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Linking to the Neuroscientific Revolution

Neuroscience is a missing link for social work. Neuroscience is the science of the brain or the science(s) of the nervous system(s). It is a missing link for human service specialists such as social workers, psychotherapists, psychologists, psychiatric nurses, educators, child care workers, and others who work with people. It is argued in this chapter that there are at least six reasons why human service professionals should embrace the missing link.

These six reasons (to which we'll return later) are as follows:

1. A neuroscientific revolution has occurred. Although this revolution may not provide all the answers, it needs to be acknowledged and understood.
2. Neuroscientific insights can be of immediate and direct benefit in improving our understanding of human behavior and practice.
3. The probability is that neuroscience over time will yield additional powerful insights, and we must be ready—intellectually, emotionally, and institutionally—to understand these developments.
4. Neuroscience is enhancing our understanding of what it is to be human; the relevance of this will depend on whether one's conception of social work is narrow or broad.
5. Neuroscience can help social workers and other human service professionals to cope with the increasing professional difficulties they face; clinical practice is becoming more difficult, as practitioners encounter an increasing complexity of human and societal problems and diagnoses.

6. Human service professionals should aspire to contribute to neuroscientific understanding by engaging more fully in cross-disciplinary study and by developing more comprehensive conceptualizations—the hallmark of social work intervention—of psychosocial adaptation.

A missing link is something, hitherto unknown, that is necessary to solve a problem, to complete a series. The link is often described as a missing item of knowledge that, when recognized and understood, explains how living entities have evolved from others. It can apply to all kinds of living entities such as flowering plants; it is more traditionally used in referring to hominid evolution. Just as the understanding of humans is incomplete without any such missing link or links, the understanding of human thinking, emotion, and behavior is similarly incomplete without including the insights from neuroscience. While biology alone is not destiny, the biological (i.e., the brain) dimension is crucial. While neuroscience does not provide the whole picture, and much remains to be discovered, it provides an important missing piece to our knowledge and understanding.

This book specifies a framework for human service professionals to understand, and to contribute to, the neurosciences. It also explains and illustrates the specifics of how the missing link can enhance specific therapeutic situations. Knowledge of brain sciences is necessary for human service professionals such as social workers, and this missing link will transform existing thinking and practices in important respects. As an example, our ability to work more effectively with those who have endured trauma is enhanced by new knowledge about the different types of memory and where they are located in the brain. Our understanding of autism has been enlarged by the very recent discovery of mirror neurons, which help to explain how an infant learns to be in relationships with others—a skill that appears deficient in persons with autism.

As an introduction, this chapter sketches the nature of neuroscience, suggests why human service disciplines should embrace the missing link, outlines social neuroscience, discusses four levels of social work interaction with social neuroscience, and indicates the contents of the remaining chapters. The levels of interaction with social neuroscience (each being discussed later) are as follows:

- advocating,
- fundamental understandings,
- policy-relevant understandings, and
- client practice-level understandings.

Linking

Why should social workers and other human service professionals embrace the missing link of neuroscience? Reconsider the six reasons just given.

Reason 1

The first reason is that the world is not as it was. There has been a neuroscientific revolution. Fundamental discoveries are clarifying the role of the brain in helping to shape and condition behavior, thought, and emotion (see Figure 1.1). We now have better understanding and opportunities for action about human functioning across the broadest range! The Decade of the Brain (1990-1999) and the Human Genome Project (1990-2003)—and other developments such as talk of the coming "neurosociety"—symbolize the importance of this neuroscientific revolution.

The Decade of the Brain had the aim, as noted in the presidential proclamation inaugurating the project, of enhancing "public awareness of the benefits to be derived from brain research" (Project on the Decade of the Brain, 2000). Authorizing the Decade of the Brain, the U.S. Senate Joint Resolution (1990) noted the scale of neuroscience's relevance, the relevance of neuroscience for particular disorders, and the potential for understanding human behavior and feelings in general. It also pointed to the fact that 15 of

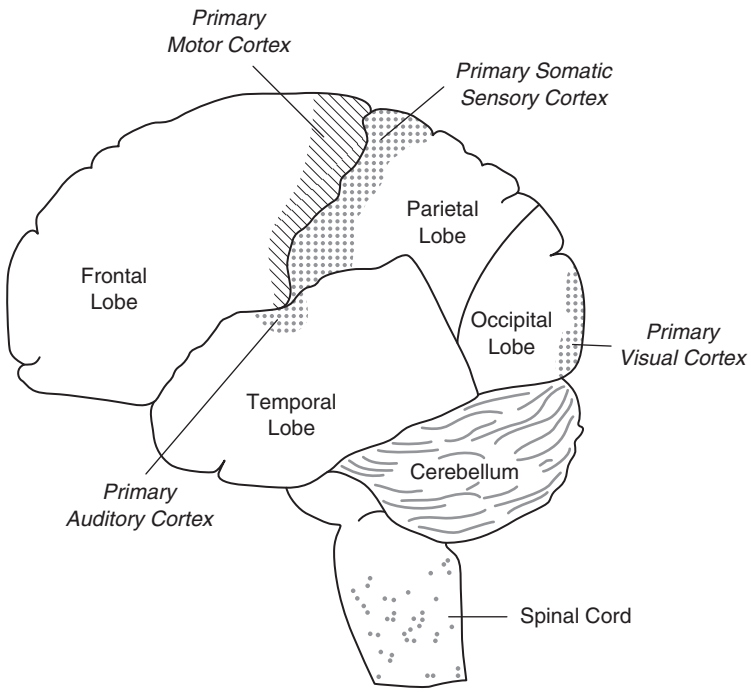

Figure 1.1 The Brain

the Nobel prizes in medicine or physiology over the past quarter century had been awarded to neuroscientists.

