Neurobiology for Clinical Social Work

Theory and Practice

Second Edition

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W. W. Norton & Company
Independent Publishers Since 1923
New York • London

Chapter 7

Adolescent Brain Development

A Trauma-Informed Approach With Adolescents in Juvenile Justice Settings

with Jillian Graves

EMERGING RESEARCH on adolescent brain development has significant implications for clinicians working with adolescents and their families. Brain development during adolescence supports the growth of many strengths and capabilities during this life phase, such as the increasing capacity for abstract thinking and future orientation (Jensen & Nutt, 2015). At the same time, research on adolescent brain also explains, in part, the inconsistencies clinicians often note in adolescent behavior and functioning. For example, adolescents can be cognitively very precocious and capable, while at the same time easily overwhelmed by emotional states of arousal. Likewise, adolescent judgment and decision making are variable and more associated with risk taking and impulsivity when adolescents are with their peers. As social workers, we often work with adolescents who are negotiating the developmental consequences of trauma and loss at the same time that they are negotiating the tasks of adolescent development and new exposure to situational stressors. Adolescents in child welfare, juvenile justice, health care, and educational set-

tings must be assessed individually as to their level of developmental maturity and their particularized histories of trauma and loss.

This chapter reviews key findings from research on brain development in adolescence. As an example of how this research may be translated to applied practice settings, we explore how research on adolescent brain development can be coupled with research on trauma during adolescence to inform applied work with adolescents in the juvenile justice system.

It is important to note that the definition of "adolescence" as a developmental phase has evolved over time and expanded in terms of its chronological age boundaries. Arnett (2014) describes a phase of "emerging adulthood," during which youths gradually mature toward the capacity for autonomy and adult functioning even as they leave their teens and enter their 20s. Research on adolescent brain development supports the notion of emerging adulthood as key aspects of brain development and organization continue into the mid-20s and are, in turn, associated with many competencies associated with maturity such as self-regulation, frustration tolerance, and executive functioning (Jensen & Nutt, 2015).

KEY CONCEPTS IN BRAIN DEVELOPMENT RESEARCH WITH ADOLESCENTS

Research on brain development in adolescence is adding a neurobiological substrate to our understanding of how adolescents are qualitatively different than both adults and younger children. Research shows that the adolescent brain differs in many ways from those of either children or adults (Casey, Jones, & Somerville, 2011). Specifically, researchers have been able to demonstrate that adolescents, while potentially cognitively advanced, may lack the developmental maturity for self-regulation, particularly within the context of peer interactions or in situations of heighted emotional resonance. Moreover, adolescents are susceptible to the attraction of immediate

rewards and are, as a group, less able to consider the future consequences of actions in the present (Jensen & Nutt, 2015).

Currently, research on adolescent brain development informs applied work with adolescents in many community-based settings including the criminal justice system (Steinberg, 2014) and mental health interventions with adolescents and young adults (Ford, Courtois, Steele, Hart, & Nijenhuis, 2005; Ford, Chapman, Connor, & Cruise, 2012). For example, several Supreme Court decisions (e.g., Roper v. Simmons, 2005; Graham v. Florida, 2011; Montgomery v. Louisiana, 2016) reflect an understanding of (1) how adolescent brain development affects behavior in ways that must be understood and taken into account, and (2) how the adolescent brain is still developing and that plasticity and meaningful change are entirely possible. The landmark case of Roper v. Simmons (2005) found that "From a moral standpoint, it would be misguided to equate the failing of a minor with those of an adult, for a greater possibility that a minor's character deficiencies will be reformed." These two ideas, that brain development is not complete during adolescence and that the brain remains plastic and open to change, are key to understanding the nature of risk and resiliency during adolescence as well.

A majority of research on adolescent brain development has focused on the amygdala, part of the limbic system, and the prefrontal cortex (Montgomery, 2013). Other aspects of neurological development emphasized in research on adolescence include (1) the pruning of neuronal connections during adolescence, and (2) the thickening of myelin that occurs during adolescence. Each is considered briefly below.

