This clear and accessible guide—written by social workers for social workers—describes the most current developments in neuroscience and their practical applications for social work in education, child welfare, health, mental health, and criminal justice settings. The contributions of social work experts in these key areas of practice make this vast and ever-expanding body of neuroscientific knowledge easily understandable, with specific relevance to understanding the impact of the environment on neural mechanisms and human life course trajectories.

The text examines how neuroimaging can be used to examine psychosocial treatment efficacy, discusses cross-system programmatic and policy implications that respond to the way in which toxic environments and early disrupted attachment affect brain and behavior, and addresses the importance of bioethics to inform the integration of neuroscience into social work practice.

This is the only text on this topic with chapters organized around five practice settings and embedded with application skills across micro, mezzo, and macro levels. Each chapter includes an overview of the latest scientific research pertaining to the topic and discusses implications for assessment, prevention, intervention, policy, research, and ethics. Real-world case studies in each chapter enhance practice applications.

Key Features:
- Describes the latest applications of neuroscience across social work settings in education, child welfare, health, mental health, and criminal justice
- Examines latest neuroscientific research for each topic and its implications for assessment, prevention, intervention, policy issues, research, and ethical/legal issues
- Draws clear practical implications in each chapter
- Written by social workers for social workers
- Includes the contributions of noted social work researchers, faculty, and practitioners
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Having lived together for over 30 years, we are overtly aware of the different ways we think, talk, react, problem solve, and even argue. Some of these differences may be by-products of our gender, personality, or life histories, but most are distinctly descended from our professional training and experience. In many ways, we, and the professional paths we represent, are quite a good match. Potent social work skills such as communication and collaboration, when combined with scientists’ conceptual and analytic strengths, could make for awesome biopsychosocial problem solving.

In contributing the foreword in this exciting new book on social work and neuroscience, we aim to introduce the reader to the fundamental language, culture, and knowledge of neuroscience so that this professional complementarity can be exploited for the good of the clients we serve. The social work profession is uniquely situated as the dendrites and axons of social neuroscience, continuously receiving and integrating information from other sources, and sending out that integrated information to the target systems we serve. Indeed, we have long experience as that “in-between” profession, putting to use our powerful skills as we mine the critical junctures between and among other professions and their knowledge bases.

We intend to introduce readers to the basics of neuroscience by way of a scripted, contemporary dialogue between a scientist and a social worker. In particular, its focus is on the reciprocity of communication and point of view needed between these increasingly converging fields. Our hope is to establish a common ground and level of understanding between the two fields. The goal is to further stretch the capacity social workers possess to
assess, use, and promote neuroscience principles and findings for social work practice and policy. Now read this imaginary conversation between a social worker (SW, asking questions in italics) and a scientist (S).

SW: I often read that various environmental conditions and interventions affect structures of the brain. What does that mean, “structures’ of the brain”?

S: The brain is the most complex organ in the human body, composed of many different structures, or parts. Each part has a particular function associated with it. Together, the structures or parts produce our every thought, action, memory, feeling, and experience. Some of the structures in this three-pound mass of jelly-like tissue include the cerebral cortex, the amygdala, the hippocampus, and the thalamus. Each has a primary set of vital functions that leads to the total well-being of the individual.

The cerebral cortex is thought of as the seat of cognition in the brain. It is responsible for all forms of conscious experience, including perception, emotion, thought, and planning. The amygdala plays a role in emotional and implicit memory and is central to processing and regulating emotions, especially fear. The hippocampus acts as a sort of entry point for information received from sensory organs and functions in learning, memory, and emotion. The thalamus serves as a relay station for most of the information coming into the brain, filtering out information of particular importance from the mass of signals entering the brain. One structure of the brain gaining increasing attention is the subcallosal cingulate, a tiny bundle of nerve cells that sits near the hippocampus. It functions as a conduit between the parts of the brain that control emotion and the parts of the brain that control cognition. It’s theorized that signals from the hippocampus tell the subcallosal cingulate to regulate mood, which then sends them on to more conscious parts of the brain so that we can both register and act on our moods. The subcallosal cingulate’s potential role in depression is currently being examined.

The brain is basically the control center of the human body—the hub of over one hundred billion nerve cells, or neurons. All of these structures function in concert to control the overall stasis or regulation of normal functioning, such as keeping your body temperature within a narrowly defined range, making sure you breathe while you sleep, maintaining a normal heart rate, being able to identify where you hurt, taking visual cues and turning them into sight, and so on. The list is literally endless, as we shall see. Even I, as a scientist, am amazed at the number of functions that have to be regulated on a second-by-second basis for a person to just exist. The complexity of the connectivity between these cells is mindboggling! Not only do a million new connections develop every second of our lives, but the pattern and strength of these dynamic changes are unique to each of us.
SW: How can something way outside the human body (e.g., poverty) affect one of these “structures”?

S: When you hear that environmental conditions or interventions affect structures of the brain, you now realize that it depends on the condition or intervention and which of the structures we are talking about. All of the structures can be stimulated in a positive or negative manner (scientists would say upregulated or downregulated).

