Social Relationships and Developing Reward Systems: The Neurobiology of Attachment

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The Big Puzzle

- How do we make room in our minds for relationships with new people?
- Special coming together of minds—parent-child relationship
The Parental Brain and Mind

Maternal Care Mediates or Protects Against Genetic Risk

Bennett, et al., 2002
Links Across the Conference

- Neurocircuitry of reward and stress systems (Weinberg & Krebs)
- Long term impact of chronic stress (McEwan)
- How acute stress impacts prefrontal fx (Arnsten)
- How social cues such as faces may elicit fear/stress (Walden)
Roots of Questions

- Studies of early adversity and impact on emotional development
  - Prenatal drug use
  - Family Poverty

Individual developmental pathways

- Meaning of behavior
- Motivation
- Relationships
Outline—Part 1

- Basic propositions about early attachment
- Relationship between stress, reward, and attachment
- Special parenting minidset of early preoccupation
- “Biology” of Parenting-- oxytocin
- Neural circuitry of parent-infant attachment
Outline—Part 2

- Concept of mentalization—and neural circuitry of mentalization
- Mentalization under Stress
- How early and chronic stress impacts parenting
- Clinical implications
  - Substance abuse and parenting
  - Parenting under economic deprivation
- Conclusions
Humans are inherently social—we need and seek other people.

Over course of evolution, we have conserved a very specialized neural system dedicated to social relationships—loving and caring for others.

Falling in love with a new baby (or another person) is a very special time in life for which we have a special biology as well as psychology.

The initial stage of love (for an adult or a baby) is very different biologically and psychologically from later stages.
Key Assumptions

- Presence of a new person (e.g., infant or new love relationship) activates specific neural circuitry involved with salience and reward.

- Underlying neural circuitry facilitates intense (and adaptive) parental preoccupation on new person.

- In parents, such a highly preoccupied state facilitates parental protectiveness and care.
BRAIN REWARD CIRCUITRY

Relationships

DOPAMINE RELEASE SYSTEM

Nucleus accumbens
Amygdala
Substantia nigra
Ventral tegmental area

Responsible for impulsivity and planning
FRONTAL LOBE
Dopamine signals

EXERCISE
GAMES
GAMBLING
SHOPPING
SEX
Salience/Reward System

- Reward system set to respond to what is most salient in environment (e.g., food, drugs, relationships); dopaminergically regulated

- Reward may be used to downregulate stress and in times of increased stress, may turn to those persons or behaviors that increase "reward input"

- Relationships based in reward pathways
The Attachment System as a Stress Regulatory System

Secure attachment is confidence that fear is a temporary state and seeking comforting will reduce discomfort.
Rooted in Attachment Theory

Acute Stress \( \xrightarrow{+} \) Fear System \( \xrightarrow{\text{Upregulates}} \) Reward System \( \xrightarrow{\text{Downregulates}} \) Affiliation/Attachment

NORMATIVE DEVELOPMENT
Disruption in Balance of Stress/Reward System

Balance between systems Altered in

- Early abuse/neglect
- Chronic Trauma
- Addiction

“Intergenerational Risk Cycle”

Increased stress sensitivity

Decreased reward sensitivity

Chronic Stress

Stress Regulatory System

Reward Motivation System

Upregulates

Downregulates

Affiliation/Attachment Work/play

Food, gambling, drugs (Short-term “goals”, impulsively sought)
Dysregulated balance between stress/reward systems may be

1. a predisposing factor for a range of later maladaptations including addiction, neglectful or abusive parenting

2. an outcome common to a range of early stressful events (e.g., trauma, neglect, deprivation, severe poverty, parental depression)
Biology of Attachment Systems

THE INITIATION OF THE PARENT-INFANT RELATIONSHIP
Genetic Factors

Environmental Influences

Neurobiological Circuits

Parental Behavior & Mental States
“Anything on romance at the entry level?”
Primary Maternal (Parental) Preoccupation—A Special Early Stage of Parenting

“I do not believe it is possible to understand the functioning of the mother at the very beginning of the infant’s life without seeing that she must be able to reach this state of heightened sensitivity...almost an illness ...and recover from it.”

