CACL 541
Disorders of Childhood I: The Neuroscience Learning Disabilities

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The goal of this class is:

1. To familiarize students with the emerging knowledge in the neurosciences;
2. To delineate the major controversies this new paradigm raises; and
3. To discuss the relevance of this body of knowledge to the development of childhood psychopathology.

The objectives are:

To illustrate the goals through a discussion of the neurobiological underpinnings of some of the major learning disabilities, namely language-based disorder, dyslexia, ADHD, and executive function disorders. The focus will be on understanding the dynamics of children with these problems and the implications for treatment interventions.

Course Bibliography

Texts: [I suggest you purchase one book with * as a basic text on brain function and one with ** as a basic text on clinical relevance]


brain systems. Requires patient reading for rewarding results.]


**Siegel, D. J. (1999). The developing mind: Toward a neurobiology of interpersonal experience. NY: Guilford Press. [Very popular, very readable, and informative book]


Course outline

Class I. Introduction

A. PDM

1. Why the PDM?


2. Major Sections Part II: Classification of Child and Adolescent Mental Health Disorders:

   a. Profile of Mental Functioning for C & A (MCA).

   b. C & A Personality Patterns and Disorders (PCA Axis)

   c. C & A Symptom Patterns: The Subjective Experience (SCA Axis)

B. The Emergence of a New Paradigm

1. Freud’s project revisited
   a. Revival of Freud’s Project
   b. Kandel’s proposal: Contribution to the integration dialogue:
      (1) The nature of the dynamic unconscious.
      (2) The problem of psychic determinism
      (3) The role of development in psychopathology.
      (4) The causes of psychopathology.
      (5) Does psychotherapy produce brain change?
      (6) Psychopharmacology and psychopathology.


   c. Can psychoanalysis and neuroscience be integrated?
      (1) Two strategies have emerged for bridging neuroscience and psychoanalysis

         (a) The Rosetta Stone strategy


         (b) The Neurodevelopmental Model


C. From Neuroscience to a Neuropsychodynamic Perspective

1. The agenda for a new paradigm: The making of minds—the sense of self
   a. A theory of development: The neurodevelopmental perspective
   b. A theory of psychopathology: Deficit model, innate factors contribute to dysfunctional states
   c. A theory of treatment: Brain changes may result from talk therapy

2. Methodology:
   a. Non-linear dynamic systems
b. Evolutionary perspective


D. A Neurodevelopmental Perspective of the sense of self

1. Neuropsychological systems and their functions

2. The relational components
   a. Sociality & social communication
   b. Emotional communication
   c. The attachment system

3. The intrapersonal experience: Meaning of experience
   a. The sense of self cohesion
      (1) Mindsharing
      (2) Emotional communication
   b. Coherent self-narratives
      (1) Personal and shared meanings
      (2) Central coherence
      (3) Relevance Theory


4. Psychopathology: Deficits and disconnections
   a. Neuropsychological Deficits:
      (1) Constraints on competence and functioning
      (2) Constraints on social relationships, affect integration, and attachments
      (3) Constraints on integration of the meaning of experiences
   b. Relational deficits
      (1) Problems in sociability & social communication
      (2) Problems in emotional communication & processing
      (3) Insecure attachments
   c. Self deficits
      (1) Selfobject function deficits
      (2) Deficits in self-cohesion
      (3) Incoherent self-narratives

5. Remediation & Treatment
a. Complementary functions:

b. Remediation of neuropsychological deficits:
   (1) provide adjunctive functions
   (2) O.T., Tutoring

c. Provide group therapy, social skills and support groups

d. Treatment of disorders of the self:
   (1) provide selfobject functions and
   (2) a coherent self-narrative


Class II. The making of minds: Of brains and selves

A. Neuropsychological systems and their functions


B. Theories of brain functions

   1. Localization theories

   2. Neural network theories

   3. The embodied mind

C. Brain structures

   1. Neuron, neuronal networks, neurotransmitters

   2. Hemispheric specialization and functions & dysfunctions associated with each lobe

   3. Functions and dysfunctions associated with the limbic system and the basal ganglia


D. The neuron

   1. Synaptic contact:

      a. Neurons do not link directly with one another, they linked with others via a synapse which enables impulses to pass between nerves.

      b. When a nerve impulse arrives at the synaptic boutton at
the end of the axon, it causes the tiny sacs to fuse with the membrane and release a chemical neurotransmitters. These travel across the narrow gap and trigger an impulse in the second neuron.