The amygdala is part of the limbic system, that region of the brain that is often described as central to the experience and processing of emotionally resonant experience and stimuli. As described in an earlier section of this book, the amygdala plays a central role in the stress response system that, in turn, is key to understanding how the experience of trauma or exposure to toxic stress may affect many aspects

of functioning. The amygdala is located deep inside the brain and has been show to grow and mature more quickly than the prefrontal cortex. Utilizing fMRI technology, researchers have shown that adolescent experience and reactions are guided more by the amygdala than by the prefrontal cortex (Giedd, 2010). These studies showed that when presented with stimuli such as a series of facial expressions that adolescents are more likely than adults to rely on emotional processing. Further, these researchers suggest that one consequence of a relatively high reliance on the amygdala, as opposed to the prefrontal cortex, in the processing of emotionally salient stimuli is perhaps a heightened sensitivity to facial expression of emotion and a more limited ability to pause to consider emotional signals in the context of higher-order information processing that would require more activation of the prefrontal cortex.

The prefrontal cortex is the last region of the brain to reach maturity. As Jenson and Nutt (2015) point out, the bottom-up and inside-out model of brain development means that the top and outside regions of brain development, such as the prefrontal cortex, are the last areas to fully mature. Clinicians will recognize the experience of adolescents who have highly developed intellectual abilities but may be less able to harness executive functioning competencies, particularly when emotionally dysregulated. Executive functioning includes many competencies such as using past experiences to inform current decision making and behaviors, the ability to control attention and shift from one activity to the next, effective planning, and capacity for self-regulation. During the course of adolescence and emerging adulthood, as the prefrontal cortex matures, the executive functioning of adolescents improves. Behaviorally, we might see an increased ability to harness reflection and information processing even during states of emotional arousal, better skills at decision making, and the development of insight into one's own behavior. The behavioral competencies associated with the development of the prefrontal cortex are aided as well by other brain functions such as working memory,

mental flexibility (shifting one's attention at will), and improvements in the capacity for impulse control and self-regulation (Blakemore & Choudhury, 2006).

According to Weinberg, Elvevag, and Giedd, the brain "produces a large number of neural connections just before puberty" (2005, p. 1). Throughout adolescence and depending in part on the pattern of experiences the adolescent brain is exposed to, the neural connections of the adolescent brain are pruned. Connections that are used or activated strengthen, while those that are unused diminish. The process of pruning is developmentally optimal in that the brain becomes more efficient as its neuronal connections are more closely associated with the behaviors and processes engaged in most frequently. Researchers have also described how during adolescence, additional myelination occurs (Weinberg et al., 2005). Myelination is a process by which neuronal connections are coated with myelin, a fatty substance, which makes the communications between neurons faster and more efficient. Researchers have also described how during adolescence, neurochemical changes occur that have key implications for understanding adolescent behavior. Specifically, the neurotransmitter dopamine increases. As described by Montgomery, "Dopamine rich areas of the brain change rapidly in adolescence and may be a factor in the sensitivity to the effects of drugs, alcohol, and sexuality, as dopamine has a role in motivation, social motivation and behavioral reinforcement" (2013, p. 200). As Weinberg et al. point out, "drugs such as cocaine and amphetamines target dopamine neurons and damage to these very neurons might affect adolescent brain development, especially the brain's ability to experience reward and learn from it throughout life" (2005, p. 9). Research on addiction during adolescence shows that one roadblock to recovery is the inability of the adolescent to take sufficient pleasure in other activities and thus maintain motivation to avoid the negative consequences of drug usage.

TRAUMA AND STRESS: A CASE STUDY

Adolescents in the juvenile justice system are, by definition, exposed to high levels of stress. Among this special population, a disproportionate number also have extensive trauma histories (Keeler, Angold, & Costello, 2007; Ford et al., 2012; Espinosa, Sorensen, & Lopez, 2013). In order to create more developmentally and clinically attuned practice and policy in the arena of juvenile justice, it is important to have an ecobiodevelopmental understanding of adolescents within the juvenile justice system. The ecobiodevelopmental model (Shonkoff, Garner, & Committee on Psychosocial Aspects, 2012) describes the intersection of social ecology, developmental processes, and biological mechanisms in relationship to indicators of child and adolescent wellbeing. Utilizing this model, it is possible to frame how prior and current exposure to traumatic stress transacts with the developmental challenges of adolescence and the unique stressors of the juvenile justice context.