Before we go too much further, though, let’s talk a little more about the brain and how it works. The neurons I previously mentioned are the brain’s main messengers, transmitting information quickly and efficiently from structure to structure and organ to organ. Signals pass between them by the release and capture of chemicals. Some of these neurochemicals, or neurotransmitters (chemical signals), spread specific messages from release sites to collection sites, called receptors.

For example, new research has just shown how much exercise seems to enhance cognitive flexibility and capacity. The neurochemicals that exercise generates seem to work as a biochemical bulwark to the brain’s natural physical decay (the brain’s hippocampus, for instance, declines about 1% annually starting at age 20). It is thought that people who exercise generate new neurons (neurogenesis) in greater proportions than those more sedentary, and further, that these new neurons are more nimble, joining existing neural networks with ease.

Another example is when you introduce a substance into your system, like nicotine. By smoking, you’re stimulating nicotinic receptors, which leads to the good feeling that many associate with the act. That good feeling occurs through the release of dopamine (a neurotransmitter) in your brain, and before you know it you become addicted both to nicotine and the behavior of smoking. There are all sorts of things out there that we either ingest, or that we lack from our interactions with other human beings or environments, that lead to an imbalance or deficit in the body’s ideal and healthy regulation.

Another, more positive, example on an interpersonal level is the neuroscience of breast-feeding. In the act of a mother feeding the baby, a feedback loop is set in place. The baby’s breast stimulation prompts the relay of a message to the mother’s hypothalamus, which leads to the secretion of oxytocin from the pituitary gland and produces a euphoric let-down reflex. This leads to the releasing of more milk and with it the feeling of relaxation, calm, and assurance that mothers feel good about while supplying valuable nutrients to the baby.

There are lots of interesting, but often tragic, examples about this interplay between the environment or experiences and the brain. One is what we are now learning about the effects of poverty on brain development and human functioning. Poverty and its related cumulative exposure to
chronic environmental stressors lead the brain to redirect its priorities at the expense of the normative processes of development and growth and health. With prolonged exposure to stress, the hormone cortisol is released from the pituitary in an attempt to reestablish homeostasis, but with the system continuing to be stimulated chronically, negative consequences for the body and mind ensue: memory is impaired, immune function is suppressed, and energy is stored as fat. Other known stress-related disorders include colitis, high blood pressure, arteriosclerosis, adult-onset diabetes, and possibly cancer. Prolonged exposure before or immediately after birth poses enormous risk to development and has the potential for decreasing both the number of brain neurons and brain size.

Determinants of health and psychosocial problems or pathologies are present at multiple levels, from the molecular to the social, and interact in ways we don’t fully understand yet. They are complex phenomena, and the research to further unravel both etiology and cure becomes quite challenging.

The truth is that much of what we know about the causes of many public health and social problems can be prevented by applying knowledge we already have in our possession. We just have to get better at implementing the solutions we know, mainly through heightening public awareness and support, leveraging political will, and supporting further efforts for the kind of rich transdisciplinary research that yields these types of successful interventions.

SW: Okay, I think I can appreciate the connection between human behavior and the social environment, via the brain, in ways I didn’t really understand before. But let’s bring it down to the social work treatment level. Does this mean that for social work treatment to have an effect—especially a long-lasting effect—the brain structures actually have to be altered somehow?

S: Not necessarily. A better way to describe it is that the structures may become more active or inactive. You’d like to see, through imaging techniques, if a known portion of the brain should be active under certain conditions and reasons why it’s not active in certain patients.

Let’s talk about depression. We have been looking at the causes and the cures for depression for a very long time now. The promises of Prozac, Paxil, and Zoloft as effective pharmacotherapeutic agents did not pan out as many drug companies had hoped. Before that, imipramine had the same equivocal end result. The rationale that antidepressants work by raising the level of the neurotransmitter serotonin in the brain is being called into question by both scientists and clinicians. What looks far more likely is that there are different causal mechanisms, with different neurotransmitters and different pathways for different levels of depression,
though scientists are still trying to gain better understanding of this complex interaction. We still don’t know why some social work treatment or “talk therapy” works in some clients with depression and not in others, or why therapy in conjunction with medication is almost always more efficacious. Talk treatment such as cognitive behavioral therapy or interpersonal psychotherapy could help the brain release helpful chemicals that promote nerve cell growth; it could alter the way nerve death is understood by the brain or even help alter behavior to the extent that different neurotransmitters are released and mood changes. Some research shows increased functioning in the hippocampus as a result of talk treatment, but it is less probable that we “talk” our brains into growing cells and change its structure in that way.

SW: But how do you know if the brain structure’s activity level changes?

S: I think probably the most well-known and informative ways are the handful of imaging techniques available now to neuroscientists to actually look at a particular structure and see if it’s active. In the past, when scientists did EEGs (electroencephalograms), they were looking at brain function overall, but not in a very specific way. The newer imaging techniques allow you to really burrow deeper and to investigate or determine which structures are active, and how active, in certain conditions. These include PET (positron emission tomography) scans, MRIs (magnetic resonance imaging) and CT (computed tomography) scans, fMRI (functional MRI), SPECT (single-photon emission computed tomography), and MEG (magnetoencephalography).