2. The neurotransmitters & Sources of Neurotransmitters

a. Dopamine (Substantia nigra & ventral tegmental area)
   (1) acts as a reward system
   (2) Involved in parkinsonism, which is produced by its absence.
   (3) Schizophrenia appears to result from and excess of dopamine

b. Norepinephrine (locus caeruleus)
   (1) Norepinephrine plays a large role in attention and focus. For people with ADD/ADHD, psychostimulant medications such as Ritalin, Dextedrine, and Adderall are prescribed to help increase levels of norepinephrine and dopamine.

c. Serotonin (raphe nucleus)
   (1) Serotonin modulates mood, emotion, sleep and appetite and thus is implicated in the control of numerous behavioral and physiological functions.
   (2) It affects many basic psychological functions such as anxiety mechanisms and the regulation of thoughts, aggression, and sex drive.
   (3) It plays an important role in the regulation of mood and a key role in the treatment of depression.

d.

3. Neuronal networks

E. Cerebral Cortex

1. Brain Hemispheres
2. Contralateral Representation
3. Corpus Callosum
4. Motor & somatosensory cortex

F. Brain Anatomy & Related Dysfunctions

1. Left Hemisphere -----------Language disorders
2. Right Hemisphere----------Nonverbal LD
3. Lobes and associated disorders
   a. Frontal-----------------ADHD, Executive Functions
   b. Parietal---------------Body in space, spatial orientation
   c. Temporal---------------Dyslexia, memory
   d. Occipital---------------Visual processing
4. Limbic System-------------Anxiety disorders
5. Basal Ganglia----------Motor movements, Tourette’s

G. Hemispheric Specialization

PPE Archive

1. Left Hemisphere: Dominant hemisphere
a. Language and speech areas:
   (1) Wernicke’s area is involved in decoding speech sounds. It is located in the temporal lobe adjacent to the auditory cortex.
   (2) Broca’s area is involved in speech production. It lies immediately in front of the part of the motor cortex that controls the muscles involved in speech.

2. Right Hemisphere: Non-dominant hemisphere
   a. Non-linguistic communication
   b. Emotion perception
   c. Spatial orientation, & Spatial relations (right-left discrimination)
   d. Timing and time perception
   e. Music appreciation

H. Case presentation

Psychopathology

Class III. Left hemisphere functions & dysfunctions

A. Left hemisphere functions
   1. Verbal language

B. Left hemisphere dysfunctions
   1. Language-based disorders
      a. Receptive language
         (1) Phonological level–dyslexia
         (2) Morphological level–reading problems
         (3) Syntactical level–grammar disorders
         (4) Semantic level–comprehension disorders
      b. Expressive language
         (1) Speech problems (motor impairments)
         (2) Level of Pragmatics (i.e., usage)
      c. Central Auditory Processing Disorders
      d. Other language-based disorders

2. Dyslexia:
   a. Characteristics
      (1) Defining Features: Dyslexia is one of several distinct learning disabilities. It is a specific language-based disorder of constitutional origin characterized by difficulties in single word decoding, usually reflecting insufficient phonological processing abilities. These difficulties in single word decoding are often unexpected in relation to age and other cognitive and academic abilities: they are not the result of generalized developmental disability or sensory impairment. Dyslexia is manifested by variable difficulty with different forms of language, often including, in addition to problems in reading, a conspicuous problem with acquiring proficiency in writing and spelling. (Orton Dyslexia Society definition adopted by the National Institutes of
Prevalence rates: Estimates of children in the school population in the U.S. who have reading difficulties range from 20 to 30%. The percentage varies among whites, African-Americans, and other ethnic groups. Only a subset of this group of children is identified as having dyslexia. The disorder may be present in a range from mild to severe and is thought to occur in approximately 3 to 6% of the school age population [Frost, 1995 #1820].

Sex ratio: Incidence is the same in males as in females, although boys may be affected slightly more severely than girls (Lyon, 1990, p. 50).

Coexisting conditions: At one time dyslexia was thought to be associated with a variety of somatic illnesses, such as allergies. But the association has not been supported by research.

b. Developmental History: Usually unremarkable as most milestones are achieved on time.

c. Disorders of the Self: Self-esteem problems are prevalent

(1) Presenting Symptoms:

(a) Academic: Problems first appear when children begin to read. They have difficulty identifying their letters. They have trouble recognizing and sounding out words. But all have good comprehension of spoken materials. Some appear to be reading, but in reality have memorized the texts of books read to them and have become quite clever at concealing their deficit. Prominent problems with spelling exist.

