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The importance of affective development for the emergence of depressive disorders during adolescence

Nicholas B. Allen and Lisa B. Sheeber

One of the most striking aspects of the epidemiology of depressive disorders across the lifespan is the rapid rise in the incidence of depression that is observed in early adolescence (Lewinsohn *et al.*, 1993, 1998). A recent meta-analysis of epidemiological studies estimated the prevalence of unipolar depressive disorders to be approximately 5.6% in adolescents as compared with 2.8% in children below age 13 (Costello *et al.*, 2006). Lifetime estimate rates for adolescents, ranging from 15–20%, are comparable with those of adults (Birmaher *et al.*, 1996). Further, longitudinal data indicate that an episode of depression is a substantial risk factor for subsequent episodes, both within adolescence and into adulthood (Birmaher *et al.*, 1996; Harrington & Vostanis, 1995). This increased vulnerability likely reflects the adverse impact of depressive episodes on neurobiological and cognitive development (Harrison, 2002; Vythilingam *et al.*, 2002) as well as on emotional, social, and occupational functioning (Bardone *et al.*, 1996; Rohde *et al.*, 1994).

These data indicate the important public health significance of adolescent depressive syndromes. Moreover, they direct our attention to the likelihood that some causative mechanism, or mechanisms, underlie this population-wide increase in vulnerability, and in so doing highlight the need to understand the relationships between early adolescent development and the psychopathological processes that give rise to depressive conditions. Explicating these relationships will yield important insights not only for understanding depressive disorders during adolescence (a critically important life stage if we are to provide effective prevention and early intervention), but likely also for understanding vulnerability throughout the life span. In other words, the developmentally driven changes that occur during early adolescence and result in an increased cohort-wide vulnerability to depression may provide clues as to

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the salient individual differences that render individuals more vulnerable to depression during other phases of life.

Emotional development during early adolescence

In this book we take the perspective that understanding the developmental changes occurring in *affective* functioning during the transition from childhood to early adolescence will enable a comprehensive and integrated picture of how vulnerability to depressive disorders is transformed during this stage of life. Not only is depression increasingly conceptualized as a disorder of affective functioning, but affective development is inextricably linked with cognitive, biological, sexual, and interpersonal processes also undergoing rapid and marked development during this period. Hence, the focus on affective development facilitates a broad and integrative exploration of the developmental roots of vulnerability to depressive disorder.

Adolescence is characterized by significant increases in negative emotionality, greater sensitivity to peer-related social interactions, greater reward-seeking, and greater engagement with long-term and socially complex goals (Nelson *et al.*, 2005). While these changes promote the skills necessary for greater independence from the family and the establishment of developmentally important peer and romantic relationships, they are also hypothesized to create greater vulnerability to emotional and behavioral dysregulation (Spear, 2000; Steinberg, 2005).

The defining neurobiological change of early adolescence is puberty. Although biological researchers have traditionally viewed puberty from an endocrine perspective, more recent developments have emphasized the neural control of hormone secretion and the extensive brain remodeling that is associated with puberty (Sisk & Foster, 2004). In particular, brain regions associated with affective processing (particularly a ventral network of structures that includes the amygdala/hippocampus, ventral striatum, and hypothalamus), are densely innervated by gonadal steroid receptors (Nelson *et al.*, 2005; Sisk & Foster, 2004). These steroids also play a role in regulating many of the neurotransmitter systems associated with affective and social responsiveness, including dopamine, serotonin, endogenous opioids, oxytocin, and vasopression (De Vries *et al.*, 1992; Epperson *et al.*, 1999; McCarthy, 1995; McEwen, 2001; Osterlund & Hurd, 2001; Rubinow & Schmidt, 1996). Furthermore, gonadal steroids have their own direct effects on affective processes (Baulieu, 1998; McEwen, 2001). For example, higher levels of gonadal steroids are associated with increased affective responses to infant stimuli in parents (Fleming *et al.*, 1997, 2002). Also, both human and animal studies support a link between gonadal hormones (especially testosterone) and sensitivity to social status (Book *et al.*, 2001; Rowe *et al.*, 2004). Thus, although the main function

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of puberty may be to increase sensitivity to sexual stimuli and increase sexual motivation (Sisk & Forster, 2004), it may also serve to increase affective reactivity to non-sexual stimuli, perhaps reflecting a more general reorientation to the social and emotional aspects of the environment (Nelson *et al.*, 2005).