The neurobiological consequences of developmental trauma and toxic stress intersect with ongoing adolescent developmental processes such as identity formation and other aspects of social, cognitive, and neurobiological development. Differentiating between adolescent behavior and the consequences of trauma can be challenging because one common presentation of trauma exposure among adolescents is externalizing behavior such as aggression and alienation from others, behaviors sometimes associated with adolescents more generally (Steinberg et al., 2008). It is critically important that adolescents with trauma histories are understood within that context and supported by the adults around them. The stress of the juvenile justice context may precipitate further destabilization if the adolescent's trauma history is not adequately understood and if steps are not taken to avoid retraumatization within the justice system.

Because externalizing behavior is often associated with developmental trauma, it is not surprising that traumatized adolescents are

overrepresented in the justice system, particularly in light of "zero tolerance" policies and observed trends in the "school to prison pipeline" (Dorado, Martinez, McArthur, & Leibowitz, 2016). Additionally, these policies disproportionately affect adolescents who already experience oppression and marginalization due to their socioeconomic status and other factors such as race and ethnicity (Fix, Cyperski, & Burkhart, 2015).

This section utilizes a case composite to examine ways that trauma intersects with adolescent development to create a potent mix that precipitates great developmental vulnerability. It demonstrates the experience of an adolescent, Lisa, with an extensive trauma history as she is engaged in the juvenile justice system. In this vignette we see that Lisa committed an act that was seemingly unprovoked, especially in the extremity of its violence. However, by understanding the effects of trauma, especially considering its impact on self-regulation, executive functioning, and cognition, her seemingly unprovoked anger and aggression can be better understood and provide a way for professionals both to hold her accountable for her actions and to provide interventions that are informed with understanding of how trauma may reverberate in the nervous system and behavior of adolescent youths.

DEVELOPMENTAL TRAUMA AND AGGRESSION

Developmental trauma can precipitate aggressive behavior in adolescents via several pathways. Emotion dysregulation, social isolation, rigid cognition, and numbing secondary to trauma exposure can often result in irritability and withdrawal, or more externalized and aggressive behavior. Among adolescents, great variation exists with regard to the rate of development of several other developmental competencies (Crone & Dahl, 2012). For example, adolescents who are exposed to toxic levels of stress are, at the same time, working to manage an increasingly complex set of cognitive and relational

tasks while being expected to become autonomous. Developmental trauma from the past as well as current levels of toxic stress may impact these normative developmental tasks and become manifest in challenging behaviors, including aggression and violence (Baer & Maschi, 2003; Ford et al., 2005; Kerig & Becker, 2010).

During the course of adolescence, the ability to manage emotion broadens and becomes increasingly less reliant on caregiving adults. This is a key competency, as an additional challenge of adolescent development is movement toward autonomy and self-reliance, affording adolescents less access to the auxiliary ego supports of adult caregivers. Ideally, they do not end up being more distant with their parents but rather renegotiate their relationship with them (De Goede, Branje, Delsing, & Meeus, 2009). This is particularly evident in capacities such as the emergence of executive functioning and the associated capacities to tolerate frustration and modulate negative affective states. Adolescents need these competencies to manage and negotiate their way through interpersonal relationships, frustrating situations, and autonomous decision making (Pharo, Sim, Graham, Gross, & Hayne, 2011). Because the development of executive functioning and emotion regulation are not really completed until adulthood, adolescents' ability to make decisions in highly evocative circumstances is not as well developed as adults'. This key difference between adults and adolescents becomes even more stark with adolescents whose self-regulation abilities are compromised by trauma.

