Grow Your Baby's Brain

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www.skintoskincontact.com
Grow Your Baby's Brain: the latest neuroscience

OLD Understanding

child helpless

mother clueless

father useless
Grow Your Baby’s Brain

The right start to life makes parenting so much easier!

Parenting is more enjoyable and fulfilling, an actively engaging baby is just much more fun!
Scientific American, December 2011

Pencil
“Scientific foundation” ... a synthesis

EVOLUTIONARY BIOLOGY ➔ NEUROSCIENCE ➔ EPIGENETICS

Everything else ➔ The Brain ➔ The DNA

The Place
FITNESS ➔ EXPERIENCE ➔ ADAPTATION

ENVIRONMENT
"Genome" - genes of species

"Genotype" - genes in specimen

"Phenotype" - specimen resulting from gene - environment interaction

... highly conserved neuro-endocrine behaviors
Unsafe environment activates HPA axis (autonomic nervous system, ANS).

“In response to stress, CRF and vasopressin are released ... anterior pituitary ... synthesis release ACTH ... glucocorticoids → ”
Early stress alters gene expression, with health impact across lifespan.
Earliest care at birth matters

Same gene $\rightarrow$ switched

“The Place" - earliest environment
“BIRTH” - earliest environment

Grow Your Baby’s Brain: the latest neuroscience
CENTRAL DOGMA - all biological processes

EVOLUTIONARY BIOLOGY
Everything else

NEUROSCIENCE
The Brain

EPIGENETICS
The DNA

The Place
FITNESS
EXPERIENCE
ADAPTATION
ENVIRONMENT

Skin-to-skin = key that unlocks the neuroscience!
CENTRAL DOGMA – all biological processes

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Grow Your Baby’s Brain: the latest neuroscience
“For species such as primates, the mother IS the environment.”


Nothing an infant can or cannot do makes sense, except in light of mother’s body.
“Scientific foundation” … a synthesis

EVOLUTIONARY BIOLOGY → NEUROSCIENCE → EPIGENETICS
Everything else → The Brain → The DNA

The Place
FITNESS
ENVIRONMENT
EXPERIENCE
ADAPTATION

“except in the light of mother’s body.”
"Scientific foundation" ... a synthesis

The DNA

Everything else

The Brain

The DNA

The Place
ENVIRONMENT

FITNESS

EXPERIENCE

ADAPTATION

For the human newborn - this place / environment is
Skin-to-skin contact
“Scientific foundation” … a synthesis

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ENVIRONMENT

Grow Your Baby's Brain: the latest neuroscience
“Cells which FIRE TOGETHER, WIRE TOGETHER, and those which don’t, won’t.”

Carla Shatz
Fetal REM sleep (or active sleep) seems to be particularly important to the developing organism.

... spontaneous synchronous firing

Marks et al 1995
MAXIMAL OCCURRENCE

Synapses

Dendrification:
peak 2m & 6m
RELATIVE BRAIN ACTIVITY

NEW SYNAPSE FORMATION

METABOLIC ACTIVITY
peaks 3 years
Gestational age  20w
all structures completed
EARLY DEVELOPMENT

Gestational age
20w  all structures completed

parallel development of structure & function

(Hugo Lagercrantz 2004)

Brain growth depends on experiences !!
Impulse

Presynaptic neuron

Vesicle

Transmitters

Synaptic cleft

Receptors

Postsynaptic activity

Postsynaptic neuron
SENSORY STIMULUS

1. Synapse store chemical signal
2. Chemical signal stronger
3. Threshold → Exempt from elimination (synapse stabilised)

Pathway

(Rima Shore 1997)
fetal REM sleep (or active sleep) seems to be particularly important to the developing organism... spontaneous synchronous firing

Marks et al 1995
BRAIN WIRING

ACQUISITION
poly-sensory input
short-term memory
stored cortex
Awake and REM

CONSOLIDATION
transfer information
“SNR” strong signals
amygdala / hippocampus
NREM stage 4

MEMORY FORMATION
P waves
returns info to neocortex:
organized REM

Stanley Graven 2006
AT BIRTH, the brain has TWO CRITICAL SENSORY NEEDS: SMELL & CONTACT connect direct to the amygdala
SMELL

modulates state organisation
elicits emotional behaviours
activates pre-feeding actions
anticipatory digestive physiology
regulates pace of ingestive behaviour
The secretion of Areolar (Montgomery’s) Glands from Lactating Women Elicits Selective, Unconditional Responses in Neonates

“... breast chemosignals activate oral activity on the nipple that releases a cascade of behavioral, neural, neuroendocrine and endocrine processes in the newborn and the mother.”

