

A NEUROPSYCHOLOGICAL PERSPECTIVE ON SPIRITUAL DEVELOPMENT

ANDREW B. NEWBERG

STEPHANIE K. NEWBERG

The study of religious and spiritual phenomena from a neuropsychological and developmental perspective presents a number of complex issues, the most important of which is to determine whether such an approach may open a window to understanding how religion and spirituality are intimately linked with human biology and psychology throughout the life cycle. We will argue that the basic mechanisms associated with religious and spiritual experiences are correlated with essential brain functions and that the development of each mirrors that of the other. The notion that as the brain develops physiologically, the human concept of religion and spirituality evolves accordingly, supports the intimate link between human biology and spirituality. By exploring this link, we hope to elucidate how religion and spirituality become hard associated with various brain functions.

EPIDEMIOLOGY AND DESCRIPTION

Spirituality, religion, and faith are complex concepts that have been defined in many different ways. For the purposes of this chapter, we will

define spirituality as distinct from religion or religiousness. Spirituality is usually regarded as less institutionally based and as more encompassing and inclusive of all groups and cultures than religiousness. Spirituality is also used to describe individual experiences such as those of transcendence and meaningfulness (Larson, Swyers, & McCullough, 1998; Spilka & McIntosh, 1996). According to a recent consensus conference report sponsored by the National Institute for Healthcare Research, the criteria for spirituality were described as "the feelings, thoughts, experiences, and behaviors that arise from a search for the sacred. The term 'search' refers to attempts to identify, articulate, maintain, or transform. The term 'sacred' refers to a divine being or Ultimate Reality or Ultimate Truth, as perceived by the individual" (Larson et al., 1998). This definition of spirituality was distinguished from that for religiousness. Religion and religiousness not only contained the preceding criteria, they also included a "search for non sacred goals (such as identity, belongingness, meaning, health, or wellness)." Religiousness also implies that the means and methods of the search "receive validation and support from within an identifiable group"

(Larson et al., 1998). It should be emphasized that these definitions were specifically intended to be operationalized approaches that would facilitate future scientific research and were not necessarily meant to be the most accurate from a religious or theological perspective.

The concept of faith is also extremely difficult to characterize clearly. Although the term *faith* has religious implications in terms of being a belief in a specific religious conceptualization of God and humankind's relation to God, faith also can be considered from a neuropsychological perspective. A neuropsychological perspective posits that all human experience is ultimately processed by the brain. The brain therefore can only provide a "secondhand rendition" of external reality. If this is the case, then human beings always have to have faith in their interpretation of that external reality as it is processed by the brain. Faith, in some sense, becomes absolutely essential for the human brain to function properly so that it assumes that the world as it is perceived and interpreted represents a reasonable one-to-one correlation with what is actually "out there." With this perspective in mind, faith clearly underlies the experiences and ideas associated with religion and spirituality. Fowler (1981) has observed that faith is universal and recognizably similar regardless of one's specific beliefs or religion. In this regard, faith might be considered to refer to the quest for meaning and its relation to transcendence and how one uses the concept to derive purpose and set priorities within life. Thus, faith can evolve over the course of an individual's life span, and will have mutual interactions with the person's sense of spirituality and religion.

In order to better understand spirituality and religion, scholars have attempted to identify the specific characteristics of experiences associated with these two concepts. A spiritual experience has been defined as a melting of boundaries and a merging with the surrounding environment (Rolbin, 1985) and as a unitary or "cosmic consciousness" (Bucke, 1961; Rowan, 1983). Spirituality has been discussed as a transcendence that occurs along a specified spiritual path that can be attained through practices such as meditation. "Through therapy or personal growth, we learn to open up to our own inner process, through mysticism we learn how to

carry on with that same process into the deepest depths of all" (Rowan, 1983, p. 9). Spirituality has been described by Maslow (1970) as a unity with all and the attainment of self-actualization. According to Rowan (1983), in order to attain a spiritual experience one must have discovered one's self through mindful awareness, therapy, personal growth, and/or meditation. However, there are clearly many examples of spontaneous spiritual experiences that include near-death experiences and religious conversions. It is also important to acknowledge that spiritual experiences likely reside along a continuum from relatively brief feelings of "awe" to profound unitary states; we will consider this issue later in this chapter (d'Aquili & Newberg, 1999).

In order to explore fully the biology of spiritual development, it seems necessary to consider briefly spiritual experiences from a neuropsychological as well as a clinical perspective to provide some insight into the significance of such experiences and to begin to consider how to incorporate the exploration of these experiences into therapy.

THE NEUROPSYCHOLOGY OF SPIRITUAL EXPERIENCES

The study of spiritual experiences has important implications for a developmental spirituality since it is frequently such experiences that can propel an individual along the developmental path. Furthermore, it may be that certain stages of spiritual development are associated with different types of spiritual experiences. There is clearly a wide variety of spiritual experiences that exist along a continuum ranging from mild feelings of "awe" to the sense of the "wholly other" of the divine being, to what has been called "absolute unitary being" (AUB) in many of the Eastern traditions such as Buddhism and Hinduism (Otto, 1970; Streng, 1978). Smart (1967, 1969, 1978) has argued that certain strains of Hinduism, Buddhism, and Taoism differ markedly from prophetic religions such as Judaism and Islam and from religions related to the prophetic-like Christianity, in that the religious experience most characteristic of the former is "mystical," whereas that most characteristic of the latter is "numinous." Of

these two terms, it is the numinous that Smart seems to have an easier time explaining, since it obviously arises more spontaneously out of Western religious traditions. Stace (1961) goes further by distinguishing between what he calls extrovertive mystical experiences and introvertive mystical experiences. Extrovertive mystical experiences are differentiated by including a unifying vision in which all things are perceived as one and the more concrete apprehension of the One as an inner subjectivity, or life, in all things. Introvertive mystical experiences are distinguished by including a Unitary Consciousness that is nonspatial and nontemporal.

