Perinatal Neuroscience

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Overview
Perinatal neuroscience
brain development
Normal newborn behaviour
Separation effects
physiology of crying
Defining the original paradigm
Perinatal Neuroscience

NEUROSCIENCE
90% of what we know about the brain has been discovered in the last 15 years
Society of Neuroscience estimate
Dr Sandra Witelson, McMaster

FETAL BRAIN DEVELOPMENT
The first 10 – 14 weeks, fetal brain growth is determined by genes (the DNA)
Thereafter, brain growth is an active process.

FETAL BRAIN DEVELOPMENT
Neuron = chief actor
Neurons push out a tree of connections (dendrification)
The also migrate …

Speaker Disclosure
Under ACCME guidelines:
a) I have a financial affiliation with AMEDA : Speakers Bureau
b) My wife markets educational materials and shirts related to the talk content Kangaroo Mother Care Promotions
"Cells which FIRE TOGETHER, WIRE TOGETHER, and those which don’t, won’t."
Carla Shatz

SECOND COMMANDMENT OF NEUROSCIENCE

USE IT, OR LOSE IT

Neuronal Plasticity

- programmed cell death or apoptosis
- pruning and elimination of redundancy

EARLY DEVELOPMENT

Gestational age
20w all structures completed

parallel development of structure & function

(Hugo Lagercrantz 2004)

Brain growth depends on experiences!!
23w fetus is aware / conscious
parallel development of structure & function

Neurobehaviour and neurodevelopment
are inseparable
a single integrated whole.

Neurobehaviour and neurodevelopment
FUNCTION and STRUCTURE
are inseparable
a single integrated whole.

28w    Birth
2 m     sympathetic
fight or flight
3rd    6 m  myelinated vagus
engage/disengage

“The brain is not a computer, it is a jungle.”
100 billion neurons x 20000 synapses ....

“The perinatal sensorium is never in chaos ....
... the infant’s world is structured, competent and organized, developing in an ever ordered, yet ever more complex and more flexible field of perception” (Laughlin)
At birth, the human being has more synapses in its brain than at any other stage of life.

Development is a process of “pruning” some, and developing other synapses – creating “neural pathways”.

**Synapse Development**

- **Synapse store chemical signal**
- **Chemical signal stronger**
- **Threshold → Exempt** from elimination (synapse stabilised)

**Sensory Stimulus**

**Pathway**

(Rima Shore 1997)
In utero: from 8w \( \rightarrow \) 20 weeks

Sensory experience ...

auditory, olfactory, contact, position

MUTED: visual, other sensory

...fires and wires brain

... the activity occurring during neonatal REM sleep (or active sleep) seems to be particularly important to the developing organism (spontaneous synchronous firing)

Mark et al 1995

deprivation of REM sleep early in life can result in behavioral problems, permanent sleep disruption,
decreased brain mass

more neuronal cell death.

Mark et al 1995

ACTIVE SLEEP: REM

'an active brain in an inactive body'
rapid eye movements
lateral plane
muscle atonia
EEG: low voltage mixed frequency
visual cortex active awake (dreaming)
suspended thermoregulation
ANS irregularities

QUIET SLEEP: NREM-4

'an inactive brain in an active body'

NREM Phase 4
deepest sleep
EEG: high amplitude synchronised delta waves

10 - 15% of total sleep

BRAIN WIRING

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

CONSOLIDATION
transfer information "SNR" strong signals
amygdala
NREM stage 4

MEMORY FORMATION
returns info to neocortex organized REM

Stanley Graven 2006
Development is a process of “pruning” some, and developing other synapses – creating “neural pathways”.

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.”
“brain is exquisitely susceptible to adverse factors” at particular times or stages

Critical period:
“Early interpersonal events positively and negatively impact the structural organisation of the brain.”

AT BIRTH, the brain has
TWO CRITICAL SENSORY NEEDS:

**SMELL**
CONNECT

... which is the first and essential first part of an efficiently regulated and organised right brain

**AMYGDALA:** fear and emotion

Prefrontal cortex approach / avoid

_behavioural activation system reward-based (dopamine) _
In early postnatal life, maintenance of critical levels of tactile input is important for normal brain maturation. Areas of the amygdala are in a critical period of maturation, in the first two months of life.

The fetus has well developed sensations for touch and position (tactile and kinesthetic sensations).