Doucet 2009
The secretion of Areolar (Montgomery’s) Glands

“In early ontogeny the sleeping brain may thus remain sentient of an organism’s odor environment.”

Doucet 2009
THE NEWBORN BRAIN

SKIN-TO-SKIN CONTACT

fires and wires

the amygdala-prefronto-orbital cortical pathway  (PFOC)
Prefrontal cortex
Executive function

AMYGDALA: Emotional Processing Unit

SOCIAL and EMOTIONAL INTELLIGENCE

CPU
Smell

Skin contact
SOCIAL INTELLIGENCE

EMOTIONAL INTELLIGENCE

Behavioural activation system
reward-based (dopamine)
Psychobiological Roots of Early Attachment

Myron A. Hofer

Fig. 1. Schematic representation of attachment responses based on the concepts of John Bowlby (Bowlby, 1973).
SENSATIONS THAT WIRE BRAIN

SEES
Mum’s eyes

SMELLS
Mum’s milk

TASTES
Mum’s milk

Hand TOUCH Mum’s skin

Skin-to-skin CONTACT

Warmed on Mum’s front

Back FEELS Mum’s arm holding

Ear HEARS Mum’s voice

Moves with Mum

Slide from JILL BERGMAN
a kind of invisible hothouse

Through
“hidden maternal regulators” ...
“physiological set points”

... through several pathways at once ...
The BOND is made up of the sensory inputs from the parent to the infant

Fig. 1. Schematic representation of the dynamics of early-separation responses based on the concept of an attachment bond as described by John Bowlby (Bowlby, 1982).
Fig. 2. Schematic representation of the dynamics of early-separation responses resulting from the loss of regulatory interactions within the mother–infant relationship.
will now describe (see Fig. 2). Our experiments showed that each of the individual behavioral and physiological systems of the infant rat was responding to the loss of one or another of the components (e.g., nutrient, thermal/metabolic, or sensorimotor)
components (e.g., nutrient, thermal/metabolic, or sensorimotor) of the infant’s previous interaction with its mother and that the complex response to separation was due to the withdrawal of all these components at once.
SEPARATION causes

---

PROTEST - DESPAIR
(hyperactivity → depression)
PROTEST - DESPAIR is accompanied by DYSREGULATION
As shown in several nonhuman primate and rodent models, early environmental exposures can alter physiological regulator systems in permanent ways. Early life experiences change the brain, the body, the social world, and the way the brain responds to environmental challenges.
FIG. 1. Schematic depiction of the neurobiological foundations, inputs, and consequences of attachment and affiliative behavior in mammals. Figure reprinted with permission of the New York Academy of Sciences.
... highly conserved neuro-endocrine behaviors

“Genome” - genes of species

“Genotype” - genes in specimen

“Phenotype” - specimen resulting from gene - environment interaction
BARKER 'thrifty phenotype'

“Fetal programming hypothesis”

Developmental Origins of Health and Disease

DOHaD

Epigenetic processes operate in the human fetus, and beyond.
Allostasis — the mechanism by which homeostatic systems are maintained in balance ...

Allostatic state — elevated activity of mediators, with return to baseline and no impact on health.

Allostatic load — elevated activity — sustained over time, or severe ...
→ changes target cells of mediators, and so changes the “set points” for homeostasis (e.g. increasing blood pressure, change in cholesterol level)
Resilience / Sensitivity

Stress Response

Allostatic State

Allostatic Load

Allostatic Overload

Health

Disease

Well-Being ➔ Susceptibility ➔ Morbidity ➔ Mortality

Neuroception

Psychological
Neurological
Endocrine
Immune
"Scientific foundation" ... a synthesis

The DNA

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ENVIRONMENT

The SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.