A neurobiological analysis of spiritual experiences might clarify some of the issues regarding these experiences by allowing for a typology based on the underlying brain functions. With regard to the continuum of spiritual experiences, unitary states appear to play a crucial role. While it is difficult to define what makes a given experience spiritual, the sense of having a union with some higher power or fundamental state of being seems a crucial part of spiritual experiences. To that end, this union helps reduce existential anxiety as well as provide a sense of control over the environment (d'Aquili, 1978; d'Aquili & Newberg, 1998; Smart, 1967, 1969). The bottom line in understanding the phenomenology of subjective spiritual experience is to understand that every experience involves a sense of the unity of reality at least somewhat greater than the baseline perception of unity in day-to-day life (d'Aquili, 1986). This may be related to altered functioning of the brain structures typically involved in helping to construct the self/other dichotomy. Usually the self/other dichotomy functions to help us distinguish our self from the rest of the external world. It has been suggested that the left posterior superior parietal lobe may be responsible for this function because it is involved in differentiating graspable from nongraspable objects (Van Heertum & Tikofsky, 1995). In human beings, it has been suggested that the functions of this structure have been elaborated to allow for the self/other dichotomy (Joseph, 1996). This dichotomy is normally based on input from all of the sensory systems. In cases of meditation, it has been suggested that there is a differential blocking, or "deafferentation," of input into the

posterior superior parietal lobe that progressively diminishes the strength of the self/other dichotomy (d'Aquili & Newberg, 1993; Newberg & Iversen, 2003). Thus, the continuum of spiritual experience relies heavily on the progressive sense of unity that is associated with a progressive blocking of input into the posterior superior parietal lobe. We have hypothesized that this progressive blocking of input into the posterior superior parietal lobe creates a sense of increased unity over multiplicity. It should also be mentioned that the right posterior superior parietal lobe is involved in orienting us within three-dimensional space (Joseph, 1996). We have proposed that the blocking of input into this structure may result in the alterations in the sense of space and time that are often described during spiritual experiences. Thus, both the left and right posterior superior parietal lobe are likely involved in spiritual experiences.

At the extreme end of the continuum of spiritual experiences is the state of absolute unitary being, which is described in the mystical literature of all the world's great religions. When a person is in that state he or she loses all sense of discrete being, and even the difference between self and other is obliterated. There is no sense of the passing of time, and all that remains is a perfect timeless undifferentiated consciousness. When such a state is suffused with positive affect there is a tendency to describe the experience, after the fact, as personal. Such experiences are often described as a perfect union with God (the *unio mystica* of the Christian tradition) or else the perfect manifestation of God in the Hindu tradition. When such experiences are accompanied by neutral affect they tend to be described, after the fact, as impersonal. These states are described in concepts such as the abyss of the German mystic Jakob Böhme, the Void or Nirvana of Buddhism, or the Absolute of a number of philosophical/mystical traditions. There is no question that whether the experience is interpreted personally as God or impersonally as the Absolute, it nevertheless possesses a quality of transcendent wholeness without any temporal or spatial division whatsoever. We have postulated that these rare states of AUB are associated with the total blocking of input into the posterior superior parietal lobe (d'Aquili, 1982; d'Aquili & Newberg, 1993).

We propose that even in more ordinary perceptions, whenever the sense of wholeness exceeds the sense of multiplicity of parts or of discrete elements in the sensorium, there is an affective discharge via the right brain–limbic connections that Schwartz, Davidson, and Maer (1975) have shown to be of such importance. This tilting of the balance toward an increased perception of wholeness, depending on its intensity, can be experienced as beauty, romantic love, numinosity or the religious awe described by Smart, religious exaltation in the perception of unity in multiplicity (described by Stace as extrovertive mystical experience), and eventually various trance states culminating in AUB.

As there is an increasing sense of unity, there is the perception of ever greater approximations of some more fundamental reality (d'Aquili, 1986). Furthermore, the more the blocking of input into the right posterior superior parietal lobe is in excess of a state of balance with the analytic functions of the left hemisphere, the stronger will be the associated emotional charge. Thus, in any perception such as a piece of music, a painting, a sculpture, or a sunset, there is a sense of meaning and wholeness that transcends the constituent parts. In aesthetic experiences such as those just described, this transcendence is mild to moderate. We would locate the overarching sense of unity between two persons in romantic love as the next stage in this continuum. Feelings of numinosity or religious awe occur when there is a marked sense of meaning and wholeness extending well beyond the parts perceived or well beyond the image generated, but in a "wholly other" context. Both Otto (1970) and Smart (1969) have described this experience in detail. It is often considered (rather incorrectly we feel) to be the dominant Western mystical experience. It is experienced when an archetypal symbol is perceived or when certain archetypal elements are externally constellated in a myth. As we move from numinosity along the continuum, we reach the state of religious exaltation that Bucke (1961) has called "Cosmic Consciousness." This state is characterized by a sense of meaning and wholeness extending to all discrete being whether subjective or objective. The essential unity and purposefulness of the universe are perceived as a primary datum despite the perception and

knowledge of evil in the world. During this state, there is nothing whatsoever that escapes the mantle of wholeness and purposefulness. But this state does not obliterate discrete being and it certainly exists within a temporal context. This roughly corresponds to Stace's extrovertive mystical experience.