“The infant actively seeks to adhere to as much skin surface on the mother’s body as possible” (Harlow 1958, from Schore 2001)

Tactile stimulations build the amygdala-preorbital cortical tract during the first 8 weeks. The next pathway requires eye-to-eye contact. This is the basis of healthy right brain development!

Tactile stimulations facilitate "the flow of affective information from the infant to the mother" "the language of mother and infant consists of signals produced by the autonomic nervous system of both parties". This is the basis of healthy development!

Through "hidden maternal regulators" a mother precisely controls every element of her infant’s physiology, from its heart rate to its release of hormones from its appetite to the intensity of its activity.

(Gallagher 1992)

(Gallagher 1992)
The First Idea: How Symbols, Language, and Intelligence Evolved from our Primate Ancestors to Modern Humans
Stanley I. Greenspan & Stuart G. Shanker

"It is necessary for a child to be engaged in a series of affective (emotional) interactions that give rise to the development of motor sensory and social capacities, which, when combined with symbol formation, lead to language.

Greenspan & Shanker 2006, p39

"The symbolic use of language, in turn, creates the foundation for more advanced social and intellectual capacities, including higher and higher levels of reflective thinking.

Greenspan & Shanker 2006, p39
The First Idea

"the capacity to create symbols and to think stems from what was thought of by philosophers as the 'enemy' of reason and logic: our passions and emotions."

Greenspan & Shanker 2006

The objective is to achieve the ability to establish an efficiently regulated right brain: 'STABILITY THROUGH CHANGE'

The foundation for INFANT MENTAL HEALTH

Schor 2001a

The First Idea

... these "uniquely human abilities" are learned; not passed on genetically or through natural selection.

Greenspan & Shanker 2006

TRAWL for IQ genes in 7000 children

Six most powerful genes accounted for 1% of variation in intelligence

Alternatively: there is no gene for intelligence !!!

Published online on November 5, 2007, 10.1073/pnas.0704292104
PNAS | November 20, 2007 | vol. 104 | no. 47 | 18860-18865

Moderation of breastfeeding effects on the IQ by genetic variation in fatty acid metabolism

Avshalom Caspi, Benjamin Williams*, Julia Kim-Cohen *, et al

BUT: there is a gene for breastfeeding to improve intelligence !!!

Caspi 2007

Nature vs Nurture

Genetic Factors

Environment

Stimulation

Behaviour

Experience
**WELL-BEING**
created defined

**CONCEPTUAL VIEW OF DEVELOPMENT**

**ATTACHMENT** creates scaffold for
abstraction    INTELLIGENCE    INTEGRATION
speech          SOCIALISATION    RELATIONSHIP
emotional       REGULATION     BEHAVIOUR
autonomic       HOMEOEPSTASIS  FUNCTION
brainstem      PHYSIOLOGY     STRUCTURE

**CONCEPTUAL HIERARCHIES**

**ATTACHMENT** scaffold for
abstraction    INTELLIGENCE    INTEGRATION
speech          SOCIALISATION    RELATIONSHIP
emotional       REGULATION     BEHAVIOUR
autonomic       HOMEOEPSTASIS  FUNCTION
brainstem      PHYSIOLOGY     STRUCTURE

**HIERARCHY OF LANGUAGES**

**Neuronal Plasticity**
“the first three years are decisive”
The cortex retains some plasticity throughout life ...

But limbic system and the midbrain are fixed after the age of three years

**BREASTFEEDING**
REGULATION ..... 
...ATTACHMENT 
WELL-BEING

**SKIN-TO-SKIN CONTACT**

**MAXIMAL OCCURRENCE**
GENETIC    EXPERIENCE

**CURRENT**    **NEUROSCIENCE**

**OLD** ASSUMPTION

**0**     **10**     **20**     **30**     **40w**    **1y**     **3y**       **13y**         **50y**          **80y**

Birth
Puberty

**BRAIN DEVELOPMENT**

**BREASTFEEDING**
REGULATION ..... 
...ATTACHMENT 
WELL-BEING

**SKIN-TO-SKIN CONTACT**
Neuronal Plasticity
“the first three years are decisive”
platform for subsequent development of higher cognitive functions.

Hofer discovered that what seems to be a single physical function, such as grooming or nursing, is actually a kind of umbrella that covers stimuli of touch, balance, smell, hearing and vision, each with a specific effect on the infant.

(Gallagher 1992)

a kind of invisible hothouse

“the wiring of the brain's pathways is best supported when it can integrate quality sensory input through several pathways at once, particularly during critical periods of development.”