... policy and practice that impacts the care of mothers and babies.
Child Health, Developmental Plasticity, and Epigenetic Programming

Z. Hochberg, R. Feil, M. Constancia, M. Fraga, C. Junien, J.-C. Carel, P. Boileau,

DOHAD
Developmental Origins of Health and Adult Disease
FIG. 2. The match-mismatch paradigm of metabolic disease. The developing organism senses maternally transmitted environmental cues, such as undernutrition, during prenatal and early postnatal life. Developmental plasticity in response to these cues modifies the default trajectory defined by the inherited fetal genome and epigenome according to whether the environment is perceived as adequate (dark background) or deprived (light background), resulting in adjustment of metabolic set points. If the eventual mature environment, whether adequate or deprived, matches the prediction, then the risk of metabolic disease in later life is low. If there is a mismatch between the predicted and actual mature environments, particularly if the mature environment is richer than anticipated, then the risk of metabolic disease is enhanced. [Reproduced from P. D. Gluckman et al.: Am J Hum Biol 19:1–19, 2007 (23). © 2006 Wiley-Liss, Inc.; reprinted with permission from John Wiley & Sons, Inc.]
Child Health, Developmental Plasticity, and Epigenetic Programming

Z. Hochberg, R. Feil, M. Constancia, M. Fraga, C. Junien, J.-C. Carel, P. Boileau,

Endocrine Reviews, April 2011, 32(2):159–224

FIG. 1. Preadult periods of adaptive plasticity in the transition between life-history phases (double arrows). Prenatal growth affects adult health and disease. The transition from infancy to childhood confers a predictive adaptive response that determines adult height. The transition from childhood to juvenility bestows an adaptive response that resolves adult body composition and metabolic consequences. The transition from juvenility to adolescence establishes longevity and the age of reproduction and fecundity. IC, Infancy-childhood (transition).
Positive Stress

• Moderate, short-lived stress responses, such as brief increases in heart rate or mild changes in stress hormone levels.

• An important and necessary aspect of healthy development that occurs in the context of stable and supportive relationships.

Slide by: Jack P. Shonkoff, M.D.
Positive Stress = Eustress

- An important and necessary aspect of healthy development that occurs in the context of stable and supportive relationships.
Tolerable Stress

• Stress responses that could disrupt brain architecture, but are buffered by supportive relationships that facilitate adaptive coping.

• Generally occurs within a time-limited period, which gives the brain an opportunity to recover from potentially damaging effects.
Toxic Stress

• Strong and prolonged activation of the body’s stress management systems in the absence of the buffering protection of adult support.

• Disrupts brain architecture and leads to stress management systems that respond at relatively lower thresholds, thereby increasing the risk of stress-related physical and mental illness.
3-day separation:

induces physiological changes (immune system, heart rate, sleep, cortisol, loss of body temperature).

anaclitic depression:
• hyperactivity
• conservation - withdrawal;
• death or recovery

Slide & photo from James McKenna
“structural organisation of the brain.”

(Ziabreva 2003)

South American small rodent
South American small rodent

separated for 6 minutes only
twice daily from d8 to d10

→ altered aminergic function in
hippocampus and amygdala

→ (modulated by mother’s voice)
Separation tolerance in mammals is measured in minutes.
Integrative Emotional System for Social Affect

SAFE

UNSAFE

Developmental Implication

competent sexual & maternal behavior

depression

Behavioral Consequence

social choice & approach

separation distress responses

Feeling State

somatosensory

visual

olfactory

vestibular

auditory

hunger/temp

Levels of Analysis

Sensory Controls

auditory

Evolutionary Antecedent

attachment mechanisms

Thermoregulation

place attachment mechanisms

pain mechanisms
"Scientific foundation" ... a synthesis

Evolutionary Biology ➔ Neuroscience ➔ Epigenetics

Everything else ➔ The Brain ➔ The DNA

"buffering protection of adult support"
"Scientific foundation" ... a synthesis

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"needed neural processes"
“Scientific foundation” ... a synthesis

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"in the light of mother’s body."
ZERO
SEPARATION
“Scientific foundation” ... a synthesis