There are several other brain structures that are likely to be important with regard to spiritual experiences. It is likely that there is increased activity in two structures of the limbic system, called the amygdala and hippocampus, resulting in the strong affective component described as part of spiritual experiences (Saver & Rabin, 1997). Electrical stimulation of these two structures has also resulted in various sensory experiences, visions, and emotional discharges similar to some of those that occur during spiritual experiences (Penfield & Perot, 1963; Valenstein, 1973). Limbic stimulation during spiritual experiences may be modulated by activity in the posterior superior parietal lobes as well as the frontal lobes since these structures are all intimately interconnected (Joseph, 1996). During practices such as meditation, stimulation of the limbic system may result from activity in the frontal cortex, which is known to modulate emotional responses via its connections with two limbic structures, the amygdala and hippocampus. Increased frontal lobe activity has been shown to occur during meditation and likely occurs during other types of spiritual practices (Herzog et al., 1990–1991; Lazar et al., 2000; Newberg, Alivi, Baime, Mozley, & d'Aquili, 2001). This frontal lobe activity is also likely associated with the concomitant experience of intense awareness and alertness reported during such experiences. Mention should also be made of the connections between the limbic system and autonomic nervous system with regard to spiritual experiences. Alterations in autonomic activity during various spiritual practices have been demonstrated in a number of studies (Corby, Roth, Zarcone, & Kopell, 1978; Jevning, Wallace, & Beidebach, 1992; Kesterson, 1989; Sudsang, Chantanez, & Veluvan, 1991). It seems likely that the feelings of the heart racing or of extreme calmness that may occur during different spiritual practices may be associated with alterations in the functioning of the autonomic nervous system. Such alterations

may also help explain other physiological changes, including those in heart rate, blood pressure, and respiratory rate.

Although spiritual experiences and the unitary continuum are crucial, it is also important to realize how they are elaborated into myth formation. A myth presents a problem of ultimate concern to a society. We have typically considered myth formation based on several prominent cognitive functions. These cognitive functions include those of causality, binary operations, affect value response, and holistic perceptions. These basic brain functions are also subserved by specific brain structures and their interactions within the brain's neural network. The ability to observe causality and to relate one event to another in a sequential ordering appears to be located in the superior temporal lobe in conjunction with the inferior parietal region (Mills & Rollman, 1980; Pribram & Luria, 1973; Swisher & Hirsch, 1971). The ability to generate a sense of binary opposites, so that we can compare concepts such as good to evil or right to wrong, is also likely associated with the inferior parietal regions (Gardner, Silverman, Wapner, & Surif, 1978; Gazzaniga & Miller, 1989). This binary function has particular relevance to religious experiences and, particularly, myth formation. Religious myths tend to involve opposites that are in some form of conflict and are then resolved through the myth process (d'Aquili, 1978). When we initially observe a pair of opposites, we encounter a sense of arousal because of the incongruity between the opposites. We desire a resolution and revised understanding because of the holistic abilities of the brain, most likely associated with the superior parietal region (Nebes & Sperry, 1971; Schiavetto, Cortese, & Alain, 1999; Sperry, Gazzaniga, & Bogen, 1969). The initial binary tension enhances activity in the autonomic nervous system, particularly in the sympathetic system, which subserves the sense of arousal and the "fight or flight" response. The parasympathetic system, which underlies quiescent functions, may be stimulated upon resolution of the opposites within a myth. Thus, the existential problem presented in the myth is solved by some resolution or unification of the seemingly irreconcilable opposites that constitute the problem, and such a resolution is associated with strong emotional and visceral

experiences. The ability to assign emotional valence to various thoughts and stimuli involved in the myth is associated with the connections between the limbic system and the other cognitive processes. Clearly, this emotional response is crucial for religious myth as well as spiritual experiences.

DEVELOPMENTAL SPIRITUALITY

Given the preceding description of the neuropsychological correlates of religious and spiritual experiences, as well as their elaboration in myth, it is now possible to consider a developmental spirituality. This developmental spirituality considers how spiritual experiences, perspectives, and concepts evolve over the course of the human life span and how they parallel human brain development. It is well known that the human brain is not static in its structures or functions throughout life. It is this ability to change and adapt that gives the brain its power to enable human beings to survive, grow, and learn new things to ever enhance and modify thoughts and behaviors and experiences. Enough studies of brain function and structure have been performed to yield an overall model of human brain development from infancy, through adolescence, and into adulthood and old age. The brain changes that occur should have a direct impact on human thoughts and behaviors and consequently on religious and spiritual experiences. In this section, we will outline a neuropsychologically based developmental spirituality in which we consider the developmental stages of brain function and compare them to the stages of spiritual development. We will primarily use Fowler's (1981) conception of faith development in his book *Stages of Faith* as a framework for this analysis. It should be stated clearly, however, that spiritual development is likely to be more complex (Oser, 1991; Tamminen, 1994) and involve subtler changes than will be elaborated here. Other cultures and traditions may have a different development of spirituality as well. Furthermore, this chapter represents an initial attempt to intimately link brain development with spiritual development. Some of the speculative concepts considered will hopefully lay the foundation for future

analyses and studies in order to more clearly establish and substantiate this link.