Consistent with this hypothesis, findings from other studies suggest that puberty is associated with increased emotionality and reward-seeking. For example, significant associations have been documented between pubertal stage and measures of sensation seeking and risk-taking (Martin *et al.*, 2002). By contrast, age did not show an association with these variables. Similarly, Steinberg (1987) found that pubertal status predicted the frequency and intensity of parent–adolescent conflict more strongly than did chronological age, which may reflect, in part, greater negative affect on the part of the adolescent. Puberty has also been shown to predict risk for depression more strongly than age (Angold *et al.*, 1999).

Adolescents are also substantially more sociable than younger children (Steinberg & Sheffield Morris, 2001), spending up to a third of their waking hours in the company of their peers (Hartup & Stevens, 1997). This sociability, as well as the more effortful and deliberate formation of relationships characterizing this age group, is at least in part driven by the increased affective salience of socially related events (Larson & Richards, 1994; Steinberg & Sheffield Morris, 2001). The social world that children encounter during the transition to adolescence, moreover, is increasingly broad, hierarchical, and complex (Brown, 2004). One-on-one relationships become more intimate and trusting (Steinberg & Sheffield Morris, 2001), and romantic relationships emerge, prompted by new motivational systems, sexual development, and cultural imperatives (Steinberg *et al.*, 2006). Small groups of between three and ten members become important (Brown & Klute, 2003), and adolescents may also start to associate with larger crowds consisting of people who have established the same basic identity as each other (e.g. goths, nerds, skaters). Thus dyadic relationships are nested in dynamic group structures that are themselves nested in broader crowd structures, resulting in a more layered and complex social system than exists in the pre-adolescent years.

Adolescent relationships are also inherently unstable (Brown, 2004; Hardy *et al.*, 2002). Fewer than half of adolescent friendships endure over the period of a year (Connolly *et al.*, 2000; Degirmencioglu *et al.*, 1998), and romantic relationships are similarly short-lived, especially in early adolescence (Connolly *et al.*, 2000; Connolly & Goldberg, 1999; Feiring, 1996). The tenuousness and complexity of adolescent relationships occur in the context of adolescents' increased sensitivity to acceptance and rejection by peers (Brown, 2004; Larson & Richards, 1994; Nelson *et al.*, 2005; O'Brien & Bierman, 1988). This combination makes adolescence a period of particularly high interpersonal stress, associated especially with the establishment and maintenance of the

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kind of social reputation that will enhance social acceptance and reduce the likelihood of rejection and ostracism.

Adolescence is also characterized by the maturation of a set of core executive and self-regulatory skills, although on a different trajectory to the aforementioned puberty-related affective and motivational changes (Steinberg, 2005). In particular, the development of these self-regulatory skills is characterized by slower and more gradual maturation that continues into early adulthood. This maturation is thought to be associated with significant remodeling in brain regions associated with social cognition, response inhibition, monitoring, emotion regulation, and the capacity for abstract, reflective, and hypothetical thinking (Nelson *et al.*, 2005; Paus, 2005). Notably, these changes have been hypothesized to both protect and increase vulnerability to depression. On the one hand, adolescents may be vulnerable as a function of being motivated toward increasingly rewarding and potentially risky activities before they have an adaptive regulatory architecture in place. This is particularly the case given the powerful negative emotions they may experience when such rewards are not realized. So, for example, their emotional equilibrium may be uniquely challenged by the vicissitudes of early romantic relationships, rendering them prone to negative affectivity and depressive symptoms (see Furman, McDunn, & Young, Chapter 16 and La Greca, Davila, & Siegel, Chapter 17, this volume) to a greater extent than they will be a few years later. On the other hand, some aspects of these developing regulatory competencies may actually increase vulnerability to distress and depression. In particular, the increased capacity to engage with abstract and temporally distal rewards may potentiate risk for depression in that pursuit of these rewards is more easily frustrated or thwarted than is the pursuit of more proximal and concrete ones (Davey *et al.*, 2008). The difficulties inherent in engaging with abstract rewards can be seen, for example, in adolescents' increasing concern about reputation and their distress at potential threats to their social standing (see Gilbert and Irons, Chapter 11, this volume).