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ADAPTATION

“in the light of mother’s body.”
Reproduction-Induced Neuroplasticity: Natural Behavioural and Neuronal Alterations Associated with the Production and Care of Offspring

Craig H. Kinsley* and Kelly G. Lambert†
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†Department of Psychology, Randolph-Macon College, Ashland, VA, USA.

the mother must overcome the fear of leaving the nest to forage and hunt, do so more efficiently, and return to her nest and vulnerable offspring as quickly as possible, lest her own pups become prey for other predators. Our data suggest that the hormones of
Estrogen peaks
Progesterone falls

Pup stimulation
Rich environment

Increased spines
(dendrification)

New circuits = enhanced learning
New circuits = enhanced learning

Amygdala → Less fear / anxiety

Hippocampus → Better learning / memory

Hypothalamus → Better stress tolerance

Maternal neurobehaviour
Maternal neurobehaviour

- Enhanced foraging
- Stress responsiveness
- Enhanced problem solving
- More emotional resilience
Enhanced foraging

Enhanced problem solving

(B) Time to approach baited food well (s)

(A) Correct responses for first eight arms

Nulliparous Foster Maternal

Trial day

Multiparous Nulliparous
Stress responsiveness

Fig. 3. Parity regulation of anxiety across the lifespan. Percentage of time spent in open arms in the elevated plus maze in age-matched nulliparous (NP), primiparous (PP) and multiparous (MP) Long Evans females tested at various ages post-reproduction (in PP and MP). *Conveys significant difference from NP animals (P < 0.05).

More emotional resilience
PROLACTIN rises
OXYTOCIN rises

LACTATION

MEMORY permanently improved

BDNF (=Brain Derived Neurotropic Factor)

Opioids
Glucocorticoids
Norepinephrine
Vasopressin

etcetera ..... (fathers specially)
MEMORY permanently improved
BDNF (=Brain Derived Neurotropic Factor)

“The picture that begins to emerge is one of a healthy, “protected” brain that may provide benefits to its owner well into senescence.” (p517)
The combination of hormonal and environmental alterations accompanying the maternal experience has also been proposed as a form of environmental enrichment. Studies partitioning out the various aspects of the maternal experience (e.g. pup exposure, pregnancy, lactation) suggest that the combination of these experiences converge to produce the most dramatic results in the maternal animal (3, 82). Viewing the maternal experience as an enriching complex experience for the animals suggests that the effects on brain and behaviour may be real, meaningful, pervasive and persistent.

“The combination of these ... converge to produce the most dramatic results ...
"Scientific foundation" ... a synthesis

The DNA
Everything else
The Brain
The DNA

EVOLUTIONARY BIOLOGY

NEUROSCIENCE

EPIGENETICS

"in the light of mother's body."
“It is a serious mistake to assume that the principles derived from careful animal studies do not apply to human infants. The risk of suppression or disruption of needed neural processes ... is very significant and potentially lasts a life time."
Fig. 1.  Hormonal and physiologic responses to Trier Social Stress Test in lactating, nonlactating, and nonpostpartum women. Period of stress test (time +10 to +20 minutes) is represented by the shaded gray bar. Values are mean ± SEM.
In lactating women, these phenomena could theoretically
# conserve energy required for lactation
# protect against stress associated inhibition of lactation,
# relieve psychological stress, and
# enhance immune function
The Relation of Early Mother-Infant Skin-to-Skin Contact to Later Maternal Sensitivity in South African Mothers of Low Birth Weight Infants

Ann E. Bigelow, et al

From Bergman et al 2004 RCT
SSC time first 24 hr correlated with SSC time first month.
Maternal behaviour Q Sort Predicts attachment security

→ Mum’s sensitivity to baby’s emotional needs and development
NCATS (Nursing Child Assessment Teaching Scale) predicts subsequent cognitive outcome.

Mum’s sensitivity to baby’s receptiveness, stimulating without overwhelming.
Correlations between Oxytocin with left NAcc and right amygdala activations were found only in the synchronous group.

Well-adapted parenting ... reward-related motivational mechanisms, temporal organization, and affiliation hormones ... anxious parenting ... mediated by stress-related mechanisms and greater neural disorganization.
This suggests that VD mothers are more sensitive to own baby-cry than CSD mothers in the early postpartum in sensory processing, empathy, arousal, motivation, reward and habit-regulation circuits.