On a scale of relevance, the Congressional Resolution claimed that approximately 50 million Americans are affected by disorders and disabilities that involve the brain; that the treatment costs are $305 billion annually; and that the incidence of neurological, psychiatric, psychological, and cognitive disorders among older persons will increase as the number of older persons increases. On the relevance of neuroscience to particular disorders, the Congressional resolution picked out the significance of neuroscientific research for some forms of mental retardation; for inheritable neurological disorders like Huntington's disease and mental disorders like affective illnesses (with the hope that mapping biochemical circuitry will permit the rational design of potent medications, with minimal side effects); for Parkinson's, schizophrenia, and Alzheimer's disease. This is a shortened list; for instance, the Congressional resolution (U.S. Senate Joint Resolution, 1990) added another "whereas" clause to the effect that

> studies of the brain and central nervous system will contribute not only to the relief of neurological, psychiatric, psychological, and cognitive disorders, but also to the management of fertility and infertility, cardiovascular disease, infectious and parasitic diseases, developmental disabilities and immunological disorders, as well as to an understanding of behavioral factors that underlie the leading, preventable causes of death. (p. 2)

That was written in the 1990s, and the growth of research achievements since then has accelerated.

The Human Genome Project set out to identify all the genes in human DNA and to determine the sequences of the some 3 billion pairs of bases that constitute this DNA (see Figure 1.2). Like the Decade of the Brain, this project was administered by the U.S. government.

The Human Genome Project was completed in 2003. The scientific aims of the Human Genome Project were achieved 2 years before the scheduled deadline, including the unexpected finding that the human genome has only about 30,000 genes and not the 100,000 originally predicted. (It is also important to note that one third of the 30,000 human genes are expressed in the brain.) The project succeeded in identifying all the human DNA and in determining the sequences of pairs of bases that make up this DNA. A genome is the totality of an organism's DNA, and that includes the genes, which provide instructions that dictate the making of particular proteins. The proteins are important because they are said to determine the functioning and behavior of the organism. The genetic instructions are written in a four-letter code, which refers to bases or chemicals that are abbreviated as A, T, C, and G. The ordering of these bases is significant because it determines even whether the organism is human, which is of significant consequence. The Human Genome Project also had

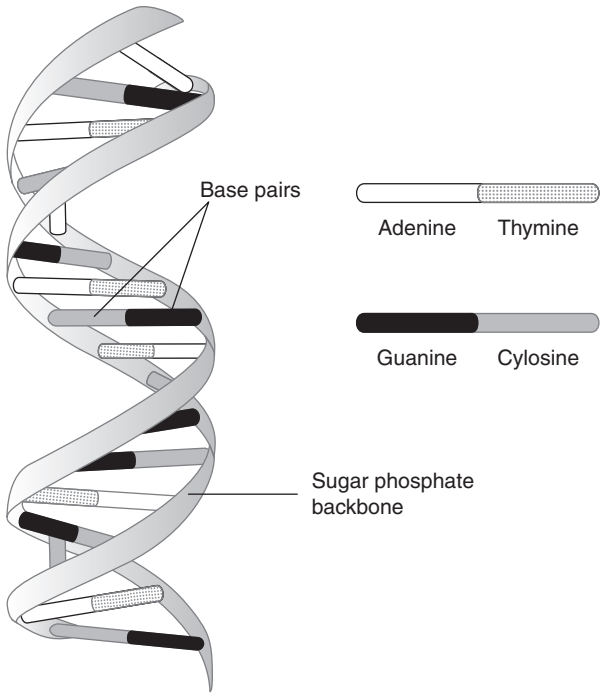

Figure 1.2 Double Helix

other objectives. One (which some might find regrettable) was transferring these technologies to the private sector, where financial gain may be more important than human benefit. Another was to address the ethical, legal, and social issues of the Project—called, in bureaucratese, the ELSI issues (also known as ethical, legal, and social issues).

Benefits from the results of the Human Genome Project in terms of molecular medicine have clear relevance for why social work should embrace the missing link. Claims have been made for improvements in molecular medicine in terms of better disease diagnosis; identification of genetic predispositions to particular diseases; gene therapy; and control systems for drugs, pharmacogenomic "custom drugs," and the rational drug design mentioned above (Oak Ridge National Laboratory, n.d.). Yet other benefits had less or no claim on social work attention (e.g., benefits for bioarchaeology and livestock breeding).

The coming neurosociety is another development symbolic of the neuroscience revolution. Restak (2006) is among those who forecast the arrival of a neurosociety, an example of other developments symbolizing the revolution: "During the first half of the twenty-first century our understanding of the

human brain will revolutionize how we think about ourselves and our interactions with other people. . . . What's more, our evolving knowledge about the brain has led to the new discipline of social neuroscience: the application of brain science to social interactions. This represents a dramatic break from our usual ways of looking at human behavior" (pp. 1-3). For social workers, who have always been keenly interested in human behavior, and for whom the *social* is paramount, this "brave new world" that Restak describes must be heeded. Social relationships and social support are often integral to the interventions social workers provide, and appreciating where in the brain (and how) the social takes place (e.g., how the right brain of the parent links up with the right brain of the infant) can enhance our ability to aid persons in their social interactions.