(Mccain 1999)

“... creates a kind of invisible hothouse in which the infant's development can unfold.”

(Hofer in Gallagher 1992)

The brain is a

SENSORY ORGAN
BREAST - FEEDING
= BRAIN - WIRING
SOCIAL ORGAN
"The brain is designed to be sculpted into its final configuration by the effects of early experiences."

These experiences are embedded in the attachment relationship.

The neurobehavioural programmes originate in the **LIMBIC SYSTEM**

Expressed through

- **hypothalamus** (autonomic nervous system)
- **hypophysis** (endocrine system, hormones)
- **cerebellar connections** (somatic system)
"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 lifetime.

All mammals have set sequence of behaviours at birth ............

... MUSCLES

BREASTFEED

After birth, events are determined ...

... by the neonate stimulating the mother!

(Rosenblatt 1994)

Breast-feeding is “established through a set of mutual, complex sensory stimulations in mother and child.”

(Kjellmer & Winberg 1994)

HABITAT DETERMINES BEHAVIOUR

BEHAVIOUR ENSURES BIOLOGICAL NEEDS
Warming, feeding and protection **behaviours** are intricately, inseparably linked to the right place.

(Alberts 1994)

= NUTRITION PROGRAMME

---

In all mammals ……

….. the **newborn is responsible** for initiating breastfeeding, **not the mother!!**

**EXCEPT IN HUMAN ???**

---

Sequence human newborn breast-feeding

Pre-requisite = habitat
- hand to mouth
- tongue moves
- mouth moves
- eye focuses nipple
- crawls to nipple
- latches to nipple
- suckles

(Widstrom et al 1994)

---

“The newborn may appear helpless, but displays an impressive and purposeful motor activity which, **without maternal assistance**, brings the baby to the nipple.

(Michelson et al 1996)

---

“The newborn may appear helpless, but

raises its own temperature,
has a higher blood glucose,
metabolic adaptation faster.

(Widstrom 1987)

---

Warming, feeding and protection **behaviours** are intricately, inseparably linked to the right place.

(Alberts 1994)
"The perinatal sensorium is never in chaos ....

DEVELOPMENT IS →

EVER MORE ORDERED

COMPETENT

COMPETENT

COMPETENT

ALWAYS!

MORE FLEXIBLE

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."

Success depends on a good start!!!

BIRTH SKIN-TO-SKIN CONTACT PLACE DEPENDENT COMPETENCE

The first hours after birth are a CRITICAL PERIOD

mutual psycho-physiological caregivers

BIRTH SKIN-TO-SKIN CONTACT CRITICAL PERIOD BEHAVIOUR

Clinics in Perinatology
June 2004, Vol 31(2) page 210
Stanley Graven
Early neurosensory visual development of fetus and newborn.

"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.

PSN envisions a community that embraces its mothers and babies, and values the unique opportunity at birth to impact the physical and emotional well-being of the newborn.

Target #1 for 2005:

Report that 65% of infants are placed and remain in direct skin to skin contact with their mothers for at least one hour during the first 3 hours after birth.
**ATTACHMENT**

**REGULATION**

**WELL-BEING**

**SKIN-TO-SKIN CONTACT**

**BREASTFEEDING**

A GLOBAL NEUROBEHAVIOUR,

MUCH MORE THAN NUTRITION ...

**KANGAROO MOTHER CARE**

A mother and baby **DYAD**

are a single psychobiological organism

**Clinics in Perinatology,**

June 2004, Vol 31(2)    p293

Joy Browne

"Early relationship environments: physiology of skin-to-skin contact for parents and their preterm infants"

The mother and infant at birth are ready to develop optimal attachment relationships and to work together toward organised cognitive, social and emotional development.

Joy Browne 2004

Used with permission: Ruth Stanhiser, MD
Robert White

"Mothers’ arms – the past and future locus of neonatal care?"

... the baby must spend most of its time in its mother’s arms to get the full benefit of her sensory environment as experienced throughout our evolution”

Baby Stohm, 780g

The DEFENCE program shuts off the others immediately

Universal response to separation (wrong habitat):

**protest** – ..... 

... intense activity, trying to find the habitat......