SW: Why is knowledge of the specific brain structure that is impacted during treatment important for social workers? Isn’t effectiveness data that shows improvement good enough, without having to know why as well?

S: Here’s a good place to emphasize how neuroscience and social work really intersect. In a mutually beneficial way, if treatment is working (as measured by a person’s actions), knowing or mapping where in the brain, if possible, this is occurring is important. This will help both parties figure out the etiology of the disease or disorder, and more clearly understand the treatment’s efficacy.

Neuroscientists can measure the objective functioning of the brain structures, but they need social workers to assess whether, behaviorally, the treatment is effective—and that’s only the first layer. The second layer is when you have not yet fully defined the disease. Combining observational with functional information is exceptionally helpful for both sides to determine causal effects for the disease’s condition.

We don’t just want to know if something works. We both want to know how it works, under what conditions, and in what ways. Translational
research is an up-and-coming field for both of us, and something we’ll be reading more about.

SW: Many social workers work in substance use treatment and hear a lot about brain receptors. Tell me again about what those are and why we should care about them.

S: Receptor molecules are specific proteins on the surface of or inside a cell with a characteristic chemical and physical structure. Many neurotransmitters and hormones exert their effects by binding to receptors on cells. There are many types of these receptors. Once the neurotransmitter or hormone molecule, or ligand, binds to the receptor, it can initiate a cascade of events. Those events are termed cell signaling. Through a variety of mechanisms, there will be signals sent through the cell to different targets. Receptors are sort of like the television antennae of the cell. They receive signals from faraway places, capture those signals, and act in response to those signals.

Once a ligand, such as the neurotransmitter acetylcholine, binds to its receptor, it initiates signaling through the cell by means of different molecules. For example, a molecule could be released within the cell that travels to the nucleus of that cell, to the DNA, and binds to a control region of a gene, either having it initiate transcription of that gene to make its protein or turning off transcription to stop making its protein.

Let’s talk about your drug treatment reference. When a person does cocaine, it enters the brain and causes specific neurons to release the neurotransmitter dopamine, which in turn gives them that “high” feeling. Many substances, such as psychostimulants, bind the opiate receptor in the brain that causes the euphoric feeling upon which the person becomes dependent. It’s not only substances that our body ingests that do this. Experiences or environmental conditions that we live through can also do this. I just read recently how the act of smiling turns on similar receptors in the brain, with a similar positive feedback loop.

Another problem that we’re trying to understand better with respect to the role of receptors and brain chemistry is that of obesity. Scientists believe there is a lack of feedback from the stomach to the brain telling it that it’s satiated. The brain doesn’t get the message that the stomach is full and continues to tell the body it’s hungry by sending a signal. There are actually multiple feedback mechanisms at play in this message. An example of one is between the hypothalamus and the gut, where receptors of neuropeptide Y and serotonin (a neurotransmitter) serve to regulate hunger and satiety. Most of these receptors, or their ligands, at one time or another have been therapy targets.

SW: What do authors mean when they use the term “brain chemistry”? Is this akin to “brain damage”?
S: There are an enormous number of chemical reactions that occur in the brain every hour of every day. The sum of all those reactions falls under the umbrella term of “brain chemistry.” One example of the signaling cascade of brain chemistry happens when you get hurt. Endorphins (the body’s natural painkillers), endogenous opioid peptides acting as neurotransmitters, bind to opioid receptors, which inhibit neurotransmitter GABA, which then causes the neurotransmitter dopamine to be released, which makes us feel good.

There is, however, a relationship between the terms brain chemistry and brain damage. If some of those chemical reactions aren’t happening that should be happening, there can be damage to the brain. I would say the difference here is that brain chemistry describes the normal operating procedures for the brain and brain damage is when you’ve had some interruption of the normal functioning of the brain. When you restrict blood flow to an area of the brain, such as what happens during a stroke, you’ve deprived it of oxygen, and all normal cellular functions in that area cease.

SW: I work in child welfare, and see lots of children who, by the age of seven, have been in seven different foster homes. Some people say this kind of trauma has “closed” structures of the brain and that the capacity for these children to later engage in healthy interpersonal relationships is diminished, forever. I’d like to remain optimistic. Please say that isn’t so.

S: Secure social relationships promote healthy neurologic functioning for humans of all ages. These relationships have been shown to lead to biologic attunement and synchrony, the downregulation of the body’s stress response system and the promotion of adaptive neurologic functioning. Our neurobiology gets influenced by the release of oxytocin, a hormone acting as a neuropeptide, during these relationships and benefits from the subsequent effects of enhanced sedation, relaxation, and reduced fearfulness. Caregiving experiences (who, how many, what quality) influence the brain’s neuronal wiring in many ways. That’s why it’s important to ensure children are in safe, loving, and consistent child-rearing environments. Exposure to such risk factors as loss, trauma, abuse, attachment difficulties, and family conflict also affect structures of the brain and their functioning. The extent to which the brain can adapt to the environmental curve balls it gets thrown is also dependent on a number of factors. So while we can’t say trauma closes structures of the brain, we probably can say that it likely impacts the healthy growth and development of those structures in ways that could potentially lead to
later negative sequelae, including a lack of capacity for healthy, secure interpersonal relationships.

