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Introduction to the special issue on typical and atypical neural processing of emotional and social cues across the lifespan

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Special Issue: Introduction

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Over the past few decades, research describing how we use our brains to perceive, evaluate, remember, and evaluate emotional and social cues has burgeoned. Accumulating evidence in this literature supports the idea that as our brains develop, mature, and age, their responses to emotion and to social interactions evolve in a variety of ways. For example, recent findings suggest neural bases for increases in emotional stability and memory for positive experiences that appear to accompany aging (e.g., Kensinger & Schacter, 2008; Williams, et al., 2006). A broad understanding of such developmental changes is difficult to acquire, in part because researchers often focus on particular age groups and publish their findings in specialized journals, with little reference to comparable (or inconsistent) findings in samples drawn from different developmental periods. This special issue, which grew out of a symposium presented at the Society for Psychophysiological Research in 2007, represents an effort to bridge the related, but distinct, literatures on neural correlates of socio-emotional experience in youths, adults, and the elderly, and to stimulate crosstalk and collaboration among researchers who use a range of tools to study the neural basis of social and emotional functioning at different stages of the lifespan.

Broadly speaking, the six articles in this issue explore ways in which the brain implements emotional processes over the course of development. The issue opens with a review by **Somerville and colleagues** of the **neuroimaging literature on facial expression recognition from childhood through old age**. In this developmentally-oriented review article, Somerville et al. provide a compelling summary and critique of this literature, highlighting both the insights that research to date has yielded into the developmental trajectory of facial expression processing and the barriers to integrating these insights into a cohesive model. Whereas this article provides an example of how distinct, but related, studies focused on

different developmental stages can be examined and evaluated collectively, the remaining articles in the issue represent cutting edge research using a variety of technologies and behavioral paradigms to examine how the brain implements social and emotional processes during adolescence, adulthood, and old age.

Three empirical articles in the special issue focus on emotion processing in adolescents. Forbes et al., Mueller et al., and McClure-Tone et al. all explored associations among neuroimaging data, psychopathology, and behavioral or emotional responses to social stimuli in healthy and clinical samples of youths. **Forbes et al.** focused specifically on **relationships among brain activation in the presence of emotional faces, pubertal maturation, depressive symptoms, and real-world subjective negative affect**. This fMRI study, which is among the first to integrate neuroimaging data with moment-to-moment ratings of emotion in daily life, yields striking evidence that younger and older adolescents show different patterns of response in the amygdala and ventrolateral prefrontal cortex (VLPFC) to facial cues. Further, propensity to experience negative mood states, including depression, appears to modulate these differences. **Mueller et al.** also examined **neural activation during adolescents' encoding of emotional faces, with a focus on healthy adolescents and peers with a genetically mediated hormonal disorder, Congenital Adrenal Hyperplasia (CAH)**. Not only did group differences in memory for viewed faces emerge, but participants with CAH also showed different patterns of neural activation during viewing of fearful faces than did same-sex peers.

With **McClure-Tone and colleagues'** article, the focus shifts from neural responses to emotional faces to neural correlates of rewarding and punitive social interactions in adolescents. This study compared **behavior, self-reported emotional response, and neural activity between adolescents with and without anxiety disorders during the Prisoner's Dilemma**

(PD) game, an economic exchange task involving betrayal and cooperation. The authors focused in particular on brain regions thought to participate in reflection on one's own and on others' mental states. Results provide preliminary evidence that anxious adolescents and healthy peers show different responses in some of these regions, as well as different behavioral and emotional responses, when they receive feedback about their co-player's actions.

The remaining two studies in the current issue both focused on neural aspects of emotion processing. Each study, however, has distinctive strengths in its approach that represent desirable directions for the literature to move and thus merit highlighting. **Bernat and colleagues'** contribution is notable in that rather than fMRI, the authors used **multiple electrocortical and psychophysiological measures to characterize healthy young adults' efforts to modulate their responses to emotionally charged images**. Their findings enhance the existing literature by characterizing how active emotion regulation efforts manifest on a variety of physiological measures and underscore the importance of combining multiple tools to more fully describe a complex emotional process.

LeClerc and Kensinger's study is also distinctive in that it is the only research in this issue involving direct contrasts of neural activity during emotional information processing between individuals at two developmental stages. Their **comparison of neural activation patterns during the processing of emotional pictures versus words between young and older adults** yielded evidence of striking developmental differences in amygdala and medial prefrontal cortex activation that are notably stimulus-specific. Direct comparisons of neural activity between individuals of different ages within a single study are increasingly common (e.g., Braet, et al., 2009; Burnett & Blakemore, 2009; Christakou, et al., 2009; Church, Coalson, Lugar, Petersen, & Schlaggar, 2008; Ernst, et al., 2005; McClure, et al., 2004; Monk, et al.,

2003). However, studies, particularly those that focus specifically on neural correlates of emotional processing, that include older adults are still relatively sparse, despite some notable exceptions (e.g., Addis, LeClerc, Muscatell, & Kensinger, 2009; Kensinger & Schacter, 2008; Wright, Wedig, Williams, Rauch, & Albert, 2006).

The studies in this issue provide a rich illustration of the value inherent in a developmental perspective on emotion and the brain. They represent, however, only a starting point. Some future steps to advance this literature include the conduct of a broader range of studies that contrast neural activity across more than two age groups (e.g., adolescents, adults, and older adults), that combine multiple physiological and behavioral approaches to characterize an emotional phenomenon, and that aggregate findings obtained with identical stimulus tasks in both healthy and clinical samples that vary in age. We hope that this issue will spark interest in collaborative efforts across diverse research labs that will ultimately provide a cohesive and comprehensive picture of emotion and its neural mechanisms throughout the lifespan.

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