The Five Further Reasons for Embracing the Missing Link

Reason 2

The second reason for embracing the missing link, as noted earlier, is that neuroscientific insights can be of immediate and direct benefit in improving our understanding of human behavior and practice. Supplementing the examples from the Decade of the Brain and the Human Genome Project, the following chapters offer specific examples of the recent neuroscience research that affects our practice (e.g., the research that has used magnetic resonance imaging [MRI] to scan the living brain and provide answers to some of the mysteries of human behavior; and neurobiological findings related to work with children, adolescents, and their families, especially in the child welfare and school settings). The applications discussed are of both micro and macro relevance. Despite the adjectives *immediate* and *direct*, social work professional skill and ingenuity is needed in applying the insights in varying and specific situations.

Let's consider an example of what is immediately relevant. As we develop psychosocial assessments and plan interventions, we are always interested in the person's past and present behavior, some of which is usually causing the problems that result in the person seeing a social worker or another human service professional. Although we have routinely looked at the psychological and the social aspects of behavior, we have paid scant attention to the biological aspects. The neurosciences provide some of the missing biological data that we need to perform fuller and more meaningful bio-psycho-social-spiritual assessments. Instead of merely listing gender, race, age, and so forth in the biological section, we can now add biological risk factors such as trauma and attachment difficulties. As we increase our understandings of problems that adversely affect the brain and nervous system, we are better prepared to provide remedies and/or management strategies for chronic and unremitting problems.

Reason 3

Reason 3—that neuroscience over time will yield additional insights—suggests that social workers should prepare themselves for this. Chapter 3 offers the transactional model, which focuses on the biological/psychological/social/ spiritual domains of human behavior. It is suggested that this model will aid in our intellectual and emotional preparation for the insights to come. Beyond this, there is the matter of institutional openness and to changed ways of thinking and knowing. For example, in several of my published works and professional presentations, I have attempted to present basic psychopharmacology knowledge for all human service professionals, not just those who work in the area of mental health. This content has been well received, though usually questioned as to why those who work in school and social service settings need to know this information. The world of practice is not as neatly dichotomized as it was in the past, so that school social workers and child welfare workers (as well as social workers in mental health) need to know about psychotropic medications and findings that add to our knowledge about which medications work for whom. They need to be alert to future findings, because inevitably there will be even more helpful data to share.

Reason 4

The fourth reason for embracing the Missing Link is that neuroscience has contributed—and will continue to contribute—to a better understanding of what it is to be human. Social workers have always been interested in human behavior, and in fact, all professionally educated social workers take at least several human behavior and social environment courses. Yet, what appears relevant in this respect depends on whether one's conception of social work is narrow or broad. Members of practice-oriented disciplines such as social work, counseling, and nursing typically face the dilemma of how to broaden their perspective beyond what has traditionally seemed to work, beyond the little fiefdoms that make up traditional social work and the other traditional subdivisions of the human service spectrum. For a discipline such as social work, which is grounded in human behavior, such insights as are available from neuroscience on the intricacies of brain function are significant. More than neuroscientific insights and data are needed for some issues, of course. For instance, there's the matter of mind, which needs the input not only of Neuroscience but also of Philosophy of Mind. With that proviso, it is helpful to learn more about the brain and the mind through neuroscience and analyze how these two constructs are related and interact. Is the mind an expression of the functioning of the brain, as some believe (Kandel, 1979), or can the mind be seen as being "at the interface of interpersonal experience and the structure and function of the brain," as Siegel (1999, p. 3) proposes? For

example, what does it mean when someone says "she is out of her mind" or "he is not in his right mind?"

Reason 5

The fifth reason for embracing the missing link is that neuroscience can help social workers and other human service professionals manage the increasing difficulties that they face as practitioners. The job is becoming more complicated, as practitioners encounter the challenges of multiple problems and diagnoses and work in an increasingly complex and stressful world. Often, we feel less than confident in our ability to help ameliorate these problems. Whereas the social worker of three decades ago might encounter a client with 1 diagnosis and 10 problems, now it is just as likely to have a client with 5 diagnoses and 30 problems. One of my own clients, for instance, suffers from Attention Deficit Hyperactivity Disorder (ADHD), depression, anorexia, bipolar disorder, and personality disorder. Knowing about the brain and its influence on all bodily functions, as well as the psychological, social, and spiritual aspects of a person, helps to provide a fuller conceptualization of the challenges being faced by this person and how to recognize and use all of the person's strengths. It is true that overdiagnosing may now be more prevalent, but it is unlikely to account for the totality of the increase nowadays in complexity. This increasing complexity is also recognized in the literature (e.g., Farmer, Bentley, & Walsh, 2006). Neuroscience can help us to understand the etiology of such complexity and therefore how better to intervene.

