Cognitive Dysfunction in Major Depressive Disorder

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‘If a fright or despondency lasts for a long time, it is a melancholic affection’

Hippocrates, Aphorisms, Section 6, no. 23
Major Depression Model

Disorder of brain systems that regulate:

• Mood,
• Motivation,
• Cognitive,
• Endocrine, and
• Behavioral functions.

Murrough et al. Neurobiology of Learning and Memory 96:553 – 563;2011
Mayberg 2003, Price and Drevets 2010, Seminowicz 2004
Schematic depicting brain regions that showed a significantly different association with amygdala in the control versus depressed states.

- **VMPFC**
- **LIFG**
- **AMYGDALA**

Left inferior frontal gyrus

Healthy

Depressed
Cognitive Dysfunction in MDD

- Cognitive biases
  - distorted information processing
  - attentional allocation toward negative stimuli

- Cognitive deficits
  - impairments in attention
  - short-term memory
  - executive functioning

Murrough et al. Neurobiology of Learning and Memory 96:553 – 563;2011
Distorted Information Processing

• Cognitive schemas
  – Negative themes self, future, world
  – Basis for CBT

• Perception and attention
  – Preferential perception and processing towards negative information

• Interpretation

• Memory

Gotlib and Joormann, 2010
Distorted Information Processing: Interpretation

• Attribution and inferential biases
• Negative inferences for the causes and consequences of life events
• Facial expressions of emotion more negative or less positive than do matched non-depressed individuals

Distorted Information Processing: Memory

• More likely to remember negative emotional information
  – Self-relevant tasks
  – Negative words
  – Negative faces

• Recalled more generic or over general memories
  – Over generalization target of CBT

Bradley & Mathews, 1983; Bradley, Mogg, & Williams, 1995; Harmer et al., 2009; Murray, Whitehouse, & Alloy, 1999; Williams JMG Psychological Bulletin. 2007
Attentional allocation toward negative stimuli

• Early stages of processing
  – only modest evidence to support an association between major depression and a subliminal attentional bias toward negative material

• Later stages of processing
  – involves difficulties in disengaging from negative material once it captures an initial attention

Foland-Ross and Gotlib 2012
Stuck in a Rut

- "Normal" state
- "Down" state
- "Depression"

Stress (trauma, loss, illness)

Healthy

MDD

Holtzheimer and Mayberg. Trends in Neurosciences, January 2011, Vol. 34, No. 1
Cognitive Bias: MDD Sticky Negative Thoughts.

When negative material was removed from working memory compared to when it was maintained in working memory, greater increase in activation in:

- Dorsal anterior Cingulate (dACC),
- Left and right insula, and
- Superior parietal lobe areas

Foland-Ross et al. Psychological Science 2013 Mar 1;24(3):334-44
Clinical Manifestations

- Vulnerable to elaborating on negative material in their environment
- Difficulty disengaging from and inhibiting processing of negative valenced content
- Ruminate
Cognitive Deficits: Impairments in attention

• Resource allocation hypothesis
  – depression uses cognitive resources and reduces cognitive capacity
  – Difficulties engaging in effortful cognitive tasks

• Impairments of effortful attention
  – processing speed,
  – selective attention

• No impairments in automatic processing

Cognitive Deficits:
Impairments in attention

• Affective interference hypothesis
  – depression involves a preoccupation with emotional material,
  – performance selectively impaired on cognitive tasks that require individuals to ignore emotional information

Cognitive Deficits: Short-term memory

• Working memory
  – the system involved in the active maintenance and manipulation of information

• Diminished ability
  – to attend to task-relevant stimuli and
  – to inhibit task-irrelevant information

• MDD with impairments in cognitive control and inhibition

Cognitive Deficits: Executive dysfunction

- Executive processing
  - control and update the contents of working memory
  - protect working memory from intrusions of irrelevant information
  - discarding information no longer relevant
- Intrusive negative thoughts
- Decreased inhibition of negative inputs
- Decreased intentional forgetting

Funes the Memorious

• “I alone have more memories than all of mankind has probably had since the world has been the world.”
• “My memory, sir, is like a garbage heap”

Implications for Treatment

- Well Being Therapy
- Cognitive Control
- Decrease overgeneralizations

Summary

• MDD associated with cognitive dysfunction
• Brain circuits and connectivity
  – Impaired cognitive control
• Cognitive biases
• Cognitive deficits
• Ruminations
• Implications for treatment