DEFENSE  
NUTRITION  
REPRODUCTION

HORMONES  NERVES  MUSCLES

= BREASTFEEDING

DEFENSE  
NUTRITION  
REPRODUCTION

HORMONES  NERVES  MUSCLES

= PROTEST - DESPAIR

SEPARATION is LIFE THREATENING (WRONG PLACE)
Universal response to separation (wrong habitat):
- **despair response** ....
  ...when separation is prolonged ...
  ...system shuts down for prolonged survival

SEPARATION is LIFE THREATENING (WRONG PLACE)

"PROTEST" is **NOT** harmful to the brain !!!
  unless it is prolonged or repetitive / frequent:
  "allostatic load"
Required to develop RESILIENCE

"DESPAIR" does **HARM**

“structural organisation
of the brain.”

(Kanitz 2004)
Consequences of repeated early isolation in domestic piglets on their behavioural neuroendocrine and immunological responses

Piglets in optimal rearing conditions 90 (versus 89 controls)

(Kanitz 2004)
Days 3 to 11
  separated for 2 hours then back
  "opaque plastic box, straw of floor, same temperature & humidity as pen"
Days 12 and 56
  weight
  behavior
  immune parameters
  hormonal parameters
  brain parameters

Decreased weight gain  (218 vs 244 g/d)
Decreased activity (despair-depression)
Higher plasma basal ACTH and cortisol
Suppression of immune function
Increased glucocorticoid receptors
Higher interleukin conc’ in limbic area
CRH activation in hypothalamus and amygdala
“structural organisation of the brain.”
(Ziabreva 2003)
South American small rodent

“Separation-Induced Receptor Changes in the Hippocampus and Amygdala of Octodon degus: Influence of maternal vocalisations”

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)

Scientific Committee 2002
European Primate Society report to EU

The welfare on non-human primates used in research:
Report of the Scientific Committee on Animal Health and Animal welfare

Social deprivation alters neurobiological systems.

This pathology ... cannot be cured ...
Scientific Committee 2002

PROTEST - DESPAIR

9.4.1. Separation of infants

causes

The impact of separation from the mother is state profound in the infant primate and is well-documented in infant macaques. They typically display a biphasic response characterised by an initial stage (protest) of hyperactivity associated with distress vocalisations, followed by a depressive stage (despair) featured by social withdrawal, a decrease in play, and the development of a typical slothish posture (Minaka and Soina, 1978; Capitanio, 1986). This is accompanied by physiological disturbances in the regulation of heart rate, body temperature, sleep patterns, cortisol secretion and the immune system (Hedelblad et al., 2002).

DYSREGULATION

3-day separation:
induces physiological changes (immune system, heart rate, sleep, cortisol, loss of body temperature...)
aanaclitic depression:
• hyperactivity
• conservation - withdrawal;
• death or recovery

Slide & photo from James McKenna

NO separation 6 months

According to the guidelines of the IPS (1993 a,b), young individuals should not be separated from their mothers at an early age (i.e. less than 6 months). They should remain in contact for one year to 18 months in monkeys like macaques, baboons and capuchins. The guidelines of the Primate Vaccine Evaluation Network also state that infants should not be weaned before 6 months and recommend separation at 12 months old (Poole and Thomas, 1995).

Continued contact 18 m
Maternal behavior among primates extends throughout an extremely long infant and juvenile period, with prolonged periods of physical contact.  

(Orangutan) from McKenna

SEPARATION is LIFE THREATENING (WRONG PLACE)

SEPARATION !!!
THE “PRIMARY VIOLATION” ... the very worst thing ... to any newborn according to biologists is SEPARATION.

Protest - despair is also called HYPERAROUSAL - DISSOCIATION

HYPERAROUSAL – (Schore 2001)

hypermetabolic state
sympathetic system activated, increasing HR, BP, tone, vigilance, distress is expressed first in crying ... then screaming, then "fear-terror"

DISSOCIATION (Schore 2001)
hypometabolic state
later forming parasympathetic, state of “conservation-withdrawal” in which individual disengages the brain “to conserve energies” ... “foster survival by the risky posture of feigning death".
HYPERAROUSAL - DISSOCIATION (Schore 2001)

"in this state both sympathetic and parasympathetic components are hyperactivated ... Creating ...
chaotic biochemical alterations ...
a toxic neurochemistry in the developing brain"
HYPERAROUSAL - DISSOCIATION (Schore 2001)

“early adverse experiences result in an increased sensitivity to the effects of stress later in life, and render an individual vulnerable to stress related psychiatric disorders.”