SW: We read a lot in social work about the brain’s plasticity. Is that what you’re talking about here?

S: Yes. Neural plasticity is generally the term we use to describe the brain’s capacity to change, modify, and repair itself lifelong. Plasticity occurs as a result of the environment and experiences we live in and through. There are certain times in one’s developmental trajectory that some aspects of brain development and function are more likely to develop. We call these sensitive periods. This is when a structure of the brain is most uniquely receptive to input from the environment. While not determinative, these periods are critical to understanding how our brains create new neurons (neurogenesis) and new pathways (synaptogenesis) and become more functional.

This significance of human relationships, especially those between children and caregivers, cannot be overstated. Early interpersonal experience is thought to play a significant role as a determinant of the capacity for affect regulation. Science suggests that some aspects of brain development may change less easily than other aspects, and that the ability of the brain to adapt to experiences is not absolute. However, recent research on neural plasticity suggests that positive nurturing relationships can help resolve some of these early deficits. When we talked earlier about the example of the foster child, we were really talking about his or her brain’s plasticity, and how neurogenesis and synaptogenesis did or did not occur during their many moves from family to family, especially during these sensitive periods. It seems that the socioemotional experiences that occur in early childhood are encoded and stored neurologically. Again, we are talking about a complex phenomenon from the cellular to the social level.

SW: I hear a lot about genetic predispositions, genetic testing, and sequencing of the human genome nowadays. Once we have a clear understanding of the causal genetic links to mental health problems like schizophrenia, will it put social workers out of a job? I mean, won’t scientists just be able to manipulate someone’s DNA and prevent their occurrence?

S: No, it will not be as easy as that. Biology is never destiny. First of all, figuring out or solving any causal genetic links is a very labor-intensive effort. Those results will come slowly into our combined knowledge base. Just because the human genome is sequenced does not mean we have an immediate understanding of the function of these genes. Ascribing function to genes has been an ongoing effort since 2001.
While a scientist’s goal is to remedy genetic deficiency, or lack of gene function in a person, by using gene therapy, the problem is delivering that gene to the right location and having it function in a sustained manner. Gene therapy is basically taking a defective gene and replacing it with a functioning one, but this becoming a routine sort of medical therapy is quite a ways off.

Even then, it will never put social workers out of a job! As we discussed already, there are frequently environmental or other components that, combined with genetic factors, lead to a disease state or some sort of pathologic functioning. It will be, as it is now, a tandem sort of effort between the scientist and social worker to ameliorate these disease states. Drug or gene therapy alone will probably never be the complete answer.

You are right in thinking we once believed that when the human genome was sequenced, many diseases could be cured, but diseases are incredibly complex phenomena, with many involved and dynamic components at play. The harvest of this whole genomics era of science, I’m sorry to say, has yielded far less than what we initially hoped for. Pharmaceutical companies have spent billions of dollars on getting genetic sequence information to help with drug discovery efforts, but until you understand the total pathway that is involved, the yield will be limited. And this work is intense.

**SW:** Why do many people say social workers do “soft” science while the type you do is considered “hard” science? Does it make yours more valid?

**S:** I’m not sure it ever helps to characterize fields of study with these kinds of dichotomous or pejorative labels. Part of the issue is the long-standing, socially reinforced notion that logical positivism or hypothetico-deductive scientific methods are somehow superior to other methods of knowledge production. This simply isn’t true. There are many different ways of adding to the knowledge base, and each has its strengths and weaknesses.

What is true is that scientific discovery or knowledge building in the so-called hard sciences (biology, chemistry, physics) is more likely to engage in hypothesis testing. We design our experiments so that we have a defined output. In our experimental work, we use controlled environments where we can hold all other potential causative factors steady so that we can manipulate the key variables and answer just one question at a time with good certainty. The goal in our kind of science is to measure effectiveness very clearly and cleanly—with the least amount of ambiguities. That, to me, is what most people mean by “hard” science: measurable outcomes, hard data, focusing on manipulating only one variable at a time. This is the classic experimental design.
In social work or the one of the so-called soft sciences (sociology, psychology, anthropology), you are dealing with human beings who have an immense number of complex variables that are hard to control for. The social sciences in that respect are much more difficult fields of study. But the knowledge you yield is incredibly important to our kind of science. Your understanding of the complex and interwoven dynamics that affect intervention outcomes is invaluable as we struggle to better understand neurochemical pathways and detours in the brain.

Of every new chemical compound discovered and refined for potential therapeutic use, only 1 out of 100 actually is proven to be clinically effective with humans, and can become an approved therapy. So even “hard” science does not mean it is any more successful than any other kind of intervention research. Your field is making huge gains in this sort of translational research, or how to go from efficacious results to solid efficacy of outcomes.