(b) Social: No social problems are associated with this learning disorder until the children confront situations in which they are required to complete reading tasks. Their embarrassment at not being able to do what other children do easily may interfere with peer relationships.

(c) Emotional: No single set of emotional problems is associated with this learning disability, although the children get embarrassed when asked to perform reading or written task. Their repeated embarrassment may eventually lead to self-esteem problems.

(2) Sense of self-cohesion: Sense of self-cohesion remains reasonably intact, although self-esteem problems are prevalent.

(3) Self-narrative coherence: The self-narrative does not adequately explain the symptoms of the dyslexia unless the child has had that explained to him. Otherwise, the child remains puzzled as to why she cannot read.

d. Interventions:

(1) Remediation: Systematic phonics instruction by a
(2) Psychotherapy: Elective or if indicated because of the secondary effects of the disorders.


3. Other language-based disorders: Central Auditory Process Disorder


C. Case presentation

**Class IV. Frontal lobe functions & dysfunctions**

**A. Frontal lobe functions**

1. The motor cortex, which lies immediately anterior to the central sulcus, is involved in the control of voluntary movements.

2. Primary and secondary levels of motor control, verbal fluency and design fluency, and spelling.

3. The remainder of each frontal lobe is referred to as prefrontal association cortex. This region is involved in complex behaviors such as perception, emotion, memory, language, and thinking.

4. The original form of psychosurgery, prefrontal lobotomy, involved disconnecting the frontal lobes from the rest of the brain to reduce constant agitation in mental patients and to relieve intractable pain.

**B. Frontal lobes dyfunctions**

1. Attention Deficit/Hyperactivity Disorder

   a. Characteristics:

   (1) Defining Features: According to DSM-IV, there are three components to AD/HD: inattention, impulsivity and hyperactivity. DSM-IV identifies three subtypes of AD/HD: combined type; predominantly inattentive type; and predominantly hyperactive-impulsive type.

   (2) Prevalence Rates: The National Institutes of Health studies fmd that 3 to 5% of all children, perhaps as many as 2 million American children, suffer from the disorder (NIMH, NIH Publication #96-3572, 1994; NIH, 2000), Cantwell states that as
much as 50% of the child psychiatric clinical populations have attention deficit disorders (Cantwell, 1996, p. 978).

(3) Sex Ratio: The ratio of male to female ranges from 2:1 to 9:1 (Pennington, 1991, p. 84.) Barkley states _epidemiological studies find the proportion to be approximately 3:1 among nonreferred children displaying [these] symptoms_ (Barkley, 1989, p. 44).

(4) Coexisting Conditions: Among those conditions found to coexist with AD/HD are: mood disorders, anxiety disorders, oppositionality and aggression, obsessive-compulsive disorder, executive dysfunction, and substance use disorder.

b. Developmental History: Most milestones are achieved on time. Some children's level of activity is noticed to be higher than average at a very early age. Most frequently, the child's hyperactivity manifests around the time he begins to walk.


(1) Presenting Symptoms:

(2) Academic: Academic performance may be impaired, but the impairment is secondary to the impulsivity or inattentiveness.

(a) Social: Social relationships and relationships within the family may be impaired because of the child's disruptiveness, bossiness, or oppositional behaviors.

(b) Emotional: Demoralization and self-esteem problems may be present secondary to the effects of others' reactions to the child's disruptiveness. Problems with self-regulation and affect regulation are often present.

(3) Sense of Self-cohesion: Sense of self remains reasonably intact, although self-esteem problems are prevalent. Regulation of affect states, particularly anger, is problematic.

(4) Coherence of Self-narrative: The self-narrative does not adequately explain the symptoms. Children may justify their behaviors by displacing the responsibility for their actions onto others.

d. Interventions:

(1) Remediation: Stimulant medications are often prescribed for the attenuation of the symptoms. These medications present a complication for children with a coexisting Tourette's disorder because the medication exacerbates the tics. Behavior modification sometimes produces positive results.

e. Psychotherapy: Family therapy or individual therapy may be used selectively, depending on the situation.


C. Case presentation

**Class V. Executive Function Disorders**

A. Executive Function Disorders

1. Characteristics:

   a. Defining Features: Executive Functioning Deficits involve a complex set of deficits that include: Difficulties with management of time. Difficulties conceptualizing the goal for a task, assessing its feasibility, lacking the organizational capacities to carry out the goal lacking ability to translate the plan into productive activity, or the capacity to self-monitor and self-regulate to measure progress toward the goal, being ineffective in the performance of the tasks involved.

   b. Prevalence Rates: No data are available on prevalence rates.

   c. Sex Ratio: No data are available on sex ration.

   d. Coexisting conditions: AD/HD often accompanies this condition.