The results of this study show that attending to own baby-cry evokes a unique pattern of neural responses in VD mothers as compared to CSD mothers in the early postpartum.
Brain differences between VD and CSD mothers ... may contribute to mental health risks and resiliency in the mother-infant dyad.

... (circuits) may be altered in CSD in which the mother is deprived of the vagino-cervical stimulation and associated oxytocin.
Maternal OT was related to the amount of affectionate parenting behaviors ... 
... whereas paternal OT correlated with the degree of stimulatory parenting behaviors ...
The right start to life makes parenting so much easier!

Parenting is more enjoyable and fulfilling, an actively engaging baby is just much more fun!
Maternal neuro-behaviour

→ More emotional resilience
  → Enhanced problem solving
  → Better stress tolerance
  → MEMORY permanently improved

😊 not so sure!
'MOTHERING' = politically incorrect terminology ...
(parenting, care-giving)
culturally not valued ....
BUT
neuroscience provides new understanding and definitions ..
biologically based survival requirement →

'MOTHERING' = biological definition
breastfeeding
carrying
secure attachment
mutual reward
enjoyment and empathy
mutual playfulness and joy

ALL have evidence-based science
‘MOTHERING’ = biological definition

basic needs of infants arise from their biology

Mothering is biology
Fathers?

5 Father frequently and closely involved ...

Father during C/S

The GOLDEN HOUR

FAMILY CENTERED CARE

→ DO IT LITERALLY !!

Triplets ... requires a team
Taken by surprise:
For mothers, the premature birth created a feeling of powerlessness and they experienced the immediate postnatal period as surreal and strange. The fathers experienced the birth as a shock, but were ready to be involved immediately.
'MOTHERING' = biological definition

basic needs of infants arise from their biology

Mothering is biology
HORMONES (peaks & falls) → NEURONS PRIME (e.g. dendrification) → New circuits = enhanced learning → Advanced behaviour

SALIENT stimulation
Rich environment
“The newborn may appear helpless, but skin-to-skin contact stimulates prolactin, oxytocin, and cholecystokinin.
Maternal ferocity

PROTECTION

OXYTOCIN
Cingulate
Suppressed

→ Maternal ferocity

PROTECTION

OXYTOCIN
→ Gaze increase:
→ BONDING
Critical period concept:

“Windows of opportunity in early life when a child’s brain is exquisitely primed to receive sensory input in order to develop more advanced neural systems.”
Centrally released oxytocin coordinates the onset of maternal nurturing behavior at parturition and plays a role in mother-infant bonding.

Ross 2009
In humans, oxytocin increases gaze to the eye region of human faces and enhances interpersonal trust and the ability to infer the emotions of others from facial cues.
When oxytocin is released within the brain, its effects are to diminish fearfulness;

- **PREDATOR**
  - Smell
  - cingulate
  - FEAR
  - FREEZE

+ OXYTOCIN
  - cingulate suppressed
  - Less fear
  - FORAGE
When oxytocin is released within the brain, its effects are to diminish fearfulness; this not only encourages social investigation of newcomers, but also may enhance a tendency to express aggression toward an intruder. Leng 2008

Measure of “good mammal mother”: FEROCITY OF DEFENCE OF YOUNG.
Milk production

NUTRITION

Hypothalamus → Pituitary:

Hypothalamus → Pituitary:

PROLACTIN → Milk production

NUTRITION
REGULATION

Amygdala:

CHOLECYSTOKININ → Emotion / satiety

REGULATION
“The newborn may appear helpless, but skin-to-skin contact stimulates prolactin, ensuring nutrition; stimulates oxytocin, ensuring protection; stimulates cholecystokinin, ensuring wellbeing bonding.”
The first hours after birth are a CRITICAL PERIOD

mutual psycho-neuro-physiological caregivers
BONDING (Bergman mini-model)

Birth experience:
Sensations → hormonal changes → neural circuits

LIMBIC PLATFORM

Early life experience:
Neural circuits → emotional & social intelligence

CORTICO-LIMBIC CIRCUITRY

MATERNAL SENSITIVITY

ATTACHMENT
BONDING (Bergman mini-model)

