Promoting Healthy Socioemotional Development: A Neuropsychologically Informed Approach
Conflicts of interest: None

Research funding:
- National Institute of Child Health and Development (NICHD)
- Anxiety and Depression Association of America (ADAA)
- Georgia State University Brains and Behavior Program
- How do emotion and emotion regulation skills develop?

- How can the dynamic interplay among intrapersonal and interpersonal characteristics lead to deviations from typical developmental trajectories?

- How can we effectively target the emotion dysregulation that can emerge in atypical emotional development?
• We begin early to experience and express emotion

http://crazytmac.deviantart.com/art/emotion-chart-140516833
• We do so in ways that others can accurately read and interpret . . .
and we do so in an incredibly nuanced way . . .

http://crazytmac.deviantart.com/art/emotion-chart-140516833
We also begin early to read and respond to others’ emotional cues . . .

http://www.youtube.com/watch?v=apzXGEbZht0
and to regulate our emotions . . . initially with ample support, increasingly on our own
How do emotion and emotion regulation skills develop?

What happens in the brain that allows us to acquire these competencies?
Prenatal development
The development of the brain displayed in a schematic form.

Development in Infancy, Childhood, & Adolescence
Cellular Level Development

Structural Level Development: Gray matter

Big Picture:

Higher-order association cortices mature after somatosensory and visual cortices

Phylogenetically older structures mature earlier than do newer ones

Around puberty, sustained GM loss begins

Gogtay N et al. PNAS 2004;101:8174-8179

©2004 by National Academy of Sciences
Right lateral and top views of GM maturation over the cortical surface (n=13; each scanned 3-4 times at 2 year intervals)

Gogtay N et al. PNAS 2004;101:8174-8179
Medial inferior temporal & caudal/medial inferior frontal regions mature early, with little change thereafter.

Orbitofrontal regions continue to mature throughout adolescence.
Structural level Development: White Matter

Non-cortical white matter circuitry becomes more coherent, or more myelinated, with age


© The Author 2005. Published by Oxford University Press. All rights reserved. For permissions, please e-mail: journals.permissions@oupjournals.org
Brain myelination across development. Top panels: Images show age-related increase in brain size and white matter intensity acquired longitudinally from 1 child.

Bottom panels: Age-related differences in the organization of corpus callosum white matter (higher values = greater organization of fiber tracts).

Longitudinal age-related changes of fractional anisotropy.

Lebel C, and Beaulieu C J. Neurosci. 2011;31:10937-10947

©2011 by Society for Neuroscience

n=103
Figure 2. Over age the graph architecture matures from a “local” organization to a “distributed” organization.

A: Anatomically-clustered regions segregate with age.

B. Functionally clustered networks become more integrated with age.

---

Changes Occur Within and Between Circuits

Gray Matter

White Matter

Volume (cm$^3$)

Age (years)

- males

- females

National Institutes of Health magnetic resonance imaging study of normal brain development (Cerebral Cortex, 2012).
What does development look like in neural regions that support emotional experience and regulation?
Emotions and Emotion Regulation

Voluntary Regulation

Emotion
Amygdala Volume Peaks Between Ages 9-11 Years

http://www.plosone.org/article/info:doi/10.1371/journal.pone.0046970
The age of attaining peak cortical thickness in children with ADHD compared with typically developing children.

A  
ADHD

Typically developing controls

B
ADHD

Typically developing controls

Shaw P et al. PNAS 2007;104:19649-19654

©2007 by National Academy of Sciences
Bottom line:
- Subcortical regions (orange, some red): develop early
- Cortical regions (blue, purple): developmental trajectory extends into adulthood
How can the dynamic interplay among intrapersonal and interpersonal characteristics lead to deviations from typical developmental trajectories?
Adaptive Emotion Regulation

Regulatory Control

Emotion
Under-regulation
Detachment/Over-regulation

Regulatory Control

Emotion
What determines whether one develops adaptive or maladaptive emotion regulation capacities?
Intraindividual moderators:
Genetic Liabilities and their Neurobiological Expressions

Interindividual moderators:
Prenatal and family environments, school environment, peer interactions

Factors that Interact to Determine Success at Emotion Regulation
Anxiety and Related Internalizing Conditions as a Model

Table 1  Gender distribution among nondepressed/nonanxious, subthreshold-depressed/anxious and depressed/anxious groups

<table>
<thead>
<tr>
<th>Levels of anxiety</th>
<th>Levels of depression</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys %</td>
<td>Girls %</td>
</tr>
<tr>
<td>No anxiety/depression</td>
<td>50.35</td>
</tr>
<tr>
<td>Subthreshold-anxiety/ depression</td>
<td>38.24</td>
</tr>
<tr>
<td>Full anxiety/depression</td>
<td>24.07</td>
</tr>
</tbody>
</table>

N = 12,395.

• Intraindividual moderators
  – Prenatal environment
  – Family environment
    • Parent mood/anxiety disorders
    • Family interaction patterns
  – School/peer environment

• Interactions
• McGrath article

Genetic Profile
• Maternal physical health
• Maternal mental health

Prenatal Environment
Outcomes associated with fetal risk exposure during pregnancy

Cumulative prenatal risk exposure significantly predicted anxiety in 8-12 year olds.

Outcomes associated with maternal anxiety during pregnancy

Research focused on 19th-31st weeks of gestation

Figure 2  Pregnancy-specific anxiety predicts anxiety classification during preadolescence. Children who are in the normal range for anxiety were exposed to lower pregnancy-specific anxiety. In contrast, children who were exposed to elevated pregnancy-specific anxiety during gestation are significantly more likely to be rated in the anxious/borderline anxious range.

N=178 mothers & their 6-9 year old children

Areas of reduced gray matter volume in association with pregnancy anxiety at 19, 25 and 31 weeks gestation. Voxels with $p < 0.001$ (uncorrected) are displayed.