2. Presenting Symptoms:

   a. Academic: The child underachieves because homework assignments are lost or not turned in. The child has poor study skills, he is inefficient in doing class assignments and appears scattered and disorganized. The child is described as procrastinator.

   b. Social: Social relationships appear unaffected by the disorders. As the child gets older, caregivers and teachers, get increasingly impatient with the child's disorganization as well as the reasons for the underachievement. Some children become oppositional in reaction to caregivers' attempts at structuring and organizing tasks for the child.

   c. Emotional: No distinctive emotional problems are associated with this disorders, although a pattern emerges of not being able to put order and sequence into life occurrences. A sense of bewilderment as to why things do not work out overtakes the child and erodes self-esteem. Patients are generally ineffectual in adapting to social and life situations, reflecting perhaps an absence of psychic structure.
3. Developmental History: Generally unremarkable with milestones achieved on time.

4. Interventions:
   a. Remediation: Intense tutoring to help the child develop habits that minimize the effects of the deficit.
   b. Psychotherapy: Parent guidance to supply structure for the child. Individual psychotherapy is elective.


B. Complex set of behaviors reflecting metacognitive and control organizational processes

1. Component Processes of EF
   a. Involve attentional and regulatory acts
      (1) Inhibition
      (2) Delayed Responding - Intentionality
      (3) Shifting Focus/Set
   b. Each component process serves as a response or action that has as its primary function the alteration of the probability of a subsequent response by the individual:
      (1) Inhibition is a conscious act at deferring or deterring a specific behavioral response
      (2) Intentionality refers to underlying motivation and drive
      (3) Shifting focus or set refers to the act of redirecting attention to aspects of the environment that are most salient at a given point in time

2. As Self-Regulatory behaviors: Interact with developing capacities and innate aspects of self to promote behavioral expression in service of goals and drives:
   a. Relationship with temperament
   b. Relationship with attentive behaviors
   c. Relationship with awareness of self and others
   d. Developmental trajectories:
      (1) Infancy: Affective attunement
      (2) Toddlerhood: Socialization & moral awareness (shame)
      (3) Middle Childhood: Cognitive competencies & social learning
      (4) Adolescence: Self-concept & refining independence
      (5) Adulthood: Establishing goal-orientation & forming primary adult roles
3. Across the Lifespan: Identifying sources of disruption in EF and cognitive acts that translate into behavioral disorders:

   a. Deficits in attention, inhibition, affect regulation,
   
   b. Comprehension of rules, language usage (expression, comprehension), social attunement -
   
   c. Failures in moral reasoning
   
   d. Disruptions in behavioral fluency and action
   
   e. Deficits contribute to specific problems:
   
   f. Lack of focus or tendency to overfocus and become locked into a particular pattern of response
   
   g. Difficulty shifting attention to new sources of information
   
   h. Prone to act impulsively and without attention or awareness of consequences and implications
   
   i. Respond in a rigid and inflexible manner, even with feedback that rule being followed is incorrect or inappropriate
   
   j. Fail to respond to environmental contingencies
   
   k. Require immediate reward or gratification
   
   l. Fail to attend to and make use of internally represented information, like past experience

C. Where do they originate?

   1. Arise from the development of neural networks within the frontal lobes of the brain and their connections with other brain regions directing thought and action -

      a. Dorsolateral prefrontal cortex

      b. Subcortical region, including basal ganglia, thalamus, and limbic structures

D. Case presentation

E. Memory Function

   1. Working memory

      a. Phonological loop:

         (1) Brief storage associated with representational code. It involves the encoding of information as part of the process of reception. But “sensations” without “concepts” are meaningless. To the extent that sensations become perceptions, they involve a form of long-term retrieval. Speech forms are auditory signals that require translation for comprehension to occur. Does the phonological loop involve comprehension or mere sensory reception?

         (2) Left parietal area holds information in place (good digits forward), rehearsal goes to frontal (poor digits backwards).

      b. Visual-spatial sketch pad

         (1) Memory for objects

         (2) Memory for spatial locations
c. Central executive  
   (1) Attention  
   (2) Executive function  
   (3) “Binding” brings together diverse information and places them in relationship to each other.