Reason 6

The sixth reason is that social workers should aspire to contribute to neuroscientific understanding; we are equipped to do this. The example given above was to engage more fully in cross-disciplinary study and to develop more comprehensive understanding of psycho-social adaptation. This will seem strange to some social workers, as neuroscience is conceptualized as hard science. Despite social work's century-long quest to be considered as a scientifically based discipline and the inclusion of quantitative approaches (as well as qualitative), most social workers enter their profession because they are less than totally enamored of "hard science" and more interested in the human sciences. The transactional model, just mentioned and as discussed in chapter 3, suggests an approach for holistic social work contributions. Supplementing that, perhaps we can learn from those in psychology (and in social science disciplines) who have expressed research interest in social neuroscience. Daniel Siegel, a child psychiatrist who is considered to be an expert on the neurobiology of childhood attachment, and whose writings and presentations bridge the gap between neuroscience research and clinical practice, refers to the social nature of the brain. For Siegel (1999), this means that social relationships (via

attachment) are necessary for the development of the brain, and social experiences of the developing child determine how neurons connect to each other. Social workers and other human service professionals, who frequently deal with the social dimension of their clients' lives, have not traditionally considered the social as having anything to do with the brain. Others are talking about social neuroscience, and we should turn toward it also.

Is the embrace of the missing link optional for social work professionals who want to achieve effective results? I think not. I'm saying this because I would not want these six reasons for linking to be seen as mere advantages that can be taken or left. The neuroscientific revolution, properly interpreted, is real and here to stay, and we need to be engaged in it.

What's Neuroscience, in a Nutshell?

Today, the neurosciences comprise a broad array of disciplines that are focused on understanding the brain and the nervous system, and they are critical links in advancing understanding of human thought, emotion, and behavior. In other words, neuroscience is an interdisciplinary undertaking that operates at several levels (i.e., the molecular, the cellular, the systemic, the behavioral, and the cognitive). The molecular level is the most elementary and includes the many different molecules that make up brain matter and "play many different roles that are crucial for brain function" (Bear, Connors, & Paradiso, 2007, p. 13). The cellular level concerns neurons; the different types of neurons, their functions, and how they become "wired together." The systemic level is about distinct brain circuits that are formed from groups of neurons and perform a specific function (e.g., visual or motor). The behavioral level describes how specific neural systems work in concert to produce integrated behaviors. The most complex level of analysis, the cognitive, is concerned with neural mechanisms that mediate higher forms of mental activity, such as self-awareness and language. Although the term is defined in different ways (e.g., study of the brain, study of the nervous system, the latter including not only the central nervous system of brain and spinal cord but also the peripheral nervous system), neuroscience includes study of how the brain and nervous system(s) mediate thinking, behavior, and feelings.

Neuroscience encompasses a large variety of specialties. Experimental neuroscientists, for example, include developmental neurobiologists (they analyze the development and maturation of the brain), molecular neurobiologists (they use the genetic material of neurons to understand structure and function of brain molecules), computational neuroscientists (who use mathematics and computers to develop models of brain functions), neuroanatomists (who study the structure of the nervous system), neuroethologists (they study the neural basis of specific animal behaviors), neurochemists (they study the chemistry of the nervous system), neurophysiologists (they

measure the electrical activity in the nervous system), neuropharmacologists (who examine the effects of drugs on the nervous system), psychophysicists (who measure perceptual abilities quantitatively), and physiological psychologists (who study the biological basis of behavior). Others include clinical specialists such as neuropathologists (they find changes in nervous system tissue that result from disease), neurosurgeons (perform surgery on the brain and spinal cord), psychiatrists (physicians who diagnose and treat mental disorders), and neurologists (physicians who diagnose and treat diseases of the nervous system).

Choice of a beginning date for neuroscience can be disputed, as for many other subjects. Some might want to choose an event in ancient history, perhaps tipping one's hat to Herodotus and Galen. A more promising choice is the 17th century, following the contribution of Rene Descartes—physiologist as well as philosopher and mathematician. Important advances were made in subsequent years. In the 19th century, for instance, Paul Broca and others provided evidence of the localization of functions in different parts of the brain; and Charles Darwin spoke to the evolution of nervous systems. In 1906, as another example, Camillo Golgi and Santiago Ramon y Cajal won the Nobel Prize for medicine and physiology: Golgi's staining technique led to a reconceptualization of the brain as composed of different cellular elements. The Golgi technique is still used today.

The term *neuroscience* itself came into use in the late 1950s and became more widely accepted in the early 1960s as the Neurosciences Research Program was developed at the Massachusetts Institute of Technology. In 1969, as the Society for Neuroscience was founded, the field became firmly established within the academic discipline of Life Sciences. Attendance at the Society for Neuroscience's annual conference now exceeds 30,000, a large increase over the 1,396 attendees in 1971.

Social Neuroscience

It is recommended that social workers particularly focus on social neuroscience. This involvement would not, of course, preclude engagement in the activity of other "basic science" levels of neuroscience. Although social neuroscience is currently ensconced mainly within the field of psychology (the 2005 Conference of the American Psychological Society featured a keynote address on the social brain), social work also can benefit from engaging social neuroscience. After all, to date we have made extensive use of concepts and theories from psychology to enhance our psychosocial perspective, so in some ways, this will be a natural extension of our theoretical frame of reference.

What is social neuroscience? At what levels of understanding should the interaction between social work and social neuroscience take place? (i.e., what levels of linkage?)

What Is Social Neuroscience?

The term *social neuroscience* was introduced in 1992 to describe a field of research—or set of fields—using social and biological levels of analysis (Cacioppo & Berntson, 1992). It is an emerging field that studies links between social processes and neurosciences. It analyzes concepts and ideas from the neural to the social level (Ito & Cacioppo, 2001). Because there is such an assortment of study areas, I use the term *social neuroscience* here in a symbolic sense to refer to a variety of disciplinary titles, including cognitive neuroscience, affective neuroscience, neuropsychology, and neuropsychiatry—as well as social neuroscience. The assortment goes on, each specialty with its own journals and literature. Generally, social neuroscience is concerned with the neurological features associated with the processes that have traditionally been studied in social psychology, and it is closely related to cognitive neuroscience and affective neuroscience.