Infancy

Fowler described the stage that precedes the first structural, developmental faith stage as "undifferentiated faith." Since there is little in the way of higher cognitive functions, especially with regard to integrating sensory phenomena, there can be no identifiable or differentiated faith or belief system. The infant operates almost exclusively in a stimulus/response mode. This notion implies that at this level, there can be no conception of a well-defined religion or spiritual viewpoint. Even if the person is raised in a highly devoted religious family, the infant cannot cognitively absorb this information in order to derive an understanding of any particular religious perspective. In spite of the lack of higher cognitive processing, this is the stage in which the seeds of trust, hope, and love are developed through the actions of the infant's caregivers. It is imperative at this stage that the environment in which an infant is raised provide enough consistency and nurturance and is not one in which there is deprivation. Such deprivation, at least in animal models, results in a significant lack of neuronal complexity and interconnectedness (Black, 1998; Kuhn & Sehanberg, 1998). This prestage is therefore critical for the overall development, both psychologically and spiritually, of the individual.

Even though there are no higher processing steps, this prestage helps to lay the foundation for future development and benefits from an environment that provides the basis for courage, autonomy, hope, trust, and strength to prepare for faith and spiritual development and subsequent stages. If there is neglect or inconsistencies in care, the infant may lock into patterns of isolation and despair and not integrate the concept of mutuality. Such isolation is arguably associated with an overall lack of connection, not only between the neurons in the individual's brain, but between the individual and the rest of his or her environment. If such a lack of connection persists beyond this stage, then the individual's association areas may not form adequately, thus preventing the person from being able to explore spirituality and meaning in the

first place. Such a phenomenon is known to occur with specific sensory systems in which an inability to make the appropriate neuronal connections early in life causes a reorganization of the brain's structure and function. This reorganization typically prevents these brain structures from functioning in their "normal" capacity even though they might be able to acquire new functions (Gazzaniga, 2000).

From the physiological developmental perspective, the undifferentiated stage is associated with the state of brain function during this infancy period. It has been shown that the brain function pattern changes throughout the first year of life with initial increases in the sensorimotor cortex, thalami, brain stem, and cerebellar vermis (Chugani & Phelps, 1986; Chugani, Phelps, & Mazziotta, 1987). These are central systems that subserve brain stem reflexes and visuomotor integrative performance that are typically displayed in infant behavior (Chugani, 1992). There are no significant higher cortical functions, however, and subsequently no strong evidence of well-integrated cognitive functioning. As visuospatial and visuo-sensorimotor integrative functions are acquired and primitive reflexes are reorganized, there is increasing activity in the primary visual cortex, parietal and temporal regions, basal ganglia, and cerebellar hemispheres (André-Thomas & Saint-Anne Dargassies, 1960; Parmelee & Sigman, 1983).

This increased activity also coincides with maturation of the EEG at around 2-3 months of age (Kellaway, 1979). At this time, there is still relatively decreased activity in the association areas that are necessary for higher cognitive processing. At 8-9 months there is increasing activity in the frontal lobes and association areas, coinciding with the advent of cognitive thinking and hypothesis forming, social interaction, and higher order thinking. This also correlates with the time that a child begins to develop the concept of object permanence such that he or she understands that things that are removed from immediate sensory perception can still exist. This is likely associated with the ability for neurons representing sensory information to connect with memory functions as the association areas become more activated.

We would argue that the initial prestage lasts up to approximately 1 year, at which time the-

metabolic pattern observed on brain scans qualitatively resembles that of the adult brain (Chugani, 1992). However, this stage may extend up to 2 years until verbal skills are more highly developed (as suggested by Fowler). From the spiritual development perspective, an undifferentiated state is likely associated with the structures that are functioning during the first year with no clear evidence of higher cognitive processing, no clearly defined sense of self, and a strong reliance on visual and motor responses. Since the association areas are not mature, any information coming into the infant is essentially unprocessed and in that respect is viewed by the infant in an undifferentiated manner. The inability to process sensory information is somewhat similar to the notion of "deafferentation," which refers to the ability to block or prevent incoming sensory or neuronal input from reaching a structure (d'Aquili & Newberg, 1993). Since sensory input arriving at the association areas cannot be further processed, the result would be a state similar to a deafferented association area observed during spiritual experiences. However, because there is no higher cognitive processing, even the association areas cannot respond normally due to an immature functional status. Thus, this state is not exactly the same as absolute unitary states that are attributed to high spiritual experiences. Specifically, there is an absence of any notion of self either in an ego context or a universal context. On the other hand, there should theoretically be some remarkable similarities, and it has been remarked by a number of mystical traditions that the ultimate goal of spiritual pursuits is to return to a time in which the mind was at its beginning. For example, the ancient Taoist text, *Tao Te Ching*, contains the following passages (Chan, 1963):

Chapter 10:

Can you keep the spirit and embrace the One without departing from them?

Can you concentrate your vital force (*ch'i*) and achieve the highest degree of weakness like an infant?

Chapter 55:

He who possesses virtue in abundance
May be compared to an infant.