Birth experience:
Sensations $\rightarrow$ hormonal changes $\rightarrow$ neural circuits

LIMBIC PLATFORM

Early life experience:
Neural circuits $\rightarrow$ emotional & social intelligence

CORTICO-LIMBIC CIRCUITRY

ATTACHMENT

MATERNAL SENSITIVITY
SENSORY STIMULATION
SKIN-TO-SKIN CONTACT
EMOTIONAL EXCHANGES
Mutual OXYTOCIN

EMOTIONAL INTELLIGENCE

SOCIAL INTELLIGENCE
SENSORY STIMULATION
SKIN-TO-SKIN CONTACT
EMOTIONAL EXCHANGES
Mutual OXYTOCIN

CRITICAL PERIOD PATHWAY FIRING

EMOTIONAL INTELLIGENCE
SOCIAL INTELLIGENCE
SENSORY STIMULATION
SKIN-TO-SKIN CONTACT
EMOTIONAL EXCHANGES
Mutual OXYTOCIN

CRITICAL PERIOD PATHWAY FIRING

EMOTIONAL INTELLIGENCE

BONDING
ATTACHMENT

SOCIAL INTELLIGENCE
"Scientific foundation" ... a synthesis

- EVOLUTIONARY BIOLOGY
- The Brain
- The DNA
- NEUROSCIENCE
- Everything else
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- The Place
- FITNESS
- EXPERIENCE
- ADAPTATION
- EMOTIONAL INTELLIGENCE
- SOCIAL INTELLIGENCE
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"Scientific foundation" ... a synthesis

The DNA

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"in the light of mother's body."
ZERO SEPARATION
Grow Your Baby's Brain: the latest neuroscience

We don't do that. Does anybody believe all this?

NO ... BUT →
Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health
Advances in a wide range of biological, behavioral, and social sciences are expanding our understanding of how early environmental influences (the ecology) and genetic predispositions (the biologic program) affect learning capacities, adaptive behaviors, lifelong physical and mental health, and adult productivity. A supporting technical report from the
“Scientific foundation” ... a synthesis

EVOLUTIONARY BIOLOGY ➔ NEUROSCIENCE ➔ EPIGENETICS

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ENVIRONMENT

FITNESS ➔ EXPERIENCE ➔ ADAPTATION

EXPECTED ➔ UNEXPECTED

HEALTH ➔ DISEASE

SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.
... policy and practice that impacts the care of mothers and babies.
INTRODUCTION

Of a good beginning cometh a good end.

John Heywood, Proverbs (1546)

The United States, like all nations of the world, is facing a number of social and economic challenges that must be met to secure a promising future. Central to this task is the need to produce a well-
The basic science of pediatrics.

“Scientific foundation” ... a synthesis

EVOLUTIONARY BIOLOGY → NEUROSCIENCE → EPigenetics

Everything else ← The Brain ← The DNA

The Place FITNESS ADAPTATION HEALTH DISEASE

ENVIRONMENT

SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.
... policy and practice that impacts the care of mothers and babies.
2 ... advances in the biological sciences underscore the foundational importance of the early years and support an EBD framework for understanding the evolution of human health and disease across the life span.
3. The biology of early childhood adversity reveals the important role of toxic stress in disrupting developing brain architecture and adversely affecting the concurrent development of other organ systems and regulatory functions.
4 Toxic stress can lead to potentially permanent changes in learning (…), behavior (…), and physiology (…) and can cause … higher levels of stress related chronic diseases, …increase the prevalence of unhealthy lifestyles that lead to widening health disparities.
5. The lifelong costs of childhood toxic stress are enormous, … and effective early childhood interventions provide critical opportunities to prevent these undesirable outcomes and generate large economic returns for all of society.
6. The consequences of significant adversity early in life prompt an urgent call for innovative strategies to reduce toxic stress within the context of a coordinated system of policies and services guided by an integrated science of early childhood and early brain development.
APPLICABILITY TO NEONATOLOGY ???