Social workers and other human service professionals, who frequently deal with the social dimension of their clients' lives, have not traditionally considered the social as having anything to do with the brain. As psychosocial practitioners, we have been remiss in that we have not fully appreciated the significance of the bio-social aspects of development. Our nonmedical background makes it unlikely that we will ever be specialists in the area of neuroscience, but social aspects of human behavior have always been a large part of the social work approach to human problems.

The current objective of social neuroscience is to understand the relationship between the brain and social interaction. *Social neuroscience* has been defined as "the exploration of the neurological underpinnings of the processes traditionally examined by, but not limited to, social psychology" (Decety & Keenan, 2006). In their introduction to the first issue of their new journal specifically intended to disseminate research and ideas on social neuroscience, editor Decety and deputy editor Keenan explained that

> [in] the past decade a new and exciting academic domain has expanded to scientifically explore the biological mechanisms of social interaction. This rapid growth is reflected in various ways, including new graduate programs, handbooks . . . textbooks . . . as well as special issues of different journals.

Decety and Keenan (2006) went on to declare that, "with roots in many disciplines, including but not limited to neuroscience, social psychology, developmental science, economics, and cognitive psychology, social neuroscience has come of age" (p. 1). It is interesting to note that social neuroscience as an academic domain has expanded to include the biological aspects of social interaction only during the past 10 years.

It is perhaps unfortunate—and I agree—that descriptions of social neuroscience should speak in terms of "underpinnings." That gives the unnecessary impression that the biological component is the more fundamental. Yet it is

natural, if regrettable, overenthusiasm, especially when neurobiological findings are providing catalytic changes in existing disciplines. The academic activity in the "new" field is impressive. Using stock market terminology, it is a growth discipline.

Decety and Keenan (2006) are referring to what I call an "assortment of disciplines." Social work is implicated in some of these, and we might consider the impact on the disciplines close to social work. Take the clinical example. Social workers have always looked toward the medical profession, and during the 20th century, we closely identified with physicians and psychiatrists, and alternatively have attempted to disassociate ourselves from the tenets of the medical model. During the 1920s and 1930s, psychiatry in the United States became increasingly influenced by psychoanalysis, and many social workers who worked with psychiatrists were also influenced by the emerging field of psychoanalysis. More recently, psychoanalysts are being influenced by research findings from the neurosciences. There is a bridging of the former divide between biological psychiatry (somatic treatments) and psychoanalytic practitioners (the psychological). The term *neuropsychoanalysis* is now being used to describe the integration of mind and brain and to appreciate the possible connection between some of Freud's ideas and those of modern neuroscience (Altman, 2003; Solms, 2000; Wolfe, 2003).

In speaking of social neuroscience, I am using the term in a generic sense rather than a bureaucratic sense of endorsing a particular institution. I do not intend to exclude variations and overlappings that sometimes go by different names. For instance, some have spoken of social cognitive neuroscience, which seeks to understand human behaviors and attitudes by involving neuroscientists with social psychologists, cognitive psychologists, anthropologists, neurologists, sociologists, and others. Social cognitive neuroscience has also been described as—repeating the metaphor—"a really hot growth area" (see Azar, 2002; Ochsner & Lieberman, 2001).

Levels of Linkage

At what levels should we interact? I discuss here four levels of interaction between social work and social neuroscience, those listed earlier in this chapter. Significant social work benefits accrue from social neuroscience in terms of the following levels:

Level 1: advocating neuroscientific research issues of greatest relevance to social work clients

Level 2: participating in identifying fundamental understandings

Level 3: developing neuroscientifically informed understandings relevant to making recommendations on policy making

Level 4: deepening understandings, also neuroscientifically informed, that will help in coping with the serious problems that clients bring

The four levels are not offered as separate and distinct; they interweave and the categories are deconstructible. For example, the most general of the levels also relates to, and overlaps with, the least general. Also, the examples operate at several of the levels. The intention in describing the four levels is merely to indicate the range of possibilities for interactions between social work and social neuroscience.

Social workers approaching social neuroscience can apply their own methods at each of these levels, such as case studies. Decety and Keenan (2006) point to the value of human case studies, for example, observing the relationship between social behavior and neurological systems. The case study has long been an important tool used in social work. Recall that Sigmund Freud relied heavily on human case studies, and he (who wanted to be a biologically based physician) has been a model for social workers for the past century. Freud developed conclusions in his case studies not only for the particular patient but also—in his profound theorizing—for human behavior in general.

An example of how different levels of analysis are integrated in the field of social neuroscience can be seen in the study of drug abuse and addiction. Using the biological level of analysis as defined earlier, data about the opiate system in the brain are studied, and this includes information about how drugs lead to opiate receptor changes, which ultimately contribute to drug tolerance and addiction. From the social level of analysis, researchers look at the social context of the individual who is using the drug (i.e., economics, opportunity, peer-group influences, and family dynamics). By looking at this problem through a lens of multiple determinism, a much richer analysis and eventual understanding ensues.

Level 1: Advocating neuroscience research questions. Some scientific research questions are of greater relevance than other questions to social work clients, and social workers should accept this traditional advocacy role—for the benefit of our clients—in relation to the neuroscientific revolution. Examples are suggested in the following chapters and include the areas of trauma, psychotherapy, and psychotropic medications. As an example, how can new knowledge about the developing brain during childhood help us to find more effective psychosocial interventions for children with ADHD and other biobehavioral disorders?