Childhood

Fowler (1981) refers to the first stage of faith as the "intuitive-projective" stage and he describes this as occurring between the ages of 2 and 6 years. A child in this stage is beginning to develop the ability to use speech to organize his sensory experience into meaning. A child is able to sort out and gain some control over the world through her use of language and symbolic representations. At this point, children's thought processes are not reversible, and the concept of causality is poorly understood. Children at this stage assume that their perspective is the only perspective, and their thinking is magical, episodic, and not constrained by stable logical operations. Their conversations can be described as dual monologues in which they have their own train of thought and cannot respond to another in a reciprocal manner. In general, during this stage a child has integrated and conceptualized God in the way in which society has ingrained it into her through fantasy, stories, and dramatic representations. This stage is largely characterized by fantasy-filled, imaginative processes that are unconstrained by logical thought processes.

It is interesting that during this stage, neurophysiological development is associated with a progressive increase in overall brain metabolism. The neonate's brain typically has an absolute brain metabolism 30% lower than adults, but this continually increases until it reaches the adult level at about age 2 (Chugani, 1992; Kennedy & Sokoloff, 1957). It continues to increase until about age 4, at which point a plateau is reached. We would suggest that because of this aspect of neurophysiological development, the intuitive-projective stage of spiritual development may actually last up to the age of 4 with an overlap with the next stage up to approximately age 6. The initial increase in metabolism is primarily in the neocortex, which has almost twice the metabolic activity as in adults (Kennedy & Sokoloff, 1957). Central structures such as the brain stem and cerebellum do not demonstrate an increase during this time. Intermediate increases occur in the basal ganglia and thalamus. The initial increased metabolism is likely associated with the overproduction of neurons and their connections (Huttenlocher, 1979; Huttenlocher & deCourten, 1987). We

would suggest that this may explain the increase in fantasy and imaginative powers of children at this age. Their brain is establishing so many different connections all of the time that there is tremendous expansion and overconnectedness between neurons that are not typically related in the adult brain. The result psychologically and cognitively is that there are few clearly defined rules, and there is a sense of blending many different experiences and ideas. The child would therefore perceive the world as being composed of many overlapping ideas, experiences, and feelings and would likely see things in ways that appear to be a fantasy to older individuals. These latter individuals have already reduced their neural interconnections and developed more concrete rules associated with their better defined neural connections.

Children in the Intuitive-Projective stage will likely not see any problem blending ideas about God with very mundane issues. They may not form clear senses of opposites such as right and wrong or justice and injustice, which will come when the overconnectedness is cut back during the developmental process. Children in this stage begin to form their first sense of self-awareness, which is most likely attributable to a greater maturity of the association areas, particularly the superior parietal region in which the sense of self, in conjunction with the other association areas, is ultimately formed. However, due to the overconnectedness of sensory neurons with the association areas, the developing self is seen as highly interwoven with the external world. This may result in the self participating in various fantasies and dream states. On the other hand, with this developing sense of self comes the beginning of experiencing concepts of death, sex, strong taboos within society, and the ultimate conditions of existence. They will not likely be able to make sense of these complex issues in the same way a mature adult would, however, since they might not be able to clearly distinguish death from life and wrong from right until their association areas are able to fully process such ideas.

This stage of development can be significantly influenced by the external environment. Problems can arise during this time if a child develops images of terror and destructiveness in the reinforcement of societal taboos. For

example, primary caretakers who are very critical, rigid, and use violent and destructive images can result in a child internalizing these negative concepts. Similar negative ideas may become associated with religion and spirituality rather than more positive conceptions of something greater than themselves. Children may also develop mood disorders that can delay their ability to incorporate religious and spiritual ideals, symbols, and rituals into their life. Consequently, the child may not be able to develop a strong sense of self, independence, or autonomy that is crucial to progress to future stages. From a neurophysiological perspective, the neuronal connections associated with negative fantasies may become stronger, making such a negative perspective more pervasive during subsequent stages of development.

The initiating factor that propels a child to the next stage is the capacity for concrete operational thinking (Piaget, 1932), at which point the child begins to discern and become curious about what is and is not "real." The second stage is referred to by Fowler as the "Mythic-Literal" stage, which he describes as occurring at approximately 6–10 years of age. During this stage, a child begins to internalize stories, beliefs, and observances that symbolize belonging to a community or group enabling the composition of a worldview and ideology. Beliefs are related to literal interpretations of religions or doctrines and are usually composed of moral rules and attitudes. From the neurological perspective, this stage appears to coincide with a plateau phase in brain metabolism such that the overall activity throughout the brain remains higher than in the adult, but there is no longer an increase in activity (Chugani et al., 1987). It is believed that during this time, from the age of 4 to 9, there continues to be a slower overproduction of neuronal connections, and there is a very active cutting back of connections (Chugani, Phelps, & Mazziotta, 1989). The removal of inappropriate connections is likely associated with the establishment of specific rules by which neural connections are allowed to continue. If the connection that $1 + 2 = 3$ is correct, then other connections that might lead to $1 + 2 = 2$ and $1 + 2 = 4$ will be pruned away. In this manner, specific and possibly literal rules of behavior, language, emotion, and thought are

values and information become synthesized, which provides for a sense of identity and outlook. Conversely, this stage can also be characterized as conformist because one is tuned in to the expectations and judgments of significant others that can actually prevent the development of independent perspectives and provide less opportunity to examine individual beliefs and doctrines systematically. All of these factors impact the pruning process of the neuronal connections, establishing which will survive and which will fall away. As a result, the person's individual approach to life and various ideologies is beginning to solidify. Such a process also can result in defining differences among ideologies and the individuals who adhere to discrepant ideologies. This can lead to alienation and possible violence toward others if the environment is depriving and prone to scapegoating. This is where hatred and intergroup rivalries can emerge and where cults and powerful leaders can provide a safe and important context to nurture vulnerabilities relating to the need to conform. In particular, rituals that can activate the same biological mechanisms described above for spiritual experiences also can enhance a sense of unity among individuals adhering to the same ideology or myth (d'Aquili & Newberg, 1999). Thus, if the myth is embodied within a ritual, then the participants experience a sense of unity and a decrease in intragroup aggression. However, there is a subsequent increase in intergroup aggression toward those individuals and groups that are not participating in the same myth or ritual.