Traumatized adolescents often misread the threat of impending violence, having a hostile attribution bias that is further impacted by their issues with self-regulation (Kerig & Becker, 2010). The higher likelihood of perceiving an action as a threat combined with difficulties in self-regulation can heighten the pressure to act, and they often strike first and exaggerate aggression from others. Issues with self-regulation can often impair cognition, resulting in a rigid coping style that may lead them to resort to aggression before other types of responses.

Many of these more highly dysregulated adolescents are especially vulnerable because their emotional reactivity often makes it difficult to connect with others (Silvers et al., 2012). Because of this difficulty with connection, they may struggle to find supports that might otherwise act as buffers against extreme emotional dysregulation, as evidenced in externalizing behaviors such as impulsivity and aggression. They are less able to slow down and manage their affect sufficiently to support constructive decision making that takes into account potential consequences of their behavior (Ford, Chapman, Mack, & Pearson, 2006). As a result, in an attempt to institute order, the adolescents engage in less nuanced, less mature, and more situationally reactive ways of handling stressful interactions and may be more likely to engage in a few tried-and-true rigid responses not appropriate to their current context.

For adolescents with a history of trauma, their childhood experiences may not have supported either secure attachment or the associated capacities for exploration, mastery, frustration tolerance, and resilience in the face of adversity and stress. Rather than developing the capacity for age-appropriate competencies in affect regulation, these adolescents may become preoccupied with "detecting and surviving threats" (Ford et al., 2012). If the adolescent is spending protracted periods in survival mode, permanent changes in the body's central nervous system, including brain development, may occur and result in an even more reduced ability for distress tolerance and frustration and an increased tendency toward impulsivity (Neumeister, Henry, & Krystal 2007). Absent mediating experiences and buffers, the neurobiological effects of trauma can inhibit adolescents' response flexibility and also limit their capacity for mentalization or the ability to understand the mental states of themselves and others (Sharp & Venta, 2012). These adolescents often alternate between extremely dysregulated emotions and numbing symptoms such as anhedonia, detachment, irritability, and restricted affect, with little insight into the reasons for these emotional vacillations (Baer

& Maschi, 2003; Ford et al., 2005; Kerig & Becker, 2010; Bennett, Kerig, Chaplo, McGee, & Baucon, 2014). Emotional underreactivity alternating with hyperactivity likely reinforces their lack of connectedness, their rigid decision making, and their need to strike first in order to protect themselves.

JULIAN FORD'S TRAUMA MODEL AND CRIMINAL JUSTICE INVOLVEMENT

Julian Ford developed a model to better understand how these symptoms and traumatic reactions can cause an adolescent to commit inexplicably violent acts. The vacillation between out-of-control and absent emotions can make decision making fraught and difficult since the emotional valence attached to an event can change dramatically and is often untethered from contextual clues. Innocuous situations can be "riddled with potential threats based on their past experiences being exploited or harmed by others in similar circumstances" (Ford et al., 2006, p. 18).

Underlying these issues of trauma exists the personal and systemic effects of racism and other forms of discrimination. Both structural racism and the personal experience of microaggressions can be framed as an experience of trauma (Jernigan & Daniel, 2011; Kang & Burton, 2014) and can lead to internalizing symptoms correlated with depression, distress, and risky behavior (Isom, 2016). Adolescents of color, in this case, African American youth, are much more vulnerable to having their mental health concerns seen as evidence of their instability, impulsiveness, and potential for violence than white adolescents with similar histories and charges.

Racism seems to both create trauma and prevent adolescents of color from receiving the type of treatment that might mitigate the negative effects of trauma. As a result, providing comprehensive and well-informed trauma care becomes particularly critical, and may help mitigate both a historical and systemic experience of trauma.

In the following vignette, I describe an assessment with an African American teenager. Her violent reactions were rooted in loss, trauma, and her difficulty managing interpersonally in intense situations. She has been vulnerable because of systemic and personal experiences of racism, including being dismissed and ignored when she sought protection from her caregivers. She is at high risk for further incarceration, not just because of her actions but lack of socioemotional support that might mitigate some of her aggressive responses and give her corrective emotional experiences.