D. Winnicott, 1956
Initiation of Parenting

- Unique behavioral characteristics and mental states in early parent-infant and/or love interactions (e.g., special language, increased vigilance)

- Think of these as hallmarks of “social salience” /reward system being “turned on” by salient person (e.g., infant or adult love object)

- Entering a “special mental and biological” transitional state (Winnicott) in the early stages of parenting
Affiliative “States of Mind”

- Preoccupation about other (reverie)
- Exclusivity of focus
- Intrusive thoughts
- Worries, doubts
- Longing for reciprocity (and relief when achieved)
- Idealization/Perception of “perfection” (crystallization)
Affiliative “Behaviors”

- Increased checking
- Enhanced attention to appearance, body
- “Grooming”
- Preparation of space and place
- Intense, sustained looking
- Change in speech and voice
Hallmarks of Early Love

Out of blue

Not understandable to others

"I don't care if she is a tape dispenser. I love her."

S.GROSS
A Longitudinal Study of Transition to Parenting
Leckman et al., 1999

Mothers | Fathers
--- | ---
N | 31 | 27
Age (yrs) | 33± 5 | 35± 5
First child (%) | 60 | 56

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Leckman et al., 1999
Early Parenting Phase—Summary of Interview Findings

- Between 2 wks and 3 mos: preoccupation and anxious thoughts decrease, positive thoughts and feeling of personal transformation increase

- Experience makes a difference (? Sensitization phenomenon in humans); experienced parents less preoccupied in beginning, behaviorally more like first time parents at three months

- Individual differences in the level of preoccupation

- Similar patterns between mothers and fathers

- Greater intensity of preoccupation = greater perception of “transforming experience”
WHAT DO WE KNOW ABOUT THE BIOLOGY OF LOVE?

“Of course I love you—I’m programmed to love you.
I’m a goddam lovebird.”
Neurobiology of Parental Behavior

- Extensive data from Preclinical Models:
  - Medial preoptic area (MPOA), bed nucleus of the stria terminalis (BNST)—salience/reward
  - Associated approach/avoidance pathways involving especially amygdala and ventral tegmental area
  - Modulation by oxytocin, estrogen, prolactin and by monoaminergic system
  - 9 genes identified (fosB, prolactin & estrogen receptors, oxytocin, DBH) as playing a role in initiation of parenting behavior
Features of Oxytocin

- Genetic sequence uniquely mammalian

- Best known function—milk ejection and uterine contraction (mammalian traits)

- Distribution of receptors in brain same for males and females but marked change from infancy to adulthood
Oxytocin Initiates Maternal Behavior in Virgin, Steroid Primed Rats

Pedersen et al., 1979
Role of Oxytocin in Maternal Behavior

- Onset of maternal behavior can be blocked by oxytocin antagonists

- Blocking oxytocin does not interfere with already established maternal behavior. Initiation phase more vulnerable
Oxytocin and Maternal Care

- Delivery-linked increases in central OT related to behavioral and physiological changes critical for maternal success
  - enhanced memory of pup-specific olfactory and auditory cues
  - increased pup-directed nurturing (pup licking, retrieving, nest building, nursing).
  - reduced aversive response to pups
- Oxytocin facilitates reward sensitivity in early attachment
Oxytocin and Human Relationships

- OT is elicited in response to sensory cues that strengthen social bonds:
  - Massage
  - Light stroking
  - Pleasant sounds and smells


- Lowers activation of HPA and sympato-adreno-medullary stress response systems

- ‘Calm and connect’ response (Uvnas-Moberg, 1999)
Oxytocin and Parent-infant Relationship (Human model)

- Higher plasma OT levels = greater “calmness” in new mothers (Carter, Altemus, Chrousos, 2001)

- Breast feeding mothers with higher OT have lower BP, less HR increase and greater vagal control of HR in response to stress (Altemus, et al, 2001)

- Maternal BP lower in hour following infant feeding (breast > bottle) (Light, et al., 2000)

- Plasma OT levels increase during mother-infant separation (Light, et al., 2000)
Oxytocin and Parent-Infant Relationship

(Light, et al., 2000)

- Mothers listening to recordings of their describing an event that made them angry and a stressful event
- Sessions with and without baby present
- Three groups—OT increase, decrease, or minimal change

- OT increase mothers showed lower diastolic BP across all conditions and on both days
- Breast feeding mothers more likely to show OT increase
- Lower BP reactivity to speech task when with baby
PROPOSITION

By maintaining calm state with less cardiovascular reactivity, is oxytocin a component of the early preoccupied state that helps parents focus on learning about their infant’s cues?
Recent human studies using fMRI and salient infant cue (auditory and visual)