Other neuro–social-science disciplines accept this advocacy role for themselves. Both those involved in neuroeconomics and neuro–political-science, for example, attempt a two-way relationship with neuroscience. The 2006 Fourth Annual Conference of the Neuroeconomics Society set up its agenda on this two-directional basis. Neuroeconomics seeks understandings from neuroscience; it also aims to offer neuroscience sounder mathematical understandings. Glimcher (2003) describes neuroscience as failing to adequately incorporate probability theory in his book subtitled *The Science of Neuroeconomics:* "Mathematical theories of decision making that include probability theory must form the core of future approaches to understanding the relationship between

behavior and brain, because understanding the relationship between behavior and brain is fundamentally about understanding decision making" (pp. 177-178). From neuroscience, neuro–political-scientists seek information on topics such as decision making, motivation, emotion, and stereotyping. In the other direction, some neuro–political-scientists want to shape the choice of research questions (e.g., focusing on the political). For example, the 2006 Annual Meeting of the American Society of Political Science contained a panel on "neuroscientific advances in the study of political science" (Alford, 2006), including significant topics such as the neurological basis of representative democracy (Hibbing & Alford, 2006), neuroscience and analytical narratives (Schiemann, 2006), and considerations on the neuroscience of power (Valk & Parisi, 2006). A few neuro–political-scientists even work directly with functional magnetic resonance imaging (imaging the workings of the living brain); they aren't limited to passive using. I mention this only because it is suggestive of the range of the interest (Alford, 2006) in using neuroscience understandings and methodologies among disciplines that have not traditionally been allied with the neurosciences.

Level 2: Fundamental understandings. At this most general level, social workers can benefit from participating in identifying fundamental insights about human behavior, thinking, and emotions. As one example, there is the question of the meaning—the implications—of a neuroscientific view that we are emotional beings who think, rather than thinking beings who have emotions (e.g., see LeDoux, 1996). Barring brain injury or malformation, a human nonemotional moment is a fiction. As Restak (2006) puts it, "Neuroscience is suggesting here that we must change our ideas about reason, rationality, and what it means to be emotional. . . . Thinking and emotionality are inextricably intertwined" (pp. 51-52). We might also consider the neuroscientific views about the brain's sensory systems being "narcissistic" (e.g., see Atkins, 1996), and about the brain being wired to lie in, for instance, the anterior cingulate gyrus (e.g., see Tancredi, 2005, pp. 119-121). What does this mean for purely rational, purely objective judgments? Social workers have access to large numbers of clients, often over long periods of time, and this puts us in an ideal position to study thinking and emotions, and their interconnections, among various persons. Other examples might include the relation of genes to behavior and the realignment of conceptual frameworks in terms of neural signatures.

Social neuroscience includes tracking the neural signatures of human behavior, thoughts, and feelings. This tracking concerns, for instance, "sophisticated mental states such as truth versus lie, veridical versus false memory, style of moral reasoning or the likelihood of aggressive behavior" (Decety & Keenan, 2006, p. 6). In schizophrenia research, neural tracking has been used extensively (via MRI and function MRI [fMRI] brain scans) to decipher the structural and functional brain abnormalities that exist in this illness. With regard to schizophrenia, enlarged ventricles (fluid-filled cavities in the brain)

and cortical atrophy (signifying loss of neurons) are found in the brains of some persons with schizophrenia and can be considered neural correlates of this illness. Farmer and Pandurangi (1997) used magnetic resonance imaging and CT scans to compare two groups of persons with schizophrenia, those with and those without brain impairment. Their study adds support for the deconstruction of the concept of schizophrenia, suggesting that it is not best understood as a unitary concept—the way that the concept has been constructed. Rather, schizophrenia is described as a heterogeneous illness. In other words, not everyone with schizophrenia looks or acts the same, and the brains of persons with schizophrenia do not look the same on scans (structural or functional anomalies may or may not be seen). In recent years, researchers have investigated the neural correlates (i.e., neural signatures) of bilingualism, self-consciousness, and autobiographical memory. Another example is a study by Krendl, Macrae, Kelley, Fugelsang, and Heatherton (2006) that investigated the functional anatomic correlates (e.g., amygdala, insula, anterior cingulate, and lateral prefrontal cortex) related to how judgments are formed about those who have characteristics known to be stigmatizing (e.g., obesity, facial piercing, transsexuality, and unattractiveness). This study provides a beginning understanding of the neural underpinnings of stigma. Another study (Haas, Omura, Amin, Constable, & Canli, 2006) examined the temporal dynamics of networks of structures associated with particular personality traits. Still other studies concern the visual analysis of human actions (Chouchourelou, Matsuka, Harber, & Shiffrar, 2006) and self-related processing in the sexual domain (Heinzel et al., 2006). Relevant concerns are also reflected in "the basic premise behind" social cognitive neuroscience. Azar (2002) describes this premise as infusing "social psychology with brain science methodology in the hopes of deciphering how the brain controls such cognitive processes as memory and attention, which then influence social behaviors such as stereotyping, emotions, attitudes and self-control."