SW: I think social workers are pretty humble about how much we still don’t know about what works for whom, when, where, how, and why. How much do you think scientists still don’t know about the human brain’s influence on behavior?

S: We certainly haven’t unlocked the total potential of the brain. Most scientists realize, because of the complexity and the redundancy of the human body, that there is just so much to learn. It is an incredible sort of machine that we both marvel at and are humbled by, but we haven’t even come close to thoroughly understanding what is going on in the human brain at the cellular and molecular levels.

While we now know immense amounts of information about the brain (a neurologist recently said, “we know more about the brain than it is possible for any one person to hold within their brain”), there’s still much more to know.

I don’t believe social workers have the market cornered on how much we respect and how much we are in awe of the human body, and especially the brain. Intellectual humility is a strength in doing any kind of research.

SW: Wow! It sounds like social work is in a perfect position to do this translating of neuroscience to the real world problems of people and communities. It feels incredibly important to the future of both the natural sciences and social work that we continue our burgeoning reciprocal work. What are some hints as to how we can better serve that interpretive or translational function and communicate well with our scientific partners?

S: It seems to me that the potential for collaboration between social workers and scientists is still largely undiscovered. Certainly in
basic research, we don’t have much experience. Clearly in the translational medical sense, getting feedback from social workers would be a good thing.

Expanding communication between our two disciplines would be great, and we should work to make it a routine part of each of our profession’s dialogues, so we can enhance our interdisciplinary language base. Another way we can do that is to develop new sorts of journals that are receptive to a wider range of intellectual and professional inputs.

There are also ways to expand the capacity we possess for collaboration through formal education. We both need more exposure to the others’ curriculum. Maybe a basic neurobiology class should be part of a standard Master’s in Social Work (MSW) program, and maybe a basic human behavior in the social environment course should be a requirement in graduate neuroscience programs.

SW: This has been a really enjoyable conversation. What’s next on the horizon? How might technological advances in your field affect the way we social workers go about our work?

S: We know, historically, that seminal scientific discoveries are usually preceded by important technological innovations, and this is what I predict will happen in neuroscience. I think probably that the ability to peer into the brain will continue to improve. The technology at our fingertips to look more truly and deeply into the amazing brain’s functioning seems to be expanding exponentially. The imaging techniques will continue to be more specific, localized, and less invasive. Real-time data will become more normative. For example, I can imagine the day when you will be able to assess the impact of your talk therapy as you’re doing the work!

I think that the function of more genes will continue to be identified in the coming years, ones that are players in neurodisorders. By these I mean addiction, mental illness, maybe even predisposition to violence. I would say the continued understanding of how the brain interacts with itself to control things—like how the brain is interconnected or how we understand all the pathways and redundancies. These things will continue to be better understood and be very important as we seek to understand human behavior differently.

We continue to be good at making correlations between how we live our life and the results. More and more data is being disseminated to the popular press that helps people better understand these links. For instance, recently there has been a lot out there about deceased professional football players donating their brains to science so we can better understand the impact of the trauma on the health of their brains. These kinds of things
will be critical to our understanding more and better connections between lifestyle, impact, and trauma on brains and on people’s long-term health.

SW: Thanks very much. I think I feel more confident being “in-between” neuroscience with its highly specific and technical knowledge base, and the clients for whom such valuable knowledge may bring untold benefits.

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The decades that have followed the “decade of the brain” have advanced our understanding of the transactional interdependencies among brain, behavior, and environment—discoveries that hold unprecedented opportunities for social workers to transform the way we work as social change agents across systems. The goal of this book is to make this vast and ever-expanding knowledge base accessible to social workers working with wide-ranging populations and in a broad array of practice settings. In doing so, we have called upon social work experts in key areas of practice, including generalist social work practice, social work in the schools and the child welfare system, in health and mental health, and in the criminal justice system. We hope you find this book a helpful bridge between the scientific world of discovery and the world of social work practice, and we hope it advances the way in which you work with clients and client systems. Each of the chapters is organized around practice, policy, and research implications, and includes case studies to enhance practice application. The impact the environment has on neural mechanisms and human life course trajectories is of particular focus. Practice implications examine how neuroscientific understanding impacts assessment practices, prevention, and intervention. Policy implications examine target areas for macrolevel change, based on the neuroscientific literature, and research implications outline new directions for future social work research to advance the current state of knowledge. As a group of editors, we have varied interests and experiences that led us to this endeavor. Collectively, we are interested in how neuroimaging can be used to examine psychosocial treatment efficacy, in the cross-system programmatic and policy implications undergirded by our understanding of how toxic environments and early disrupted attachment affect brain
and behavior, and in the complex bioethics that we as social workers must closely examine in our integration of the neurosciences in social work practice. We invite you to join us.