SEPARATION IS HARMFUL

“Origins of many behavioural deviations are unknown - child neglect, abuse, abnormal shyness, attention deficiencies, hyperactivity, colic, sleep disorders etc,

SEPARATION IS HARMFUL

“Origins of many behavioural deviations are unknown …

… can some be traced back to violations of an innate agenda?”

Kjellmer & Winberg 1994

SENSORY STIMULATION

The First Idea: Authors have based their work partly on study of AUTISM

The First Idea: How Symbols, Language, and Intelligence Evolved from our Primate Ancestors to Modern Humans

Stanley I. Greenspan & Stuart G. Shanker

SEPARATION IS HARMFUL

"Early separation can produce major shifts in susceptibility to stress-induced pathology" (Hofer 1994)

(Maladaptive pathways have formed… )

SEPARATION IS HARMFUL

"Early separation can produce major shifts in susceptibility to stress-induced pathology" (Hofer 1994)

Syndrome X BARKER HYPOTHESIS

Obesity

Diabetes

Hypertension
The Fetal Matrix:

**PREDICTIVE ADAPTIVE RESPONSES (PARs)**

Gluckman & Hanson 2005

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**The Fetal Matrix:**

<table>
<thead>
<tr>
<th>Genome</th>
<th>species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genotype</td>
<td>specimen</td>
</tr>
<tr>
<td>Environment</td>
<td>(expected or harsh)</td>
</tr>
<tr>
<td>Adaptation</td>
<td>→ homeostasis</td>
</tr>
<tr>
<td>→ Prediction</td>
<td>(fetal programming)</td>
</tr>
<tr>
<td>Prediction = environment</td>
<td>Expected</td>
</tr>
</tbody>
</table>

| Phenotype A | healthy | dis-ease |
| Phenotype B | dis-ease | healthy |

Gluckman & Hanson 2005

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**Schore / Bergman**

"developmental psychoneurobiological model"

Poor adult mental health → from
Poor infant mental health → from
Poor right brain regulation → from
POOR ATTACHMENT → from
lack of skin-to-skin contact → from

**SEPARATION = CURRENT ROUTINE !!**

---

**HYPERAROUSAL - DISSOCIATION** (Schore 2001)

"In this state both sympathetic and parasympathetic components are hyperactivated ... Creating
... chaotic biochemical alterations
... a toxic neurochemistry in the developing brain"

---

**SEPARATION !!!**

THE “PRIMARY VIOLATION”
... the very worst thing ... to any newborn according to biologists is **SEPARATION.**
Mother and offspring live in a biological state that has much in common with addiction. When they are parted the infant does not just miss its mother; it experiences a physical and psychological withdrawal from a host of her sensory stimuli, not unlike the plight of a heroin addict who goes cold turkey. (Gallagher 1992)

Separation tolerance in mammals is measured in minutes

(Gallagher 1992)

Separation tolerance in HUMANS is NOT measured

(Gallagher 1992)

Jacksonian Dissolution

The more threatened the individual, the more 'primitive' (or regressed) becomes the style of thinking and behaving.

Perry 1995

Perry: Responses to threat

<table>
<thead>
<tr>
<th>Adaptive Response</th>
<th>REST (Adult Male)</th>
<th>VIGILANCE (Crying)</th>
<th>FREEZE Freeze</th>
<th>FLIGHT</th>
<th>FIGHT</th>
</tr>
</thead>
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<tr>
<td>Hyperarousal</td>
<td>REST (Male Child)</td>
<td>VIGILANCE (Crying)</td>
<td>RESISTANCE Freeze</td>
<td>DEFIANCE 'Posturing'</td>
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<td>Dissociative Continuum</td>
<td>REST (Female Child)</td>
<td>AVOIDANCE (Crying)</td>
<td>COMPLIANCE Freeze</td>
<td>DISSOCIATION 'Numbing'</td>
<td>PAINTING 'Mini-psychosis'</td>
</tr>
<tr>
<td>PRIMARY secondary Brain Areas</td>
<td>NEOCORTEX</td>
<td>SUBCORTEX Limbic</td>
<td>LIMBIC Midbrain</td>
<td>BRAINSTEM Brainstem</td>
<td>AUTONOMIC Autonomic</td>
</tr>
<tr>
<td>Cognition</td>
<td>ABSTRACT</td>
<td>CONCRETE</td>
<td>'EMOTIONAL'</td>
<td>REACTIVE</td>
<td>REFLEXIVE</td>
</tr>
<tr>
<td>Mental State</td>
<td>CALM</td>
<td>AROUSAL</td>
<td>FEAR</td>
<td>TERROR</td>
<td></td>
</tr>
</tbody>
</table>
Schore:

“Infant trauma will interfere with critical period limbic organisation ...
future capacity to adapt ... correlated with maladaptive adult mental health”

Schore:

“long term alterations brain function... risk for developing severe psychopathologies at later stages of life.”