Social workers should be equipped to collaborate appropriately with others who are also concerned with such fundamental understandings. For example, neurophilosophy applies neuroscienctific concepts to traditional philosophical questions. An example of an exciting neurophilosophical issue is the nature of a unified self. Social workers have been involved with self psychology since the 1970s, when Heinz Kohut began to formulate this new theory about what is required for the development of a cohesive self. Several social work clinicians in the Chicago area have been closely involved with the ongoing development of this theory (Elson, 1986; Palombo, 1985). Other examples include the nature of psychological states (e.g., emotions, beliefs, and desires) and of perceptual knowledge. Neurophilosophy is usually distinguished from philosophy of neuroscience. The latter is concerned with foundational issues in neuroscience (e.g., descriptive, normative, and constructive questions about the nature of neuroscientific explanations). The exchange between neuroscience and philosophy, in an ideal world, thus would be bidirectional—the same ideal as

intended in the neuropolitical and neuroeconomic (e.g., see Churchland, 1986, 2002).

Level 3: Policy-relevant understandings. The more familiar—and less general—level of understanding would include using thoughtful neuroscientific results as part of "considered policy making around controversial issues" (Decety & Keenan, 2006, p. 6), offering "new perspectives and tools for policymakers willing to use them." Decety and Keenan use addiction as their example, and that is a topic discussed in chapter 7, where we consider addiction as a brain-based mental illness. In this vein, it could be argued that more resources are needed for treatment of persons who become biologically addicted to a substance than for the building and maintenance of prisons. For other examples, there is the mass of social and political issues that result from completion of the Human Genome Project, noted above.

Social workers should be well placed to understand policy-relevant issues in the post–genomic age—the period after completion of the Human Genome Project. The ELSI program within the Human Genome Project identified some nine areas that raise social concerns (U.S. Department of Energy, n.d.); I include only some as examples of policy-relevant areas as follows:

- Fairness, privacy, and confidentiality in the use of genetic information are concerns, and this includes concerns about genetic discrimination in insurance coverage and in the workplace. Social workers should be able to advise and advocate for clients on questions such as who should have access to personal genetic information and who owns and controls genetic information; for instance, how should such information be used, if at all, by the courts, schools, and adoption agencies?
- Psychological impact and stigmatization is another set of questions raised by the ELSI program. Social workers are in a good position to be able to advise on how genetic information affects society's perceptions of an individual, how genetic information affects individuals who are members of minority communities, and how to assist clients in managing stigma when it does occur.
- Another issue is the use of genetic information in reproductive decisions and reproductive rights (e.g., about the risks and limitations of genetic technology).
- The uncertainties associated with gene tests constitute another area. For example, there is the issue of whether genetic testing should be performed when no treatment is available and whether minor children should be tested for adult-onset diseases. Again, these are all issues that social workers need to be prepared to help their clients address.

Level 4: Client practice-level understandings. More specific would be the benefits of neuroscientific findings for purposes such as working with clients with dysfunctional human bonding or relationship issues associated with, for example, impulsivity in decision making (or judgment). Examples include decision making involving antisocial behaviors, couple relationships, and

certain medical afflictions. Social workers have historically worked with persons who experience environmental deprivations as well as serious emotional and psychiatric problems, and social neuroscience is a resource for such work. The relevance and scope here is suggested in a discussion by Fisher, Aron, and Mashek (2002) concerning three primary emotion-motivation systems that have evolved in the brains of mammals and birds for mating, reproduction, and parenting. It argues that each system is associated with neural correlates and behavior repertoire. The study claims that the evolution of these emotion-motivation systems "contribute to contemporary patterns of marriage, adultery, divorce, remarriage, stalking, homicide and other crimes of passion, and clinical depression due to romantic rejection" (Fisher et al., 2002, p. 416). Neuroscientific explanations are also relevant for social workers concerned with the criminal justice system. Antisocial behavior and day-to-day impulsivity attitudes are frequently studied in connection with criminal behavior, and knowledge gained from these studies would be useful to those who work with criminal offenders.

There is a neurobiological component in impulsivity and antisociality, to be sure. As an example of the relevance of neuroscientific factors, prefrontal lobe abnormalities are among other biological factors implicated (Bechara & Bar-On, 2006). Studies have shown that low levels of serotonin are associated with impulsive and aggressive behaviors, also perhaps associated with depression. Persons who have low levels of serotonin are impulsive in the sense that they have little regard for the longer term consequences of their actions. They are aggressive in that there might be violence against others or, in the form of suicide, against the person himself or herself. The mechanism of serotonin is not completely understood currently, as the reader might expect.

There is a strong genetic component to antisocial behavior. Although warning against "genetic etiology," Lisa Cohen (2005) points to this component and reports that estimates of the genetic contribution range from a low of about a third (compared with other "environmental" components) to a high of almost 70%. Among the many issues that Cohen discusses is that "animal research and studies of healthy humans also point to potential lines of investigation, specifically into the relationship between oxytocin, vasopressin and the reward circuitry as well as the integration of cortico-limbic circuitry in antisocial individuals" (p. 118).

Also at this more specific level, neuroscientific findings have relevance for social work and all clinical practice with a large number of persons with specific illnesses. These understandings can be used for all kinds of interventions. Consider some kinds of mental retardation and recall the role that impoverished environments play in some cases. There can be a failure of normal circuits to form in the brain as associated with mental retardation. It has also been established that normal synaptic development, including dendritic spines, depends on a rich early environment. Examples of other particular illnesses include eating disorders, depression, posttraumatic stress disorder (PTSD),

Alzheimer's, phobia, Tourette's syndrome, and autism—a disorder characterized by "deviant reciprocal social interaction, delayed and aberrant communication skills, and a restricted repertoire of activities and interests" (Sadock & Sadock, 2003, p. 1208). All of these disorders have been found to involve various problems in brain structure and/or function.