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How does empathy, the ability to accurately appraise and affectively attune to another’s biopsychosocial experience, develop over the life course, and what are the determinants and consequences of empathic capacity? How might the field of interpersonal neurobiology inform child welfare policy? Should our country’s immigration policies be drafted according to what we know about the neuroscience of early childhood attachment? Should judges take into consideration early environmental deprivations, toxicity, and relational trauma in their sentencing procedures? Should the impact of environment and developmental experience be used in adjudication proceedings for adolescents in the juvenile justice system? If so, how far back should judges be required to consider a person’s history in sentencing policy? These are some of the pragmatic questions that social workers grapple with in the field each day, and these also are some of the same questions scientists have endeavored to examine over the past two decades.

In this book, we have invited experts in the field to bring together the most relevant and cutting-edge neuroscientific findings to help guide social workers in their practice. The book serves as a practice resource for social workers by making accessible the vast territory covered by the social, cognitive, and affective neurosciences over the past 20 years, helping the reader actively apply scientific findings to practice settings, populations, and cases. We aim to increase learners’ sophistication in understanding the neuroscientific literature and to increase their facility in using such knowledge to work most effectively with clients and within client systems at multiple levels of practice. We anticipate that as you grow in your professional career,
you will want to revisit the concepts learned and return to some of the big ideas presented in this book.

Neuroscience is at a historic turning point. Today, a full decade after the “Decade of the Brain,” a continuous stream of advances is shattering long-held notions about how the human brain works and what happens when it doesn’t. These advances are also reshaping the landscapes of other fields, from psychology to economics, education and the law. (Volkow, 2010)

The current decade of discovery is focused on advancing understanding of the ways in which strategic psychosocial interventions act on brain structures to change behavioral response. This focus is deeply relevant to the person-in-environment perspective integral to the social work profession. In advancing our profession’s practice models to incorporate current brain science research, social workers will be positioned to more effectively work with the diverse client populations and settings of our profession, and we can use such knowledge to inform advocacy efforts, influence human service policy decisions, and contribute to practitioner education.

This first chapter serves as an introduction and “tour” of the human brain and its relevant structures, functions, and processes. The brain, as an adaptive organ, responds to and acts on the environment, and is shaped by the relational actors and experiences it comes in contact with over time. Each of the brain’s 1 billion neurons communicate with each other through chemical and electrical signals transmitted across synapses or neuronal spaces, and each neuron can connect with 10,000 other neurons (Cozolino, 2006). Wernicke’s area, associated with understanding language, is not developed in the human brain until 12 months; Broca’s area, associated with speech, is not developed until toddlerhood, at about 2-1/2 years; and the hippocampus, the structure responsible for explicit memory processing, matures around age three years old. Thus, the brain undergoes tremendous and rapid growth during the first three years of life.

_Fetal programming_ is a concept that suggests that environmental changes can impact the developing fetus, resulting in long-lasting structural and functional changes to the brain’s developmental trajectory. For example, maternal anxiety and stress (moderate and severe) during pregnancy is related to the risk of developing a host of mental health and behavioral problems (e.g., ADHD, conduct disorder, anxiety), controlling for other significant confounding factors. Early maternal care and attachment experiences can influence gene-related alterations that are enduring and impact physical and mental health over the life course, with epigenetic changes occurring across two generations of offspring.

Stress in the first trimester has been associated with schizophrenia; later in pregnancy, particularly in the last trimester, stress has been linked to other mental health disorders. The relationship between prenatal stress during
pregnancy and later childhood emotional and behavioral disorders can be partly mitigated by early nurturing attachment between mother and infant, reminding us of the importance of the postnatal environment and developmental plasticity of brain development in those early years postbirth (see Glover, 2011). Early interaction with caretakers influences brain pathways, specifically the amygdala and the orbitomedial regions of the prefrontal cortex, and facilitate self-regulation capacity (Schore, 2012). Stress-induced alterations in gene expression related to early life attachment disruption can not only create behavioral disturbance in offspring, but also in subsequent generations of offspring (Franklin et al., 2010).

As social workers, we are motivated to better understand how the environment impacts development of neural circuits responsible for biopsychosocial functioning across the life course. We know that early experience can impact brain architecture and neural circuitry development and function, the synaptic connections, neural activity, and behavioral expression via its impact on the protein production of genes. We also know that intervention timing is important. When interventions come outside of a developmental sensitive time, the intervention or experience must be more intense and sustained to be able to alter the circuitry—in a sense, it needs to work harder. The hierarchical nature of neural circuitry development means attention to environmental experiences and understanding of genetic dispositions are to be done in the context of timing—timing is important. The importance of nurturing, stable, responsive adults in children’s lives is critical.

For example, Drury et al. (2011) measured telomere length (the caps at the end of chromosomes that keep DNA intact) in 100 orphaned children in Romania, and found the more time spent in institutional care during the first 4-1/2 years of life, the shorter their telomeres when DNA was checked between ages 6 and 10 years old. Lifecycle economic models have consistently shown that the economic return on investment in human capital in disadvantaged communities is significantly greater in preschool and early childhood as compared to remedial programming efforts and job training later in an individual’s life course, school, and work career. Longitudinal studies like the Perry Preschool Program and Abecedarian Study show that high-quality intensive early childhood interventions in disadvantaged communities have a positive lifelong economic, academic, and social impact for children well into middle adulthood (Knudsen, Heckman, Cameron, & Shonkoff, 2006).