Finally, significant changes also begin to occur in the nature of family and social relations. One of the primary developmental tasks for families of adolescents is renegotiating relationships such that the necessarily asymmetrical power structure evident between children and their parents starts to become more balanced, as adolescents are increasingly allowed more autonomy and input into family and personal decision-making (Gutman & Eccles, 2007; Steinberg, 2001). These changes in parent–adolescent relationships necessarily mean that external contributors to adolescent affective and behavioral regulation, in the form of parental support and structure, are reduced at the same time that increased emotionality and reward-seeking create additional regulatory demands.

This brief review of some of the salient factors impinging on emotional development during early adolescence illustrates the range of developmental changes potentially contributing to vulnerability to depressive disorder: (1) puberty-driven

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increases in reward seeking and social sensitivity, (2) immaturity of the neurobiological systems underlying emotion and self-regulation, (3) reductions in parental supervision and increases in family conflict, (4) increased cognitive capacity to affectively engage with abstract, temporally distant, and socially embedded goals and (5) increased importance of, and instability in, peer relationships. Surprisingly, however, although adolescence is a time of increased stress, most adolescents negotiate these changes successfully (Arnett, 1999). This implies that the increased prevalence of depressive disorder during adolescence must be a result of these developmental processes interacting with other individual, environmental, and cultural vulnerabilities to result in depressive symptoms. Examining the interaction between developmental processes during adolescence and pre-existing vulnerability factors therefore has the potential to offer unique insights into the etiology of depressive disorders. It is the desire to enhance our understanding of these interactions that has motivated the preparation and design of this volume.

The structure of this volume

This volume has, to our knowledge, a unique structure. We have identified a series of critical domains relevant to adolescent emotional development, and within each of these domains we have included one chapter from a leading developmentalist (or group thereof) describing the normative adolescent developmental processes relevant to that domain. These chapters are paired with chapters written by clinicians and clinical researchers, who explore the relationship between developmental processes in that domain and vulnerability to depressive disorders. Each chapter addresses gender and cultural differences as well as risk for bipolar disorder within their relevant domain, to the extent that the literature allows. By utilizing such a structure, we hope to not only create a set of up-to-date and comprehensive reviews of the issues relevant to adolescent emotional development and the emergence of depressive disorders, but also to create a "conversation" between the developmental and clinical perspectives on these issues for the reader.

In the first section following this introduction we include a pair of chapters describing the changes in *emotional experience and the prevalence of depressive disorder* during the transition from childhood to adolescence. First Reed Larson and Lisa Sheeber describe the normative changes in the daily emotional experience and behavior during this developmental transition, with an emphasis on findings from studies using experience-sampling methodologies. They describe adolescence as a time of increasing negative affect, examine the contributions of stress, puberty, and cognitive development to this increase, and explore how these normative changes may relate to depressive disorder. The chapter by John Seeley and Peter M. Lewinsohn draws on data from the

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Oregon Adolescent Depression Project, which is one of the most important epidemiological studies of the causes and consequences of depressive disorders during adolescence. They describe not only the epidemiological changes in depression that occur during the transition from childhood to adolescence, but also the implications of these disorders for lifetime risk for mental health problems.

The second section explores *adolescent brain development*. Tomáš Paus first describes how research in structural and functional neuroimaging has shed new light on our understanding of brain development during adolescence, and also specifically explores the issue of sex differences in adolescent brain development. Given that the rise of depression during adolescence is particularly notable in females, sex differences in brain development is one domain that might provide clues to the emergence of these sex differences in vulnerability. Erika Forbes, Jennifer Silk, and Ron Dahl then explore the links between brain development and adolescent depression. They note the striking overlap between the neural systems undergoing development during adolescence, and those associated with depression. As well as exploring the impact of brain development on risk for depression, they also consider the important, but under-researched topic of the impact of adolescent depression on brain development and future functioning.