The initiating factor to the next stage is frequently the experience of leaving home or receiving more education, which precipitates the examination of self, values, and background that gives rise to the transition to the next stage. In addition to the establishment of the basic functionality of the brain as determined by the neuronal connections, this is also the stage in which the cognitive functions described in the previous section become fully established. The binary and causal functions, for example, are now fully operational and base that function, in part, upon the connections established between and within the brain structures subserving these functions. However, these functions have not

yet been used to their fullest extent to help the person examine beliefs and doctrines systematically. This appears to occur in the fourth stage.

Adulthood

While the focus of this book is on child and adolescent development, several issues pertaining to spiritual development into adulthood may help to demonstrate the full range of spiritual experience. The fourth stage that begins in adulthood is referred to by Fowler as the "individuated-reflective" stage. This stage occurs when there is an interruption of reliance on external sources of authority, usually during young adulthood but sometimes as late as age 30-40; it is a time when one begins to take responsibility for one's own choices, irrespective of what others feel. Neurophysiologically, this stage is associated with the full development of the cognitive and emotional processes that are now significantly more stable than in all of the previous stages. There are limited new connections and limited pruning (at least connections are in balance). Thus, the cognitive functions of the individual are operating for their first time in their full manner and can be brought to bear on all types of experiences and ideas (both internally and externally generated). The more mature functioning of the brain is likely associated with the ability to establish a well-defined identity and to imbue that self with a set of cognitive, affective, and behavioral processes that together help to define the self. The overall brain metabolism is highly stable as well, reflecting this overall mature stage of the human brain. In fact, the metabolism remains at this level until the end of the fourth decade of life. There is an ability at this stage to critically and objectively reflect on identity and outlook and translate symbols into concepts with deeper meanings. There is also the struggle for self-fulfillment as a primary concern versus service to and being for others and the question of being committed to the relative versus struggle with the possibility of an absolute.

Fowler refers to the fifth stage as "conjunctive faith" and it generally occurs at midlife.

At this stage the individual is ready for significant encounters with other traditions in a quest for meaning and value in life. As the individual gains access to various perspectives, each one will augment and correct aspects to eventually sort out the realest and truest ones. The end result is a reclaiming and reworking of one's identity and faith through understanding their own life and how it relates to humanity. Neurophysiologically, this stage is associated with a decrease in overall brain metabolic and neurotransmitter activity (Newberg & Alavi, 1997). This decrease begins around the age of 40 and slowly progresses throughout the remainder of the individual's life. This decrease, while unknown to the person, may reflect or at least contribute to the notion of disillusionment since the brain no longer appears to be able to find the answers it was striving so hard to find with its full complement of functions. As connections are lost, there may be a sense that the answers are slipping away, and that it is unlikely that they will be obtained on the present path. The self may also be perceived to be somewhat slipping away since the connections between the neurons subserving the self and the sensory and cognitive input become diminished. The result may be a concern that the self can no longer face the struggle to know and understand.

The last stage Fowler refers to is that of a "universalizing faith." In universalizing faith, there is a sense of unity between the self and the tenets of the individual's religious tradition. This may represent a sense of union of the self with God or ultimate reality. This union may result from various spiritual practices or experiences such as those described earlier in this chapter. In fact, this type of experience likely arises from the deafferentation of sensory and cognitive inputs into the association areas that subserve the orientation abilities of the brain. That there is already a concomitant decrease in overall neuronal function and interconnectedness may actually contribute to this type of experience typically occurring in older individuals. There may also be a notion of universalization across traditions, namely, that all faiths have similar perspectives and derive from a similar root. It is interesting to note that physiologically, the brain of an older individual begins to

decrease activity in the association areas similar to what is found in the infant brain. It is not a coincidence that individuals suffering from disorders such as Alzheimer's disease can actually have brain metabolic patterns that appear almost identical to that of an infant (Newberg & Alavi, 1996). The difference here is that such an experience is built upon the entire developmental basis of the individual as he or she progresses through the various stages.

CONCLUSIONS

Our purpose here has been to outline a neuropsychological developmental spirituality. This initial attempt at combining the phenomenological aspects of spiritual development with observed changes in brain function over the life span of the human being provides a hypothetical framework upon which to base future studies of normal and abnormal development. In particular, an updated phenomenological model of faith development is required. Although few models developed in recent years have had the same depth as those of Fowler's, with the advances in child development and pediatric neuropsychology, it is likely that future work can also address issues pertaining to the development of the sense of self, moral development, and concepts such as theory of mind. However, the purpose of this chapter was to provide a potential starting point with a relatively well-known and comprehensive account of spiritual development. Future work might also explore how tight the correlation is between neurophysiological changes in the brain and various elements of spiritual development. The ability to observe potential physiological and clinical sources of "abnormal" spiritual development may prove to be a valuable interface to begin to design interventions that may help prevent such problems from arising. Finally, it appears that there is a strong correlation between a number of the characteristics of spiritual development and the changing function of specific brain structures over time from infancy through adulthood. Thus, this developmental approach suggests a deep interconnection between neuropsychology and spirituality.