As social workers, we work to help clients organize their attachment systems, develop and enhance affect and self-regulation capacity, and change the trajectory of brain development in favor of strengthening adaptive structures and integrative functioning. We seek to effectively use interactive relationships to help clients recalibrate their emotional system. “A growing number of studies now support the observation that right-lateralized limbic areas responsible for regulation of autonomic functions and higher cognitive processes are involved in the formation of social
bonds,’ are ‘part of the circuitry supporting human social networks’” (Schore, 2012, p. 33). Affect dysregulation is core to all mental health diagnoses, and is represented as sympathetic-dominant arousal (hyperarousal) and parasympathetic-dominant (hypoarousal—withdrawal depressed/flat affect, shame; Schore, 2012). Therapeutic change occurs through caring, nurturing relationships that enhance regulatory control. Research consistently shows that behavioral health intervention can change brains and behavior: “recent research in brain imaging, molecular biology, and neurogenetics has shown that psychotherapy changes brain function and structure. Such studies have shown that psychotherapy affects regional cerebral blood flow, neurotransmitter metabolism, gene expression, and persistent modifications in synaptic plasticity” (Glass, 2008, as cited in Schore, 2012, p. 143). Indeed, as Louis Cozolino (2002) suggests, helping professionals become the “amygdala whisperers” for our clients, and as Allan Schore (2012) directs, we are there to help recalibrate the emotional system in order to help our clients move from “insecure attachment” to “earned secure” relational stability.

**OUR CHARGE**

The neuroscience literature has compelling and important guidance for the social work profession. As a profession built on the foundation of social and economic justice, we should not only focus on equality of opportunity or equality of outcome but, rather, the neuroscientific literature invites us to focus on the transactional space among our various biopsychosocial dimensions. We are asked to examine the conversion capabilities of our clients and client systems—the ability for individuals, populations, and communities to convert the transactions that occur between brain, environment, and behavior into optimal developmental opportunities and outcomes. As social workers, we know conversion can be maximized by focusing on optimal caregiving and support, especially in developmentally vulnerable times such as birth through five years of age and adolescence, and with particularly vulnerable populations, such as children who have experienced trauma/maltreatment and/or who live in economically and socially disenfranchised communities. A systems approach to intervention relies on developing relational supports that create a “village” of influence. As social workers, we focus on creating caring homes and caring communities, and work to promote not only growth-enhancing social worker–client relationships, but enriching ecosystems for human development. As a profession, we need to take the lead in understanding the neurobiology of healing, transformation, and resiliency—not just the neurobiology of stress, dysfunction, and pathology. We need to know how our programs, interventions, and policies shape brains and behavior; how therapeutic alliances with caring social work professionals change...
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brain structures and functions in favor of recovery; and how connection to empowered communities can alter life course trajectories toward more full participation in and acquisition of society’s opportunities and resources. The promise of developmental plasticity is, indeed, the hope and promise of the social work profession.

We organize the book by four practice context sections: Section A: Generalist Social Work Practice; Section B: Child Welfare and Education; Section C: Health and Mental Health; and Section D: Criminal Justice. The first section of the book addresses the person-in-environment perspective, illustrating how neuroscience has shaped our understanding of developmental opportunities and challenges, as individuals interact within their social and physical environments. Gerdes and Segal introduce readers to cognitive and affective dimensions of empathy, which include appraising another person’s intentions and feelings, and feeling what another person feels. Affective resonance, feeling another’s feelings, includes a physiological component, distinct from cognitive interpretation and intention appraisal. The authors discuss the importance of using one’s own emotional history to inform, but not block, resonance ability. Rosemary L. Farmer discusses the mirror neuron system and illustrates how the mirror neuron system mediates imitative learning which, in turn, helps facilitate acquisition of new behaviors through observation and enhanced social communication. Farmer discusses the neurobiological differences in the brains of individuals with autism that lead to impaired understanding of the “why” of others’ actions. Susan A. Lord then discusses the cultivation of empathy and compassion through the use of meditative dialogue for survivors of complex trauma. Creating an intersubjective space for healing to occur through shared relational discovery, she explores the literature suggesting that meditation increases activity in the insula and right temporal-parietal lobes associated with empathy, and increases gray matter density in the hippocampus, a structure responsible for trauma memory integration. Carbajal and Aguirre examine traumatic stress response and the way in which traumatic experiences compromise medial prefrontal cortex functioning. Specifically, they draw upon the literature that suggests that trauma decreases the functioning of the left anterior cingulate cortex, the structure responsible for regulating hypothalamus-pituitary-adrenal axis, integrating emotion and cognition, and regulating autonomic and experiential aspects of emotion. They note that a significant goal in working with such clients is to help reorganize trauma representations in the brain. Warley, Thomas, and Harris conclude the section by introducing readers to an 8-week positive youth development program called F.I.T. (Focus, Initiative, and Tenacity) Camp for youth ages 12 to 15 years old who reside in socially disorganized communities. The program is holistic in composition and includes physical training, games and recreation, career development, relationship development, nutrition, relaxation training, and a social network analysis where each youth contracts with a “village” of adult supportive mentors.