The third section of the book addresses *pubertal and sexual development*. Laura DeRose and Jeanne Brooks-Gunn first explore the association between both pubertal stage and pubertal timing and affect. Julia Graber then explores the impact of these processes on risk for depressive disorders. Although both these reviews find evidence of an association between pubertal development and vulnerability to distressing affect and depressive disorder, they also make it clear that puberty, as a normative developmental process, is not pathogenic in and of itself. Rather, it plays a role in potentiating the effects of other vulnerability factors. Both chapters also identify priorities for future research.

The next section deals with *cognitive development*. Amanda Kesek, Philip David Zelazo, and Marc Lewis describe the development of executive cognitive functions and their implications for emotion regulation. Their chapter specifically explores the relationship between the development of the prefrontal cortex and these executive abilities. They describe how as these brain structures develop, adolescents are increasingly able to use complex rule hierarchies to guide their behavior. Christopher Monk and Daniel Pine then explore the relationship between cognitive development and depression, and they describe how cognitive function can be used to bridge the symptoms of depression to brain function.

The next section is the first to explicitly explore individual differences that might impact on both emotional development and risk for depression. Developmental researchers have long used *temperament* to describe the fundamental dimensions of individual differences across the life span. Ann Sanson,

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Primrose Letcher, and Diana Smart first explore the specific characteristics of temperament that are relevant to adolescent socio-emotional functioning. They describe the degree of stability and change in temperament from childhood through to adolescence, how temperament provides the basis for emerging personality differences, and the implications of temperamental differences for both healthy and unhealthy development. Dan Klein, Lea Dougherty, Rebecca Laptook, and Thomas Olino then explore the relationship of temperament to risk for mood disorders. They conclude that temperament is a well-established risk factor, and explore some of the potential mediators and moderators of this relationship, including gender, stress, and neurobiological processes.

Familial processes are explored in the next section. Erin Hunter, Danielle Hessler, and Lynn Fainsilber Katz examine the role of the family in the affective development of adolescents, with a particular emphasis on the role of socialization processes during both childhood and adolescence. Martha Tompson, James McKowan, and Joan Asarnow then explore the relationship between family processes and mood disorder, including a specific discussion of the impact of parental mood disorder on both family processes and adolescent risk. They conclude that the adolescent in a distressed family environment will have more difficulty navigating the developmental tasks of the adolescent period and developing a positive and effective sense of self, potentially resulting in increased risk for depression. With the onset of depression, youth may also have increasingly conflictual, and less rewarding interactions with family members.

Many of the brain and cognitive changes occurring during adolescence are thought to potentiate significant changes in social cognition and behavior, which are the focus of the next two sections. Developmental changes in *social and moral emotions*, such as shame, guilt and empathy/sympathy, are explored in the next section. Nancy Eisenberg and Amanda Sheffield Morris describe the development of these emotions and their relationship to a range of socio-emotional outcomes in non-clinical samples. Paul Gilbert and Chris Irons then address the emergence of shame, self-criticism and self-compassion during adolescence, and explore their implications for depressive disorders.

The next section deals with social behavior in the form of *peer and romantic relationships*. Wyndol Furman, Christine McDunn, and Brennan Young describe the impact of these social relationships on affective experience and affect regulation. They conclude that despite the salience of these relationships during adolescence, the particular pathways by which they impact emotional development are not yet well delineated. Annette La Greca, Joanne Davila, and Rebecca Siegel then explore the significance of the adolescent social context for the development and maintenance of depression. As in the previous chapter, they outline how despite the clear association between peer processes and depression, more research is needed on the particular mechanisms by which these associations emerge.

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We (the editors) provide a final chapter exploring the implications of the material presented in the book for a developmentally informed account of depression during adolescence. First, we consider the possibility of developing a more integrative perspective on adolescent development and risk for depression, and explore some recent examples of such perspectives, including one of our own. Finally, implications for future research directions, prevention, and early intervention are explored. We are hopeful that the material presented in the volume will stimulate further empirical and conceptual work on the relationships between development and psychopathology during adolescence, and that these developments will be translated into effective, evidence-based approaches to preventing and treating adolescent depression and promoting healthy youth development.

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