LISA: A CASE COMPOSITE

Lisa is a 17-year-old African American teenager who was evaluated while being held in a juvenile detention center. She has a long history of abuse in the context of frequently moving to different housing and group homes throughout her childhood. In response to abuse by caregivers, she has alternated between aggression and withdrawal by running away. However, Lisa has significant strengths as well, resulting in periods of educational and relational success until it is undermined by her own actions. This has presented significant dilemmas for the providers around her and the court, which is where I encountered her. The hope was that I would be able to provide insight into her behavior and a set of recommendations.

Lisa has lived in the same major northeastern city her entire life and has been in the permanent custody of the Department of Protective Services since she was 6. Because she has sporadic contact with her mother and none with her father, she knows very little about her childhood. Lisa was the second of three children born to her mother, Ann, and the only child of her father, John. Lisa's mother Ann, has abused heroin since her teenage years, after being introduced to it by her own mother. Lisa's older sister spent many years in foster care and now

lives with her boyfriend and her infant daughter. Her younger brother was adopted at a young age and has no contact with his birth family.

Because of her mother's heroin addiction, Lisa was at high risk for exposure to abuse and neglect. Not only are children of substance abusers more likely to experience all sorts of internalizing and externalizing violence, they are more likely to be exposed to interpersonal violence, including domestic violence. Lisa witnessed violence between her parents, was reportedly sexually abused by her father, and was frequently neglected while people came in and out of her house to abuse drugs.

Lisa bounced between home and group placements until she was 6, when she and her older sister were permanently removed from their home. Her functioning before she was permanently removed is not reported. However, once she made it to her first placement, she became violent in an apparent attempt to cope with the effects of trauma.

Lisa and her older sister lived in their foster care family for approximately 2 years. She reported that they were physically and emotionally abused, being frequently hit hard enough to leave bruises, and were forbidden to discuss their abuse with social services. However, she and her sister reported the abuse to their social service workers but were accused of lying. Lisa and her sister were not only being abused but also suffered from a likely familiar dynamic, namely that no responsible adults were willing to intervene on their behalf. Fearing for her safety, Lisa threatened her foster parents with a knife. Rather than taking a trauma-informed approach to Lisa's action, social services decided to blame the sisters' relationship and permanently separated them.

Isom's (2016) article about discrimination in the juvenile justice system particularly talked about smaller events accumulating across the life span and at different life stages as the way

that racism changes people's lives. In Lisa and her sister's case, being ignored by foster care workers, being seen as violent and separated can be best understood along a larger trajectory. She was not necessarily seen as vulnerable and abused but rather as a risk that needed to be contained without thinking of the importance of maintaining sibling ties for her emotional development.

Additionally, Lisa's experience at her foster home is an example of what often occurs among traumatized children; she was in frequent physical and emotional danger and utilized the best strategy available to her, especially because she was likely constantly hypervigilant and trying to survive. As Ford et al. (2006) alluded, traumatized children need to use whatever skills they have to survive. From an early age, Lisa learned that violence may be the only option available to her. Whether or not she reliably remembers the events correctly, her memory of the event has helped shape a narrative that other people will not protect her the way that her use of violence did.

Lisa lived in a series of specialized foster homes and was in therapeutic schools until she was 12. During that period and possibly due to the structured nature of her home and school life, she stabilized and was placed in a preadoptive home. Perhaps her providers interpreted her improvement as evidence that her skills had improved rather than that she needed a high level of structure, which became more evident after she entered mainstream public schools. When that happened, Lisa was frequently in both physical and verbal altercations with her peers.

Lisa was likely demonstrating her difficulty in discerning dangerous situations, seeing innocuous events as threatening and protecting herself at all costs. Her presentation was consistent with the presentation of traumatized people in other ways. Because she was so focused on survival, she was poorly organized and had difficulty concentrating and completing her

schoolwork. She needed more support when she was entering adolescence, a time when she had greater responsibilities and expectations, which contributed to her involvement with the juvenile justice system.

Lisa may have begun to find many things in her life intolerable, exacerbated by her entrance into adolescence and the relative lack of structure which may have previously held her together. When she was a young teenager, she ran away from her foster placement and was subsequently placed in a group home. While there, Lisa and a few other residents vandalized the group home's office. When asked why, she answered that she wanted to see her records in order to better understand how others viewed her.