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Section B considers the neuroscientific implications for social work practice in child welfare and educational settings across system levels. The section begins with an in-depth overview written by Fawley-King and Merz on the intersection of child maltreatment on brain development and mental health. The authors spotlight an intervention focusing on a foster parent training program, Multidimensional Treatment Foster Care-Preschool for 3 to 6 year olds, with a goal of increasing placement stability. Wendy B. Smith advances our knowledge of how adolescent brain development can inform our work with youth transitioning out of foster care. She didactically weaves a case study throughout her chapter, helping the reader truly apply challenging neuroscience concepts to child welfare practice. Smith discusses the importance of developing positive transitional living programs for transitioning youth whose experiences and history may have contributed to a dysregulated stress response characterized by an overactive reward system and an immature regulatory control system. Such programs need to help youth process trauma experiences in order to alter maladaptive stress response. Woodside-Jiron, Strolin-Goltzman, and Suter develop a bridge between the child welfare and education chapters by discussing the educational achievement gap for youth in foster care, exploring the effects of maltreatment on the brain functions and structures specifically related to learning and identifying promising educational and child welfare policies, and practices for youth in foster care to optimize educational success. Mogro-Wilson illustrates how learning and other disabilities can be managed in schools settings. She emphasizes the importance of the learning environment (social, physical, nutritional) and specific techniques that facilitate learning by improving working memory. Smith-Osborne ends the section with a discussion.

Section C highlights the neuroscientific literature that can inform social work practice in health and mental health. Matto, Brown, and Ballan highlight the latest literature informing addiction treatment, including community engagement models of addiction and recovery, dual processing practice models, and an integrated neurosystems approach. Garland, Williams, Gale, Kelly, and Howard introduce the transdiagnostic perspective that recognizes psychological symptoms as manifest attempts to adapt to context or challenge, and attends to the commonalities across mental health conditions. The six core commonalities of the transdiagnostic perspective include: automaticity, attentional bias, memory bias, interpretation bias, suppression, and stress reactivity. The authors illustrate how mindfulness training targets these six core processes, and describe the scientific evidence linking mindfulness training with increased hippocampal density, enhanced cingulate cortex, temporoparietal junction functioning, and decreased amygdala activity. Hutto and Viola discuss the relationship between homelessness, poverty, and toxic environmental stress on brain development. They illustrate the importance of improving our understanding of the interaction between toxic stress and brain development to improve social work practice with young homeless children and their parents. Smith-Osborne discusses traumatic
brain injury incurred during combat and how social workers can help to identify and cultivate resources to enhance resiliency of injured veterans and their caregivers. Concluding the section, Littrell discusses the brain science behind major depression, illustrating that stress can increase inflammatory biomarkers released by white blood cells, which, in turn, increases activity in brain regions that process negative emotions. Obesity, sleep deprivation, and metabolic syndrome also increase inflammatory markers and increase the risk of depression. Scientific evidence suggests that exercise, diet, and social supports can decrease systemic inflammation, increase heart rate variability, and decrease risk for depression.

Section D concludes the book by discussing the neuroscientific implication of social work practice in the criminal justice system. The chapters in this section focus on work with adolescents and adults in our correctional facilities. Evans-Chase discusses the neurobiology behind adolescent risk-taking behavior, highlighting the differential timing in neuropsychosocial development of adolescents, where early adolescence is marked by increased salience of the reward system (increased dopamine in nucleus accumbens), and late adolescence/emerging adulthood is associated with increased self-regulation capacity. Not until the early 20s is the medial prefrontal cortex strengthened. Findings suggest that early adolescent prevention programs should be developed with structural supports in mind (e.g., after-school programs) in order to bolster adolescent decision making, and should include mentoring supports and meditation strategies to enhance self-regulation skills in areas of the brain that are still developing. In addition, strengths-based prosocial risk-taking opportunities for youth, using peer mentors to guide activities, are described. Leibowitz discusses the neurodevelopmental approaches of working with youth in the juvenile justice system, detailing the impact of victimization, as it relates to traumatic experiences, posttraumatic stress disorders (PTSD), dissociation, and sexual and nonsexual offending. He concludes the chapter with a discussion about the neuroethics of utilizing brain research to make decisions about criminal intent. Finally, Hutchison introduces readers to the neurobiology behind adult criminal behavior. Neurobiological risk factors for criminality include: decreased left temporal lobe activity; low resting heart rate (biomarker); hippocampal asymmetry; impaired amygdala; dysregulation in frontotemporal network; and decreased serotonin, which is associated with increased aggressive behavior and impulsivity. Genetic risk, when expressed within a harsh environmental context, leads to increased risk of violence. Thus, social workers should focus on lifelong social development programs, mentoring programs, early childhood education, and multimodal interventions. It is our hope that this book will help readers gain a deeper understanding of how neuroscience should and can help inform the design, development, and expansion of therapeutic interventions, social programs, and policies for working with our most vulnerable populations.

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REFERENCES