Developing Brain (1)
- Neurogenesis
- Neural morphology
- Synaptogenesis
- Myelination

Early Stress (2)
- Neuronal death, smaller brain
- Fewer dendritic spines
- Poorer connections
- Fewer glial cells, less myelin

Sensitivity (3)
- Genetic
- Gender
- Timing
- Developmental rate
- GCR density

Enduring (4) consequences
- Attenuated L brain development
- Poor R/L integration
- Irritability limbic system
- Poorer function vermis

Neuropsychiatric vulnerabilities (5)
- Dissociative identity disorder
- Depression
- Personality disorder
- Substance abuse
- Post Traumatic Stress Disorder

TEICHER’S EARLY STRESS CASCADE MODEL

Stimulation → Resilience → MENTAL HEALTH

Maternal Dependence

0 10 20 30 40w 1y 3 5 7 9 13 23 53

Maternal Dependence

0 10 20 30 40w 1y 3 5 7 9 13 23 53
... prolonged and repeated neonatal stress ... and pain exposure ... may alter self-regulation in multiple systems ...
... changes may underlie long term difficulties in this population.

Grunau et al, Pain 2005; 113(3): 293-300
Neonatal procedural pain exposure predicts lower cortisol and behavioural reactivity in preterm infants in the NICU.

Page, J o Perinatal Education 2004; 13(3): 10-17
Are there long-term consequences of pain in newborn or very young infants?

Youngest preterm neonates undergo 750 procedures during their hospital stay
less than 10% get opiates
Growing evidence shows that early pain experiences in newborn infants may have long-term consequences ...
... only minimally monitored
Developing Brain (1)

Neurogenesis
Neural morphology
Synaptogenesis
Myelination

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Neuropsychiatric vulnerabilities
Dissociative identity disorder
Depression
Personality disorder
Substance abuse
Post Traumatic Stress Disorder

Stimulation
Resilience

MENTAL HEALTH
TEICHER
EARLY STRESS CASCADE MODEL

MATERNAL DEPENDENCE
NEWBORN: MATERNAL ABSENCE = MOST SEVERE & EARLIEST STRESS
POOR QUALITY SURVIVAL

Tu et al, 2007
Grunau 2004, 2005

Infant brain development

OLD PARADIGM
ASSUMPTION: BRAIN GROWS LINEARLY, GENETIC MATURATION

Survival

TIME

Tu et al, 2007
Grunau 2004, 2005

IN THE PAST,
WE BELIEVED
BRAIN DEVELOPMENT:
1. genetically determined
2. linear development
3. activity increased with age
4. Mother good but not essential
5. deficits correctable later

(Rima Shore 1997)

= FALSE ASSUMPTION!!

NEUROSCIENCE
90% of what we know about the brain has been discovered in the last 15 years

Society of Neuroscience estimate
Dr Sandra Witelson, McMaster

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3. activity increases
4. Mother not essential
5. deficits correctable
   = FALSE ASSUMPTION!!

“Current neuroscience and recent research have
-disproved the assumptions,
-destroyed the platform,
on which modern neonatal
care has been built.”
N Bergman 2006

THE CURRENT
“BELIEF SYSTEM”
SEPARATES
MOTHERS & BABIES

SEPARATION
VIOLATES
THE INNATE AGENDA
OF MOTHER
AND NEWBORN

MATERNAL DEPENDENCE
HABITAT NICHE

MATERNAL SEPARATION

For the human newborn,
it is the habitat which
determines which brain
programme is operating,
which then determines
the behaviour (niche).
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<th>HABITAT NICHE</th>
<th>MEANS</th>
<th>RESULT</th>
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<td><strong>BREAST-VAGAL</strong>&lt;br&gt;MOTHER FEEDING (PSNS)</td>
<td>GROWTH</td>
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<td><strong>OTHER</strong></td>
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<td>VIOLATES&lt;br&gt;THE INNATE AGENDA&lt;br&gt;OF MOTHER&lt;br&gt;AND NEWBORN</td>
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Separation violates the innate agenda of mother and newborn.

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