It is important to appreciate intersection of developmental and trauma-reactive issues at play here. For adolescents, self-worth is largely based on the acceptance or rejection of their peers (Arnett, 2014). Lisa may have sought to increase her self-esteem and group worth by engaging in a delinquent activity with the other girls in her house. Additionally, because of the the previously reported "hostile attribution bias" (Kerig & Becker, 2010), she did not trust her providers and sought to find out the truth by looking at what her providers wrote about her in confidential records. Her actions were impulsive and reactive, which isn't surprising. When put in the framework of the trauma coping model, she was responding to perceived neglect and rejection by using aggression as a "protective counter-reaction" (Ford et al., 2006).

The idea that this incident is a protective counterreaction is confirmed in part by Lisa's own recollection of her placement. She had "destroyed" this placement because other girls were "talking trash" about her, diminishing her self-worth, and in response, she threatened to beat up a staff person as an aggressive counterreaction. Fighting her peers might further diminish

her self-esteem in a way that striking against an authority would not. Additionally, Lisa admitted that she had animosity toward people who had control over her, fueling the aggression. When Lisa and a few of the other girls angrily broke into the office to read what the staff wrote about her, she saw notes describing her as cocky and stuck up, which likely confirmed her fears. This dynamic of a desire for peer acceptance and a use of aggression for self-protection was later revisited in another, much more personally violent counterreaction.

After the incident in the group home, Lisa was placed in juvenile detention and then in a different group home. It is notable that she began doing well in school. She was in a mainstream high school, getting some special education support but rapidly transitioning into a mainstream curriculum. Her high school counselor reported that she was on the honor roll and formed positive relationships with teachers and school administrators. Despite this success, she still felt the need to protect herself and brought a knife to school. Lisa was more relationally focused, however, and let the staff at school know. While her behavior here was not perfect, it demonstrated significant progress.

Because Lisa was not externalizing her pain at the time, she was internalizing it. Even if Lisa was not openly expressing her negative feelings, the hostile attributions, the dysregulation, the affective flattening, and the rigid problem solving remain an issue. She was being compliant with adult expectations because of her desire to be successful, but her fears about being hurt or disappointed remained intolerable. She admitted to frequently cutting with razors, knives, and needles when she was wrong in an attempt to punish herself. She was discovered and encouraged not to cut, and stopped herself from doing so, which might seem like a treatment success, but then again, without a new coping strategy and in a context where

compliance and obedience were expected, Lisa needed to find another way to manage these negative feelings.

A few months later, Lisa poisoned a staff member by spraying her cookies with house cleaner. Once again, Lisa found herself in a highly evocative peer situation, where other girls at her group house were becoming increasingly angry at a couple of staff who were seen as cruel, arbitrary, and uncaring, a template of what Lisa feared in authority figures. Her peer group included other girls in foster care who were traumatized and likely held similar views of authority figures. Hearing the anger from the other girls may have triggered negative feelings in herself that she needed to manage. Taking action was a way to stave off these negative feelings and increase her self-worth and feeling of control.

Lisa said that she did not plan on trying to kill the staff person but only wanted her to be sick. However, the wrong staff person got it and as a result, Lisa told her to go to the hospital. Lisa's impulsive decision had far graver results than she imagined. The staff person almost died, and Lisa was shocked by the results of her aggressive act. However, her regret seemed less about the gravity of her act than about her feelings about her target. She described the person who was poisoned as "cool staff" and someone well liked by the other girls in the house.

Perhaps Lisa's recollection of the act and her regret only at hitting the wrong target speaks to not only impulsiveness but intense anger and resentment. While peer responses and reactions might push her to act impulsively and violently, the simmering feelings of anger fueled much of the aggression. As Kerig, Ward, Vanderzee, and Moeddel (2009) claim, trauma can account for the persistence of psychological symptoms that may only be noticeable from time to time in what might be seen as surprisingly sudden and violent reactions. However, these reactions are just the intensification of the way Lisa often feels, rather than a sharp deviation.