- Overlapping with preclinical findings
- Limbic, hypothalamic, and midbrain regions reflecting adaptation to homeostatic demands associated with maternal care (e.g., hippocampus, superior/medial temporal, hypothalamus)
OWN BABY VISUAL CUES ACTIVATE DOPAMINE REGULATED REWARD CIRCUITS

STRATHEARN, et al., 2008
Own Baby Images Activate Orbitofrontal Cortex

OFC
appraisal of
positive/
negative
affective value

Nitschke, 2004,
Neuroimage
CRY AS SALIENT SIGNAL FOR ACTIVATING ATTACHMENT SYSTEMS

Effect of Time with Infant and Overall Parenting Experience
Infant Cries Relative to Matched Noise

Point 1: Both novice and experienced mothers activate superior temporal regions.

Point 2: By 3-4 months, for both, increased R medial temporal lobe activation.

Point 3: For novices, increase in R hippocampal activation by 3 mos; for veterans present at 2 weeks already & no change by 3 mos.
Infant Cries Relative to Matched Noise

- Use Functional Connectivity Analysis to test for inter-regional correlations in activity across group (novice/veteran) and time (2 wks-3 mos) \((L.\text{Jacobsen, M.D.})\) between hippocampus (affiliation) and other regions.

- Increasing connectivity for novice mothers between 2 wks - 3 mos.

- More modest increase for veteran mothers.

1st Mom’s - OWN BABY CRY - Time 1

Striatum

N=14; Talairach z=-5 p<0.001

R = 0.39

Perception of Life Change

Own Baby Brain Activity
1st Mom’s - OWN BABY CRY - Time 1

Right Amygdala

R = 0.64

N=14; Talairach y=-9 p<0.001
Neurocircuitry mediating maternal attachment undergoes significant change during the initial postpartum months in new mothers, with increased activation in reward circuitry and increased functional connectivity between components of this reward circuit and other brain regions during the early postpartum period.

Observations in veteran mothers suggest that these changes in connectivity may be longlasting, and undergo relatively modest increases in strength with subsequent births.

Initial activation of reward circuitry essential to early preoccupation with greater activation in reward circuitry = more intense experience of preoccupied state of mind.
WHERE WE’VE GONE SO FAR

- Relation between reward and regulation of fear/stress
- Balance of sensitivity to fear/worry and to reward/attachment
- Early parental preoccupation as a common (and ? essential) early mindset
- Neural substrates of early parental behavior with attention to oxytocin (“calm and connect”)
- Converging preclinical and human literature on basic circuitry of early parental affiliation
- Neural circuitry of parental response to infant signals—ventral striatum (reward), superior temporal gyrus and R medial temporal
AFTER THE BREAK

- THINKING ABOUT OTHER’S MINDS-MENTALIZATION AND RELATION TO PARENTING
- STRESS and LONG TERM IMPACT ON PARENTING
- CLINICAL IMPLICATIONS
WHERE WE’VE GONE SO FAR

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WHAT’S COMING IN PART 2

- Concept of mentalization—and neural circuitry of mentalization
- Mentalization under Stress
- How early and chronic stress impacts parenting
- Clinical implications
  - Substance abuse and parenting
  - Parenting under economic deprivation
- Conclusions
SPECIAL STATE OF MIND
THINKING ABOUT OUR OWN AND MINDS
“MENTALIZATION”
WHAT DO YOU SEE?
**What is Mentalization**

- Psychological skills that allow us to make sense of the actions of others as well as our own actions by reference to mental states (e.g., desires, thoughts, memories, feelings)
  - Spontaneous, Intuitive, Rapid
- Qualitative difference between describing mental state and physical state events (“She feels vs she fell”)
  - Physical stance = prediction of the behavior of objects through laws of physics
  - Mental stance = prediction of the behavior of others based on assumptions about their mind
Nature of Mentalization

- Mentalization skills develop over childhood, increasingly complex and only gradually achieved fully.

- Mentalization is a part of social attachment.
  - Sharing internal experiences with others makes them meaningful.
  - Central to understanding and regulating own emotions (“why am I so worried…..”)
  - Also central to regulating emotions in interactions with others (e.g., empathy…)
Parental Preoccupation

When I look at my baby, I feel like I am on a different, wondrous planet—is this really me, is this MY baby. I smile, she smiles, I talk, she coos. She’s really listening to me and so interested in all that is going on. We’re getting to know one another’s likes and dislikes. She feels so happy and I don’t think she has a worry in the world—or I don’t want her to have any. I’m a worrier, I don’t want her to be—maybe she already knows that since I check on her all night but maybe that just helps her know I’m there for her. I wonder what will she think when she sees more of the world, what kind of person will she be. She’s probably thinking about me too, does she know how much I love her—so much going on in that little head, so much for her to feel and learn about……..