2. Long-term memory: Long-term memories are so enduring because they are encoded in several places. There is a great deal of redundancy in the process. Two types of memory:

a. Declarative; Explicit/verbal conscious

   (1) It includes semantic and episodic memory. It is well suited for connecting the pieces of information needed to acquire a new fact, it allows one to model the external world, and in that sense it is either true or false. It is fast but not always reliable (i.e., forgetting and retrieval failures can occur), it is flexible in the sense that it is accessible to multiple response systems. It is especially suited for one-trial learning and for forming and maintaining an association between two arbitrarily different pieces of material, e.g., conventional paired-associate learning, in which a person has to remember pairs of unrelated words. Recognition memory is declarative memory.

   (a) Semantic memory is memory for facts. Semantic memory is a network of associations and concepts that underlies our basic knowledge of the world, that is word meanings, categories, facts and propositions, and other. It also stores objective personal information. It contains grammatical rules of language.

   (b) Episodic memory:

      i) Episodic memory involves the literal “re-experiencing” of past events. It constitutes the central features of the autobiographical self. Extended consciousness is “extended” precisely because it extends the quality of consciousness backwards onto past self – object contents. It involves the reliving of past moments of core consciousness.

      ii) The sense of self appears to be necessarily conscious. Although external events can be encoded unconsiously, the episodic living of those events apparently cannot. It is the self that binds our fragmented representations of the world into unified, lived experiences.

      iii) From a neuroscience perspective, what we feel about our experiences is what renders them susceptible to repression. When psychotherapists speak of unconscious memories of personal events, they are really referring to something that distorts memories of the event in question would be as if they were re-experienced. Unconscious memories of events (unconscious episodic memories) are “as if” episodic memories. They do not exist is experiences until they are reactivated by the current self. In the interim they only exist, as such, in the form of procedural and semantic traces (habits and beliefs).
iv) Source memory is memory of the source of the event being remembered; it is mediated by the frontal lobes. Frontal lobes are crucial for retaining source information and for maintaining coherence of an episodic memory.

3. Non-Declarative/nonverbal/non-conscious, Implicit/: expressed through performance. It is neither true nor false, but refers to experience that can lead to altered dispositions, preferences, and judgments (beliefs). It includes procedural memory, priming, associative learning and nonassociative learning.

a. Procedural:

(1) Procedural memory is a kind of bodily memory. It is memory of habitual motor skills. There is a degree of overlap between procedural and semantic memory, as many motor skills are encoded and stored in both. These memories are extremely resistant to decay with time. Skill learning and habits, and execution of learned motor movements.

(2) Procedural memory and the unconscious: an important feature of procedural memory is that it functions implicitly. As soon as a procedural memory is rendered explicit, it becomes something else; it is translated into a semantic or episodic form. Typically, procedural memories will be associated with both semantic and episodic memories. Transference clearly encompasses aspects of procedural memory.

(3) Skill learning and habits, and execution of learned motor movements. Neural substrate: Neostriatum (Basal Ganglia) Skeletal motor outputs.


d. Associative learning: Neural substrate:

(1) Delay vs trace conditioning

(a) Delay conditioning involves simultaneous presence of CS and US/occurs nonconsciously, i.e., procedurally/and is independent of hippocampus...fear conditioning for example requires intact AMG

(b) Trace conditioning involves a time gap between CS and US/person must cs detect gap/depends on hippocampus and therefore results in explicit (declarative) memory.

(2) Reward vs Aversive Associative Conditioning:

(a) Conditioning can be appetitive if US is rewarding (food, drugs) or aversive if US is punishing or danger (shock, predator).

(b) Aversive conditioning involves AMG/fear system. Sensory inputs to AMG lead to outputs which enable fight or flight response [catecholamines, ANS, freeze,
avoidance behaviors...cf. Ledoux] experiments with shock and fear in rats]

(c) This can be a model for signal anxiety. EX: animal sees tree then lion...previous neutral stimulus, the tree, now attains predictive value and serves as _signal_ for danger thus itself can trigger a fear response.

(d) Ledoux and others report that if hippo is damaged due to stress, this leads to impaired _contextual_ conditioning and impaired cs awareness of events and may relate to etiology of PTSD.

(3) Habituation, sensitization and desensitization.

(4) Evolutionary adaptation of 'conditioning' is to provide animal with a way of being able to predict the likelihood of regularly occurring events...animals need to predict the likelihood of predators, food, mates and therefore it is adaptive to have a way in which the animal can know if a particular stimulus or a behavior is likely to lead to these events.


F. Case Presentation

[Click here](#) for PowerPoint outline of Classes VI through X