REFERENCES

- André-Thomas, C. Y., & Saint-Anne Dargassies, S. (1960). *The neurological examination of the infant*. London: Medical Advisory Committee of the National Spastics Society.
- Black, J. E. (1998). How a child builds its brain: Some lessons from animal studies of neural plasticity. *Preventive Medicine*, 27, 168-171.
- Bucke, R. M. (1961). *Cosmic consciousness*. Secaucus, NJ: Citadel Press.
- Chan, W. T. (1963). *The source book in Chinese philosophy*. Princeton, NJ: Princeton University Press.
- Chugani, H. T. (1992). Functional brain imaging in pediatrics. *Pediatric Clinics of North America*, 39, 777-799.
- Chugani, H. T., & Phelps, M. E. (1986). Maturation changes in cerebral function in infants determined by [18F]FDG positron emission tomography. *Science*, 231, 840-843.
- Chugani, H. T., Phelps, M. E., & Mazziotta, J. C. (1987). Positron emission tomography study of human brain functional development. *Annals of Neurology*, 22, 487-497.
- Chugani, H. T., Phelps, M. E., & Mazziotta, J. C. (1989). Metabolic assessment of functional maturation and neuronal plasticity in the human brain. In C. von Euler, H. Forsberg, & H. Lagercrantz (Eds.), *Neurobiology of early infant behavior* (pp. 323-330). New York: Stockton Press.
- Corby, J. C., Roth, W. T., Zarcone, V. P., & Kopell, B. S. (1978). Psychophysiological correlates of the practice of tantric yoga meditation. *Archives of General Psychiatry*, 35, 571-577.
- d'Aquili, E. G. (1978). The neurobiological bases of myth and concepts of deity. *Zygon*, 13, 257-275.
- d'Aquili, E. G. (1982). Senses of reality in science and religion. *Zygon*, 17, 361-384.
- d'Aquili, E. G. (1986). Myth, ritual, and the archetypal hypothesis: Does the dance generate the word? *Zygon*, 21, 141-160.
- d'Aquili, E. G., & Newberg, A. B. (1993). Religious and mystical states: A neuropsychological substrate. *Zygon*, 28, 177-200.
- d'Aquili, E. G., & Newberg, A. B. (1998). The neuropsychological basis of religion: Or why God won't go away. *Zygon*, 33, 187-201.
- d'Aquili, E. G., & Newberg, A. B. (1999). *The mystical mind: Probing the biology of religious experience*. Minneapolis, MN: Fortress Press.
- Fowler, J. W. (1981). *Stages of faith*. San Francisco: HarperCollins.
- Gardner, H., Silverman, J., Wapner, W., & Srief, E. (1978). The appreciation of antonymic contrasts in aphasia. *Brain and Language*, 6, 301-317.
- Gazzaniga, M. S. (2000). *The new cognitive neurosciences*. Cambridge, MA: MIT Press.
- Gazzaniga, M. S., & Miller, G. A. (1989). The recognition of antonymy by a language-enriched right hemisphere. *Journal of Cognitive Neuroscience*, 1, 187-193.
- Herzog, H., Lele, V. R., Kuwert, T., Langen, K.-J., Kops, E. R., & Feinendegen, L. E. (1990-91). Changed pattern of regional glucose metabolism during yoga meditative relaxation. *Neuropsychobiology*, 23, 182-187.
- Huttenlocher, P. R. (1979). Synaptic density in human frontal cortex: Developmental changes and effects of aging. *Brain Research*, 163, 195-205.
- Huttenlocher, P. R., & deCourcien, C. (1987). The development of synapses in striate cortex of man. *Human Neurobiology*, 6, 1-9.
- Jevning, R., Wallace, R. K., & Beidebach, M. (1992). The physiology of meditation: A review. A wakeful hypometabolic integrated response. *Neuroscience and Biobehavioral Reviews*, 16, 415-424.
- Joseph, R. (1996). *Neuropsychology, neuropsychiatry, and behavioral neurology*. Baltimore: Williams & Wilkins.
- Kellaway, P. (1979). An orderly approach to visual analysis: Parameters of the normal EEG in adults and children. In D. W. Klass & D. D. Daly (Eds.), *Current practice of clinical electroencephalography* (pp. 69-147). New York: Raven Press.
- Kennedy, C., & Sokoloff, L. (1957). An adaptation of the nitrous oxide method to the study of the cerebral circulation in children: Normal values for cerebral blood flow and cerebral metabolic rate in childhood. *Journal of Clinical Investigation*, 36, 1130.
- Kesterson, J. (1989). Metabolic rate, respiratory exchange ratio and apnea during meditation. *American Journal of Physiology*, R256, 632-638.
- Kuhn, C. M., & Schanberg, S. M. (1998). Responses to maternal separation: Mechanisms and mediators. *International Journal of Developmental Neuroscience*, 16, 261-270.
- Larson, D. B., Swyers, J. P., & McCullough, M. E. (1998). *Scientific research on spirituality and*