A new mother....
Mother's Mentalizing or Reflective Ability Predicts Infant-Mother Strange Situation Situation Classification at 1 year

Reflective function ratings

% SSTs Classified

- 100%
- 80%
- 60%
- 40%
- 20%
- 0%

Attachment classification at 12 months
- Avoidant
- Resistant
- Secure

p < .0001
WHAT DO WE KNOW ABOUT NEURAL CIRCUITRY OF MENTALIZATION PROCESSES?
Caution about Reductionism

Differing domains of discourse

Thoughts, hopes, feelings, dreams, wishes, loves, hates
Superior Temporal sulcus, R temporal active across different types of mentalizing events (Spiers, Maguire, Neuropsychologia, 2006)

Could response to cry (with similar regions activated) reflect parental reflection on infant’s state of need—using a specialized circuit in service of parenting?
“MENTALIZATION CIRCUITRY”

- Mentalizing functions of superior temporal sulcus and temporal pole (*Frith and Frith, 2003*) especially in response to sensory signals that provide clues to mental states.

- These regions connected to medial prefrontal cortex which may be involved in processing the mental versus physical representations of these “mental state clues”

- “Top Down” component of mentalization circuit.
“Signal detection” and “top down” mentalization processes
Early Parenting and Mentalizing

- Infant cues activate parts of “mentalizing circuitry” that give clues to infants’ mental states (“signal detection” component)

- Early preoccupation = increased activation of “signal detection” aspects of mentalization circuitry

- Initially in highly preoccupied state, “top down” aspects of mentalization circuitry may be less active but comes into play with experience with infant and as level of preoccupation/worry diminishes
Stress and Mentalizing

ANGRY  WORRIED  SAD  AFRAID
JEALOUS  GRIEVING  TIRED
SUSPICIOUS
WHAT DO YOU SEE?
Stress and Mentalizing

- Mentalizing capacity diminished during acute stress
- Neurobiological model—take aspects of prefrontal cortex off-line during acute stress to allow for more automatic responding (Arnsten, 2004)
- “Switch point” for taking prefrontal cortex off-line individually variable—reflecting individual differences in stress reactivity
- With acute stress or increased stress sensitivity, more readily take “top down” mentalization circuit components off-line—may respond to “mental states sensory cues” but not reflecting on these
“Threats” to Intact “Parental (Mentalization) Circuitry”

- Impact of parental depression, substance abuse, and other psychopathology when reward circuitry dampened or co-opted (e.g., addiction)
  - Less active response of “signal detection” components of mentalization circuit that is sensitive to “mental state” cues

- Impact of early deprivation/neglect with heightened stress reactivity and less effective downregulation of stress by reward
  - Less effective “top down” processing of mental state cues
EARLY and CHRONIC STRESS AND IMPACT ON PARENTING
Genetic Factors

Environmental Influences

Neurobiological Circuits

Parental Behavior & Mental States
Parenting and Emotional Regulatory Systems

- Naturally occurring variations in maternal care in the amounts of licking and grooming a mother provides pups (“low” versus “high” care)

- Long-term changes in both reward sensitivity and stress reactivity can be produced by these natural variations in maternal care and early separation/disruptions in parental care (Meaney, Francis, Plotsky)
Experience and Intergenerational Transfer of Parenting Behaviors

- Offspring of, or those cross-fostered to “low care” mothers show, as adults, increased response to acute stress, decreased exploration in novel environments, enhanced startle, decreased hippocampal glucocorticoid receptor mRNA expression.

- Among cross-fostered offspring, individual differences in maternal behavior related to rearing, rather than biological mother.

- Decreased reward with increased stress sensitivity.

Francis et al., '99
Intergenerational Transfer of Parenting Behaviors

Offspring from high levels of maternal care cross-fostered to “low care” mothers and vice-versa (low to high)
Low Maternal Care in Humans Associated with Greater Striatal Dopamine Response* to Stressor as Adult

** reduction in [11C]raclopride binding potential

Pruessner, et al, 2004
Women with early history of abuse/neglect show altered stress responsivity in mid-adulthood.

