GABA) onto the lower limbic areas mediating fear, such as the extended nuclei of the amygdala. In this way, fear may be learned limbically, but its "unlearning" may be carried out via growth of these middle prefrontal fibers that can modulate that fear (Figure 2.7).
8. Intuition seems to involve the registration of the input from the information processing neural networks surrounding our viscera; for example, the heart, lungs, and intestines. Our body's wisdom is then more than a poet's metaphor, it is a neural mechanism by which we process deep ways of knowing via our body's parallel distributed processing surrounding these hollow organs. This input registers itself in the middle prefrontal cortex and then influences our reasoning and our reactions.
9. Morality: Studies reveal the participation of the middle prefrontal cortex in the mediation of morality. Taking into consideration the larger picture, to imagine what is best for the whole not just oneself, even when alone, is what morality can be seen as entailing. The middle prefrontal region when damaged is associated with impairments in moral thinking leading to a form of amorality.

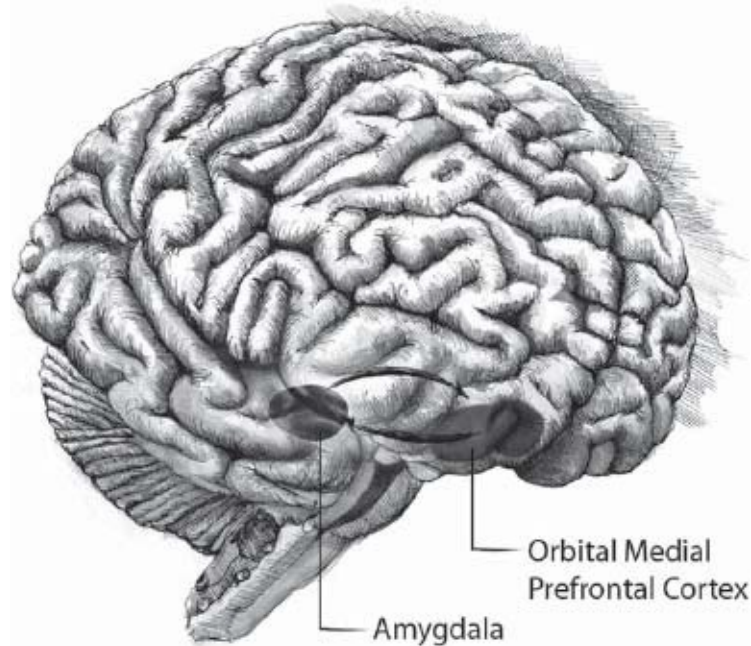


Figure 2.7 The orbital-medial prefrontal cortex: amygdala network.
(Cozolino, 2006; reprinted with permission.)

LEFT AND RIGHT

In Figure 2.2, we can see that the brain is divided into a left and right side. In considering left and right hemisphere distinctions, it is important to avoid “dichotomizing.”

In the course of evolution as back-boned animals, the left and right sides of our nervous systems have had different functions (Halpern, Güntürkün, Hopkins, & Rogers, 2005). The benefit of this asymmetry, shared with fish and frogs, lizards and birds, and rats and people may be that with more differentiation, we are able to achieve more complexity of function. Why should left and right, or up and down, be the *same*? As we noted earlier, the brainstem and limbic areas develop earlier than the cortex. Their asymmetries push for a difference in the connectivity of the right and left cortical hemispheres. These emerging structural differences result in some relevant and quite robust differences in function between left and right. The right hemisphere develops and is more active in the first two or three years of life. The left comes on line around the second birthday, followed by a periodic shift in the developmental thrust of left and right in the years ahead. The connecting tissue—the corpus callosum—begins its developmental thrust at this time, lasting well into the twenties.