Question: do PRETERMS experience TOXIC STRESS ??
(Modi & Glover 1998, Mouncey et al 1997)

“Non-pharmacological reduction of hypercortisolaemia in preterm infants”

Preterm infants experience prolonged severe stress with tenfold increases in stress hormones. Stress hormones at such levels are neurotoxic.

RCT on methods to reduce of stress (at one hour):

<table>
<thead>
<tr>
<th>Method</th>
<th>Cortisol</th>
<th>Endorphin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Massage</td>
<td>slightly lower</td>
<td>no change</td>
</tr>
<tr>
<td>Soft music</td>
<td>no change</td>
<td>no change</td>
</tr>
<tr>
<td><strong>Skin-to-skin</strong></td>
<td><strong>66% lower</strong></td>
<td><strong>74% lower</strong></td>
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Preterm infants experience prolonged severe stress with tenfold increases in stress hormones. Stress hormones at such levels are neurotoxic.

### SSC - PROTECTION

SEPARATION RAISES STRESS HORMONES

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Separation from mother is stressful for humans. Salivary cortisol is a good measure of stress.

RCT (Anderson et al 1998)
Two groups of newborns, both given best care, only one separated from mother at one hour age
Cortisol levels measured every hour.

Cortisol separate = 9
Cortisol with mom = 4
Preterm infants have LESS RESILIENCE → Need “ideal” EEA

TOXIC STRESS concerns the NEONATOLOGIST more than the PEDIATRICIAN
The basic science of pediatrics.

For newborn: it is MOTHER that is ecology, biology, development.
BERGMAN COMMENTARY - NEWBORN
Early years = early hours & days
BERGMAN COMMENTARY - NEWBORN
Maternal absence is TOXIC STRESS
BERGMAN COMMENTARY - NEWBORN

For separated preterm newborns, we have decades of evidence for this.
Early Years → Life Span

Learning Behavior
Physical well being
Mental well being

Toxic Stress

Makes poorer
Linguistic
Cognitive
Emotional
Adaption
responsivity

→ unhealthy lifestyle
→ Chronic disease
→ health disparity

Massive Cost $$$$$

Berghman Commentary - Newborn

Even more massive ??
Early Years → Life Span

Reduce Toxic Stress

Toxic Stress

Early Life Adversity

Makes poorer linguistic, cognitive, emotional adaption

Responsivity → unhealthy lifestyle → chronic disease → health disparity

Massive Cost $$$$
KEEP US TOGETHER
An ecobiodevelopmental framework for early childhood policies and programs.

Innovative strategies ... ... reduce toxic stress

Creative new strategies

“compelling need for bold new strategies”
“compelling need for bold new strategies”

NOT ➔ Kangaroo Care !!!

BUT ...
Developmental science
(ecobiodevelopmental)

APPLYING PRIMATE EVOLUTIONARY BIOLOGY
“Scientific foundation” ... a synthesis

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Everything else ➔ The Brain ➔ The DNA

The Place ➔ FITNESS ➔ EXPERIENCE ➔ ADAPTATION ➔ ENVIRONMENT

EXPECTED ➔ UNEXPECTED

HEALTH ➔ DISEASE

SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.

... policy and practice that impacts the care of mothers and babies.
Building a New Biodevelopmental Framework to Guide the Future of Early Childhood Policy

... time to leverage new scientific knowledge ...
... new strategies ... substantially greater impact ...
... the compelling task of innovation.
... a science-based approach ...
... overcome fragmentation ...
... synthesizers,
Skin-to-Skin Contact

Attachment

Bonding

Breastfeeding

Regulation
Skin-to-Skin Contact → Attachment

Breast-feeding → Bonding

Regulation

Emotional & social IQ

Relationships

Safe places

Nutrition

Self-Regulation: RESILIENCE
Public Health Implications of skin-to-skin contact.

INTRODUCTION

“It is easier to build strong children than to repair broken men.”

Frederick Douglass (1817–1895)
The right start to life makes parenting so much easier!

Parenting is more enjoyable and fulfilling, an actively engaging baby is just much more fun!
... the newborn child is a small human being, with all its senses developed, open and receptive.

(John Lind, 1979)
Grow Your Baby’s Brain: the latest neuroscience

... the newborn child is a small human being, with all its senses developed, open and receptive.

(John Lind, 1979)