- health: A consensus report. Rockville, MD: National Institute of Healthcare Research.
- Lazar, S. W., Bush, G., Gollub, R. L., Fricchione, G. L., Khalsa, G., & Benson, H. (2000). Functional brain mapping of the relaxation response and meditation. *NeuroReport*, 11, 1581-1585.
- Maslow, A. H. (1970). *Religions, values, and peak experiences*. New York: Viking.
- Mills, L., & Rollman, G. B. (1980). Hemispheric asymmetry for auditory perception of temporal order. *Neuropsychologia*, 18, 41-47.
- Nebes, R. D., & Sperry, R. W. (1971). Hemispheric disconnection syndrome with cerebral birth injury in the dominant arm area. *Neuropsychologia*, 9, 249-259.
- Newberg, A. B., & Alavi, A. (1996). The study of the neurological disorders using positron emission tomography and single photon emission computed tomography. *Journal of the Neurological Sciences*, 135, 91-108.
- Newberg, A. B., & Alavi, A. (1997). Neuroimaging in the in vivo measurement of regional function in the aging brain. In S. U. Dani, A. Hori, & G. F. Walter (Eds.), *Principles of neural aging* (pp. 397-408). Amsterdam: Elsevier Science.
- Newberg, A. B., Alavi, A., Baime, M., Mozley, P. D., & d'Aquili, E. (2001). The measurement of regional cerebral blood flow during the complex cognitive task of meditation: A preliminary SPECT study. *Psychiatry Research: Neuroimaging*, 106, 113-122.
- Newberg, A. B., & Iversen, J. (2003). The neural basis of the complex mental task of meditation: Neurotransmitter and neurochemical considerations. *Medical Hypothesis*, 61, 282-291.
- Oser, F. K. (1991). The development of religious judgment. *New Directions for Child Development*, 52, 5-25.
- Otto, R. (1970). *The idea of the holy*. New York: Oxford University Press.
- Parmelee, A. H., & Sigman, M. D. (1983). Perinatal brain development and behavior. In M. Haith & J. Campos (Eds.), *Biology and infancy* (Vol. 2, pp. 95-155). New York: Wiley.
- Penfield, W., & Perot, P. (1963). The brain's record of auditory and visual experience. *Brain*, 86, 595-695.
- Piaget, J. (1932). *The moral judgment of the child*. London: Routledge & Kegan Paul.
- Pfibrum, K. H., & Luria, A. R. (1973). *Psychophysiology of the frontal lobes*. New York: Academic Press.
- Rolbin, S. B. (1985). The mystical quest: Experiences, goals, changes, and problems. *Dissertation Abstracts International*, 47, 940A-941A.
- Rowan, J. (1983). The real self and mystical experiences. *Journal of Humanistic Psychology*, 23, 9-27.
- Saver, J. L., & Rabin, J. (1997). The neural substrates of religious experience. *Journal of Neuropsychiatry and Clinical Neurosciences*, 9, 498-510.
- Schiavetto, A., Cortese, F., & Alain, C. (1999). Global and local processing of musical sequences: An event related brain potential study. *NeuroReport*, 10, 2467-2472.
- Schwartz, G. E., Davidson, R. J., & Maer, F. (1975). Right hemisphere lateralization for emotion in the human brain: Interactions with cognitions. *Science*, 190, 286-288.
- Smart, N. (1967). History of mysticism. In P. Edwards (Ed.), *Encyclopedia of philosophy* (pp. 419-428). London: Macmillan.
- Smart, N. (1969). *The religious experience of mankind*. London: Macmillan.
- Smart, N. (1978). Understanding religious experience. In S. Katz (Ed.), *Mysticism and philosophical analysis* (pp. 10-21). New York: Oxford University Press.
- Sperry, R. W., Gazzaniga, M. S., & Bogen, J. E. (1969). Interhemispheric relationships: The neo-cortical commissures; syndromes of hemisphere disconnection. In P. J. Vinken & C. W. Bruyn (Eds.), *Handbook of clinical neurology* (Vol. 4, pp. 273-290). Amsterdam: North Holland.
- Spilka, B., & McIntosh, D. N. (1996, August). *Religion and spirituality: The known and the unknown*. Paper presented at the annual meeting of the American Psychological Association, Toronto, Canada.
- Stace, W. T. (1961). *Mysticism and philosophy*. London: Macmillan.
- Sueng, F. (1978). Language and mystical awareness. In S. Katz (Ed.), *Mysticism and philosophical analysis* (pp. 141-169). New York: Oxford University Press.
- Sudsuang, R., Chentanez, V., & Veluvan, K. (1991). Effects of Buddhist meditation on serum cortisol and total protein levels, blood pressure, pulse rate, lung volume and reaction time. *Physiology and Behavior*, 50, 543-548.
- Swisher, L., & Hirsch, I. (1971). Brain damage and the ordering of two temporally successive stimuli. *Neuropsychologia*, 10, 137-152.

- Tamminen, K. (1994). Religious experiences in childhood and adolescence: A viewpoint of religious development between the ages of 7 and 20. *International Journal for the Psychology of Religion, 4*, 61-85.
- Valenstein, E. S. (1973). *Brain control: A critical examination of brain stimulation and psychosurgery*. New York: Wiley.
- Van Heertum, R. L., & Tikofsky, R. S. (Eds.). (1995). *Cerebral SPECT imaging*. New York: Raven Press.
- Worthington, E. L., McCallough, M. E., & Sandage, S. J. (1995). Empirical research on religion and psychotherapeutic processes and outcomes: A 10 year review and research prospectus. *Psychological Bulletin, 119*, 448-487.