A general sense of the difference can be pictured by just imagining that the

cortical columns of the right hemisphere may have more horizontal linkages between them, making the representational processes more “cross-modal” in that the differentiated processes of one area communicate with those of other areas. This finding, for example, helps us understand why the right hemisphere is better at seeing context and the whole picture than the more detail oriented left hemisphere. In the left hemisphere, the cortical columns appear to work more on their own, which allows for the more in-depth, analytic, problem focused, detail monitoring, and fact accumulating processes of the left.

The streams of input from the subcortical regions feed different sources of sensory data to these two regions, which also helps us understand why such distinctions emerge. People always ask about gender differences, and so here is a general statement, biased in favor of both genders. Female brain development appears to involve more integration, with a thicker corpus callosum that connects the left and right hemispheres. The male brain can be said to be more differentiated, or more specialized, allowing the separate regions to work intensively more on their own. These gross generalizations make me nervous, but that’s generally what the science reveals. In clinical work it is important to connect with people as they are, not what statistics say they may be.

The functioning of the left hemisphere is easiest to remember because its functions have four L’s: The left specializes in linguistics, linearity, logic, and literal thinking.

In contrast, the right reveals the following features: Nonverbal, holistic, visuospatial, and then a whole host of noncorrelated specialties such as autobiographical memory, integrated map of the whole body, raw spontaneous emotion, initial empathic nonverbal response, stress modulation, and a dominance in the alerting aspect of attention. The right side is thought in some perspectives to mediate distress and uncomfortable emotions and correlates with withdrawal from novelty. The left is seen to mediate more positive affective states and is associated with approach behaviors. The coordination between the left and right in shaping our overall emotional tone may be an important dimension of how mindful awareness alters our affective style (Davidson, 2000). As we have seen, mindfulness appears to lead toward an approach state, with a left sided shift in frontal electrical activity.

When functions are separated, the brain can harness them into a state of connection to achieve more complex and adaptive functions. This is neural integration. This is the way the complex system of the brain, and the mind, may become flexible and create new combinations of functioning. With a left and right hemisphere physically separated and functionally differentiated, we have the opportunity to achieve more adaptive function if we come to integrate them

into a whole. This is how, I believe, creativity emerges not from one side or another, but from their integration.

As we shall see, the left hemisphere may have a “narrator” function in which this region serves to linguistically articulate the ongoing story of a person’s life. But the “goods” of our autobiographical memories are located primarily in the right hemisphere, and so creating a coherent narrative of one’s own life may involve at a minimum this bilateral form of integration. Integrating left and right helps us to make sense of our lives (see Appendix III on laterality for further discussion).

Awareness of the totality of our body’s experience may require us to link the right hemisphere’s integrated whole-body map with the side prefrontal cortex’s activation. In mindful awareness we are often focusing on aspects of our bodily function. This then would involve not only the interoception of the insula and middle prefrontal cortex, but also the whole map of the body represented in the right side of the brain. If in mindfulness practice our mind is filled with word-based left-sided chatter at that moment, we could propose that there is a fundamental neural competition between right (body sense) and left (word-thoughts) for the limited resources of attentional focus at that moment. Shifting within mindful awareness to a focus on the body may involve a functional shift away from linguistic conceptual facts toward the nonverbal imagery and somatic sensations of the right hemisphere. This may help us understand the finding of Lazar that revealed an increase in structural thickness in the middle prefrontal and right insular areas (Lazar et al., 2005).

But if ongoing narration, perhaps even without words in the form of a witnessing awareness or an internal observer, is truly a function of the left hemisphere, then there would be a prefrontal activation on the left side (executive attention with active narrative observation) and perhaps also a right middle prefrontal activation (nonverbal self-reflection and meta-awareness in the medial prefrontal) and right insula activity with viscera representation. This could help us make sense of and synthesize the findings of the left sided/approach shift that Davidson and colleagues have noted (Davidson et al., 2003) and Lazar’s middle prefrontal and right-sided insula findings (Lazar et al., 2005). The implications of this line of reasoning need empirical exploration to verify their validity. But this is an example of a way we can draw on existing knowledge of brain function (laterality) to ask testable questions about phenomena (mindful awareness) and general principles (neural integration and well-being) so that we can deepen our understanding of our subjective and neural lives.