Heim, et. al., 2000
Early neglect in humans associated with reduced neuropeptide (Oxytocin) response to interaction with parents

Fries, Ziegler, Kurian, Jacoris, and Pollack, 2006
Impact of neglect on diurnal cortisol/HPA axis in institutionalized Russian infants and toddlers

Kroupina, Gunnar, Johnson, 1997
Maternal Depression and Child Cortisol—Impact of Poverty

Family income correlated negatively with both mother’s depressive score ($r = -0.25, p = 0.001$) and child’s cortisol levels ($r = -0.31, p = 0.001$).

Figure 2. Correlation between mother’s score on the depressive subscale of the Derogatis Stress Profile and child’s cortisol level.

Stress summary

- Early, chronic stress has enduring impact on
  - Stress regulatory abilities (increased sensitivity to stress)
  - Learning and flexibility to new experiences
  - Reward sensitivity (decreased sensitivity to reward)
  - Parenting behavior
Early Stress and Parenting

- One mechanism shared across a range of early “exposures” (e.g., depression, poverty, abuse, neglect) is altered parental environment through both genetic and experiential impact on stress-reward system function (increased stress reactivity and decreased reward sensitivity).

- Impact endures into adulthood. Expressed in brain circuitry, oxytocin fx, cortisol, and behavior.

- This may alter parental ability to enter critical preoccupied mental state, to focus on infant’s needs, and respond to infant’s cues early on. Infant cues are less “rewarding”, more “stressful”
If early “preoccupied” or “invested” state diminished, may impact capacity to perceive own and other’s mind—or the “sensory detection” component of mentalization circuitry

Infant negative cues (cries, negative facial expressions) are more stressful as not seen as signal about other person but processed more automatically, out of awareness as stress/danger

With heightened stress reactivity, “top down” mentalization facility impacted, “off line”
Signal detection for “fear”, not needs of other which increases stress and impairs top down processing as well.
CLINICAL APPLICATION

- SUBSTANCE ABUSE AND PARENTING
- ECONOMIC DEPRIVATION
Early Life Stress and Substance Abuse

- Higher rates of early abuse and neglect in drug-using parents
- Higher rates of attachment related violence (parent-child abuse and domestic violence) among substance using adults
- Altered stress response in drug-using adults—?
  Both reflective of chronic drug use and of own history of early care
- ? Substance Use also as an attachment disorder
BRAIN REWARD CIRCUITRY
Mechanism for addiction in dopaminergically regulated reward systems
ATTACHMENT BASED VIEW OF ADDICTION

- Dysregulated balance between stress reactivity and reward sensitivity is one mechanism of addiction—enhanced stress reactivity and reduced reward sensitivity.

- Addiction and social attachment share a common neurobiology.

- Addiction “co-opted” dopaminergically regulated reward circuitry key to initiation and maintenance of parent-child attachments.

- In addicted adults, infant cues increase stress response and serve as potential cue for increased craving and drug use.

- Because reward system co-opted by drug, cannot use attachment based reward to mediate stress.
Preclinical models of parenting & drug abuse

- Suckling increases activation in mesolimbic dopaminergic reward system and cocaine diminishes this activation (Ferris, et al., 2005; Febo and Ferris, 2007)
OWN BABY VISUAL CUES ACTIVATE
DOPAMINE REGULATED REWARD CIRCUITS

STRAITHEARN, et al., 2007

Preliminary findings in cocaine-abusing mothers: Relative decrease in activation in ventral striatum in response to infant positive affect

n=28, p<0.001 (uncorr.)
Decreased activation of right hippocampus (arrow), modest activation of right superior temporal gyrus (STG) in contrast to increased hippocampal and greater STG activation in non-drug using.
Oxytocin & Parent-Infant Relationship Among Cocaine-Using Mothers

*(Light, et al., 2008; preliminary data)*

- Cocaine using mothers had lower overall baseline plasma OT levels than control mothers (means = 1.1 ± 0.2 vs. 2.0 ± 0.2 pg/ml, p< .01).
- Cocaine-using mothers show decrease in OT during speech tasks and higher BP and urinary NE
Cocaine-Using Mothers Show Diminished Oxytocin Response to Salient Infant Cues

*Light, et. al, 2007*

**Perceived Stress**
Parental Behavior Among Substance Abusing Adults

- In human mothers:
  - Withdraw in face of infant distress
  - Less attentive to infant bids for attention
  - Less contingent responding or increased non-contingent behaviors
  - Higher rates of negative affect in interactions and heightened physical provocation and intrusiveness
  - ?? Each as markers of heightened stress in response to infant
Do Salient Infant Cues Increase Stress and Craving in Addicted Adults?