Despite Lisa's callous treatment of her house staff, most staff people see her as good natured. Her anger seems more self-protective than evidence of persistent issues with lack of empathy; rather, she is more negatively affected by lack of self-esteem, mistrust, and vulnerability. Her history has shown an underestimation of the severity and persistence of her trauma symptoms and misunderstanding of the unevenness of her development. While she can develop care and concern for others and an ability to make decisions, Lisa struggles to hold onto these developmental achievements when she becomes dysregulated, reverting to the fight-or-flight responses that characterized her childhood.

DISCUSSION OF LISA

Lisa's presentation is a reminder of the importance of building capacities for self-regulation and not just teaching relationship skills or increasing empathy and insight. Lisa struggled with overwhelmingly negative feelings when she became dysregulated and triggered by authority figures and by her need to be accepted by her peers. Lisa did much better in highly structured environments, most likely because they provided predictable roles and responses to her behavior. She was not left to interpret the best course of action. However, highly structured settings are not sustainable in the long run if she wants to achieve typical goals of adulthood, namely a long-term relationship, a stable home life, and steady employment.

The Trauma Affect Regulation: Guide for Education and Therapy (TARGET) model may provide a better bridge to help Lisa traverse the path to adulthood with its emphasis on autonomy and increasingly complex relationships with both peers and authority figures, because it seeks to build internalized structures to better self-regulate, especially when confronting highly evocative situations. The model (Ford et al., 2012) provides strategies for practitioners who want to help

build the capacity for self-regulation and frustration tolerance among traumatized adolescents. Areas of emphasis include recognition of triggers and flashbacks, an increased capacity to recognize feelings, and learning to better observe one's thoughts and interactions with others. Additionally, goals include adolescents identifying incremental progress toward treatment goals and understanding how they can empathize with themselves and others. Providing that understanding within a milieu setting where it is repeatedly enforced can begin to affect them relationally and neurobiologically in a deeper way, where they might be likely to make more sustained gains.

Lisa would have benefited significantly from a caring and stable specialized foster family rather than the less predictable structure of a group home. However, in the absence of that option, the next best thing is an environment that emphasizes building capacities for self-regulation and empathy for herself and others. Given the right treatment, she could consolidate her gains, allowing her to be placed in less restrictive settings along a continuum of care because she would internalize the structures around her. Without this kind of trauma-informed care, she will just be temporarily contained and may continue to struggle with relationships, anger, and impulsivity. Lisa is an intelligent, caring young woman who has experienced great injustices of abuse, racism, and numerous displacements but has enormous potential for growth. Providing the right kind of intervention would influence the trajectory of her entire life, allowing her to fulfill her own ambitions and dreams.

CONCLUSION

This chapter has reviewed key elements of brain development in adolescence and how an understanding of the neurobiology of adolescence can help social work practitioners to add a neurobiological substrate to their psychosocial understanding of the opportunities and challenges associated with this developmental phase. A key char-

acteristic of adolescence is that the brain is wide open to new experience and highly capable of learning, or laying down new neuronal connections, in response to both positive and negative experiences. Because the adolescent brain learns so quickly, negative exposures such as substance abuse can become encoded or wired very quickly, changing the neurochemistry of the adolescent brain in ways that may be more difficult to reverse. Developmentally supportive experiences during adolescence, such as those associated with youth development programs, can also exert protective influences on the adolescent brain that are long lasting and serve adolescents well as they transition into adulthood.

Practitioners often come to know adolescents during times of crisis, developmentally precipitated or more clinical in nature. As has been described in the case composite of Lisa, a developmentally informed approach to work with adolescents, especially those with histories of trauma and adversity, can support models of assessment and engagement with adolescents who might otherwise be seen as resistant and hard to engage. Combining an understanding of how trauma can reverberate across time with an understanding of adolescent brain development supports the ability of practitioners to work with the most challenging adolescent presentations including challenges in self-regulation, executive functioning, and the capacity to utilize self-awareness to guide decision making and change.