“BRAIN” AND “MIND”

Whenever the term *brain* is used in this work, it refers to the brain as an integrated part of the whole body. This reality changes the way we think about the relationship of brain and mind. Because the mind itself can be viewed as both embodied and relational, our brains actually can be considered the social organ of the body: Our minds connect with one another via neural circuitry in our bodies that is hard-wired to take in others' signals.

To examine the relationship of the mind—the flow of energy and information—to the brain—neural connections and their complex patterns of firing—we need to be careful of certain preconceived ideas that might restrict our understanding and bias our thinking. We need to be cognitively mindful: To be open to contexts, embrace novel ways of perceiving, distinguish subtle differences in ideas, and create new categories of thinking in our awareness of concepts in the moment. Here we see that the idea of a cognitive dimension of mindfulness can help in how we think and how we approach learning, even about reflective mindfulness.

The timing and location of neural activation correlates with the timing and characteristics of mental activity. If a person looks at a photograph, his or her brain activity can be monitored with a functional scanner. Activation will be evident in the posterior part of the brain (usually blood flow increases during activation and is visible on a functional MRI scan or as electrical activity on an EEG). The most accurate thing we can then say is that occipital lobe firing correlates with visual or spatial perception.

Why not say the neural activity created the visual perception? If we make causal phrases like this, the erroneous idea is reinforced that the mind is only created by the brain. If we are cognitively mindful here, we need to be open to the truth that seeing the picture actually created the neural firing. The directional arrow goes both ways: The mind can actually use the brain to create itself.

Without cognitive mindfulness, we would miss this bidirectional point. When we examine the nature of our evolution as a species, for example, we find that in the last 40,000 years our species has changed by way of cultural evolution. Culture is the way that meaning is transferred among individuals and across generations with groups of people. How this energy and information flow shifts its patterns across time is what cultural evolution involves. This reality of how we have changed as a species involves not the genetically driven evolution of our brains, but the *mental* evolution of how we collectively pass energy and information among each other across generations. This is the evolution of the mind, not the brain. One view is that for the mind (energy and information flow)

to exist it may need to harness the activity of the brain. In this manner, the mind uses the brain to create itself.

This perspective is consistent with the scientific state of our understanding of how mind and brain are related to each other. There is no need to try to simplify the dimension of one reality into that of another. Mind is not “just” brain activity; energy and information flow happens in a brain within the body and it happens within relationships. To visualize this perspective we can say that the mind rides along the neural firing patterns in the brain, and realize that this riding correlates with bidirectional causal influences. Terms such as *mechanisms* or *neurally mediated by* in this text are not meant to imply one directional causality. Neural events are “correlated” or “associated” with mental activities, each influencing the other.

Relationships among people also involve the flow of energy and information, and thus utilize these riding patterns along neural firing as well. This interconnection among brain, mind, and relationships will be a triangle of reality that we will be returning to again and again. With this perspective we can sense a “tridirectional” influence of these three irreducible dimensions.

Relationships shape energy and information flow—as is happening now by these words in your mind. But the brain’s activity also directly shapes how energy and information flow is regulated. Right now your brain may be activating certain firing patterns that distract you from paying attention to the text. This would impair your ability to be mindfully aware at this particular moment. There may be a distraction, and this will shape how energy and information flow—the focus of your attention—occurs at this particular moment.

Attention to the present moment, one aspect of mindful awareness, can be directly shaped by our ongoing communication with others, and from the activities in our own brains. Indeed one of the biggest challenges to being present are the top-down patterns of activation in our brains that continually bombard us with neural firing and mental chatter that keep us from being in the moment.

In the next section we’ll be diving deeply into the nature of direct experience and mindful awareness. We can keep all of these ideas about brain, mind, and relationships in the back of our minds as we let them go for now and immerse ourselves in the subjective reality of inner life.