Engaging social neuroscience will lead to better understandings at the advocacy, the fundamental, the policy-making, and the day-to-day practice levels. Yet mental health professionals encountering social neuroscience should not request a menu of what to do and how to do it; they should be open to the uncomfortable, the unfamiliar, and the less-than-certain.

Book Contents

Themes

This book has two main themes: (1) presentation of selected neuroscience research findings in areas critical to social work and other human service professions, specifying why this knowledge is important for practicing clinicians and indicating how these findings can influence the development of neuroscience; and (2) use of the transactional model as the conceptual framework for incorporating neuroscientific knowledge into clinical practice.

Chapter-by-Chapter Outline

Chapter 1: Linking to the Neuroscientific Revolution

Why should social workers and other human service professionals embrace the missing link? Linkage with social neuroscience is recommended. Neuroscience and social neuroscience are outlined. Reasons for linking with the neuroscientific revolution are discussed, and four levels of linkage with social neuroscience are indicated.

Chapter 2: A Tour of the Brain

What brain basics should a social worker know when beginning to engage in neuroscience? Selected characteristics, functions, and "geographical" features are discussed.

Chapter 3: Neuroscience as Link: Transactional Model

How can social work and other human service disciplines best understand and contribute to the research findings of the neurosciences? Enter the transactional model, which provides the conceptual framework for using this

new neuroscientific knowledge in social work and other disciplines. While we must be knowledgeable about the latest research findings from the neurosciences, I argue that biology alone is not destiny, and that we err if we get caught up in the biological determinism that findings from the "Decade of the Brain" compel us toward. The Transactional Model can serve as the framework for understanding and applying the latest neuroscience research findings to practice situations and for social work contributing to the development of social neuroscience.

Chapter 4: Linking to Social Work: Attaching and Bonding

How can neuroscientific research help in improving the understanding of attachment theory and human bonding in general? Social workers have historically worked with persons who experience environmental deprivations as well as serious emotional and psychiatric problems. As suggested earlier, we, and other mental health professionals, have recently been finding that clients have more intransigent and multiple problems and diagnoses. I suggest that recent neuroscience research provides some of the biological information that is necessary for understanding the etiology of these problems and how to intervene. It also presents us with the challenge of complexity in understanding human bonding in general.

Chapter 5: Linking to Social Work: Trauma

What is the relevance of neurobiological findings to work with children and adults who have been traumatized? To increase their reliance on science-based explanations, social workers should study trauma in the light of three main understandings. First, social workers should examine trauma within a neurodevelopmental perspective, seeking explanations in terms of the growth and functioning of the brain. Second, they should recognize that the biological is important but not "the" decisive determinant, as can be illustrated by considering the significance of a social or other dimension like that of the caretaker in childhood. Third, the social worker has an advocacy role, especially in identifying and arguing for the kind of neuroscientific research questions that he or she considers most relevant to the challenge of living.

Chapter 6: Linking to Social Work: Psychotherapy

How does neuroscience research fit or clash with psychotherapy? Neuroscience promises to transform both psychotherapeutic understandings and the practice of psychotherapy; it promises to enrich understanding and practice in clinical social work. Matters of understanding and of practice are considered. The first section discusses understanding, beginning with the dualism of mind and

brain, the neurobiology of psychotherapy, and the relevance to clinical social work. For example, it is indicated why understanding will be deepened over time as the artificial and counterproductive character of the distinction between mind and brain is increasingly recognized in terms of treating mental illness. The second section examines promising neurobiological models for psychotherapeutic practice that use neuroscience results in terms of neural growth and integration; and results are demonstrated for such conditions as PTSD. It illustrates the practice significance of recognizing neural substrates of psychotherapeutic change. It discusses the practice relevance of the therapeutic relationship in terms of mirror neurons. Practice comments are illustrated with four case studies. The third section invites social work to embrace the opportunities proactively and realistically.

Chapter 7: Linking to Social Work: Medications and Drugs

How can neuroscience research help social workers and others intervene with persons who take prescribed psychotropic medications and those who are drug dependent and drug abusing?

During the past quarter century, we have seen the emergence of many new psychotropic medications, some of which have a more benign side effect profile than the older drugs. Since the early 1990s, it has been observed that there exist ethnic and individual differences in drug response; but as a result of the findings of the Human Genome Project, we now have some hard data to corroborate and explain these observations. This chapter reviews the main findings of this developing research, so that social workers and other human service professionals can become knowledgeable about differing medication response among African Americans, Asians, Hispanics, and women. Because we work with persons from these different ethnic and gender groups who use psychotropics, it behooves us to know about these differences so that we can facilitate medication management activities

In the second section, the focus is on the brain's pleasure circuit (the mesolimbic dopamine pathway) and its relationship to drugs of abuse. Enter neuroscience research to describe the processes of drug addiction, craving, and tolerance. Although the biological basis of drug use has become more widely accepted, there remains much stigma. To help lift the stigma, while providing more accurate knowledge, social workers and other practitioners need a better appreciation of what actually happens biologically when a person ingests a substance, why the substance use begins, and why it is so difficult to stop. This chapter also speaks to why substance use is such a challenging problem in our society. The transactional model is revisited, with specific application to medications that help and drugs that hurt.

Turn now to a tour of the brain.