- Mechanism for clinical observation of increased drug use/relapse in adults after birth of infant

- Changes or amplifies intervention focus
  - Decrease drug use———improve parenting or…..
  - Improve parenting———decrease drug use

- Focus intervention on how infant signals may be stressful, difficult to interpret, increase parental stress with withdrawal from infant
Mothers and Toddlers Drug Treatment Program (Nancy Suchman, Yale)

- Intervention for drug-using mothers focusing on relationship with child in addition to standard drug treatment focused on decreasing or quitting drug use.

- Treatment focuses on *specific maternal behaviors and responses* to specific child cues.

- Early treatment effects show both positive impact of intervention on maternal attention and sensitivity to infant cues.

- Treatment also increases reward aspects of parenting and decreases stressful impact of infant signals.
  - Does this also impact drug use by increasing salience of infant attachment?

- Mothers in enhanced treatment group show greater change in drug (opiate and methadone use) compared to those in standard drug treatment.
ECONOMIC DEPRIVATION AND EARLY ADVERSITY

- Substance abuse not a special case but rather an example of how increased stress reactivity and decreased reward sensitivity may impact parenting.

- Same principles apply to economic deprivation in which parents are struggling daily to provide.

- Also co-morbidity of chronic poverty with other early adversities—abuse, neglect, parental depression, etc.—and impact on stress reactivity.
An Intervention Research “Gap”

How do early interventions with an attention to the relationship between mother and infant work—what is the mechanism of action?

Do changes in parental reflective or mentalizing capacities vis a vis the infant mediate the positive outcomes of relational/attachment based therapies?
Mentalization based intervention programs may improve both signal detection and top down processing components of parental reflective or mentalizing function.
Minding the Baby: A Reflective Parenting Program

Lois Sadler, PhD, APRN, PNP,
Arietta Slade, PhD, Cheryl deDios-Kenn, MSW, Sarah Fitzpatrick, MSW, Denise Webb, MSN PNP, Betsy Houser, MSW, Linda Mayes, MD

A Collaboration:
Yale Child Study Center
Yale University School of Nursing
Fair Haven Community Health Center
How does understanding the biology of parenting help us?

- Focuses our interventions on response to specific responses infant cues:
  - On how those cues such as a cry may increase parental stress, diminish “reward” of effective parenting
  - On helping parent understand impact of cry, for example, on self and then on response to infant—and “meaning” of cry for them
- Also focuses on key developmental period—initiation of parenting and setting up of “parental reward circuits”
Neural circuitry of reward, stress regulation, environmental shaping of gene expression—each component/“building blocks” of capacity to be preoccupied with child

Managing stress gives time to observe, reflect on own—and child’s—experience

In this reflective time, meanings come into being—meaning of a cry, of child’s expressions and behaviors—and these meanings shape moment to moment “mind forming” interactions

Child “comes into being” with experience of a mind that holds his mind in mind
WHAT WE HAVE COVERED--1

- Relation between reward and regulation of fear/stress
- Balance of sensitivity to fear/worry and to reward/attachment
- Early parental preoccupation as a common (and ? essential) early mindset
- Neural substrates of early parental behavior with attention to oxytocin ("calm and connect")
- Converging preclinical and human literature on basic circuitry of early parental affiliation
- Neural circuitry of parental response to infant signals—ventral striatum (reward), superior temporal gyrus and R medial temporal
WHAT WE HAVE COVERED

- Mentalization as a human process with neural components—signal detection and top down processing
- Stress and impact on mentalization
- Enduring impact of chronic stress on parenting
- Substance abuse in parents as a clinical example
Conclusions

- Early initiation of parenting is a time of very rapid change in adult mental states and behavior (and of changing neural substrates).

- Parental ability to shift mental energy/investment toward infant may be a key reorganizational phase for setting up the parent-child affiliative system and parental reflective capacities toward infant.

- Early stress has an enduring impact on both reward sensitivity and stress reactivity—and potentially on components of parental and mentalization neural circuitry.
CONCLUSIONS

- Interventions may fruitfully focus on this critical initiation phase and the degree of parental “mental” as well as behavioral investment.
- Interventions have capacity to change parental “mentalizing” function such that alter expression of key capacities (reward sensitivity, stress reactivity) in child.
Collaborative Network

Yale
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- Shmuel Shulman
THANK YOU

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SLIDES WILL BE AVAILABLE ON CONFERENCE WEBSITE