

Perinatal Neuroscience



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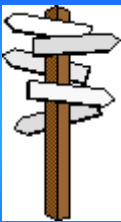
www.kangaroomothercare.com

Speaker Disclosure

Under ACCME guidelines:

- I have a financial affiliation with
AMEDA : Speakers Bureau
- My wife markets educational materials
and shirts related to the talk content
Kangaroo Mother Care Promotions

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)

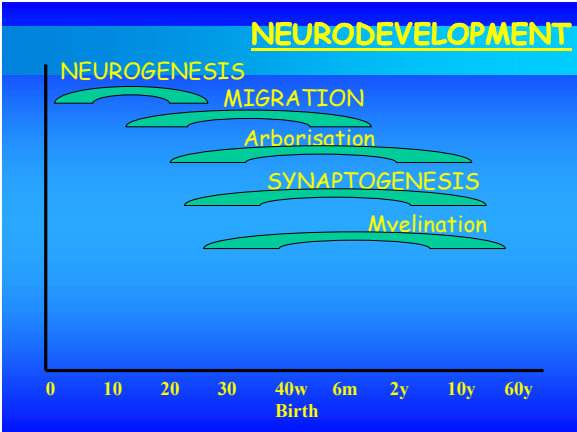
Thereafter, brain growth
is an active process.

FETAL BRAIN DEVELOPMENT

Neuron = chief actor

Neurons push out a
tree of connections
(dendrification)

The also migrate ...

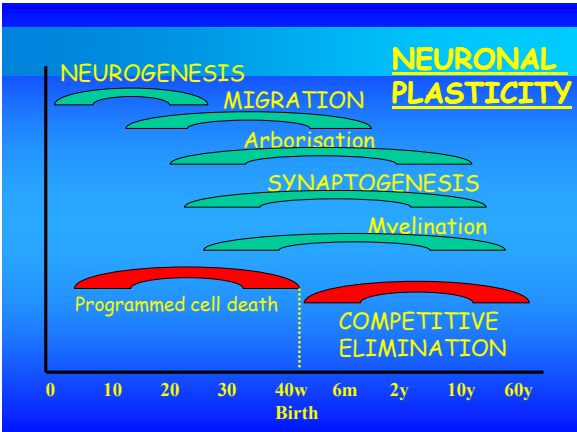


*"Cells which
FIRE TOGETHER,
WIRE TOGETHER,
and those which
don't, won't."*
Carla Shatz

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

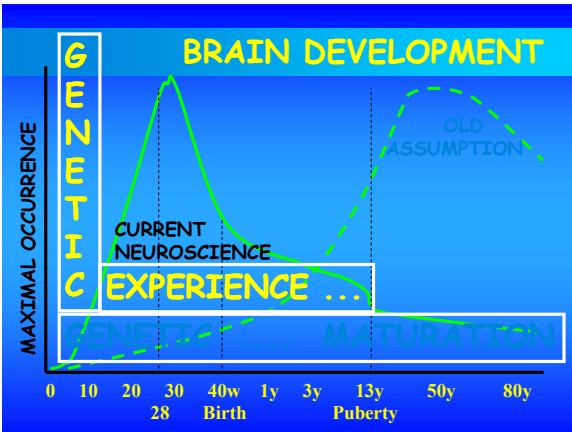
Neurobehaviour and neurodevelopment

are inseparable
a single integrated whole.

23w fetus is aware / conscious
parallel development of structure & function

FUNCTION and STRUCTURE
Neurobehaviour and neurodevelopment

are inseparable
a single integrated whole.



EARLY DEVELOPMENT

"The brain
is not a
computer, it
is a jungle."

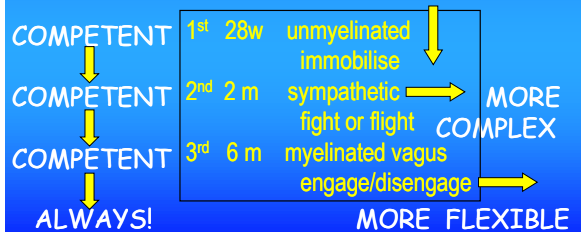
100 billion neurons x 20000 synapses

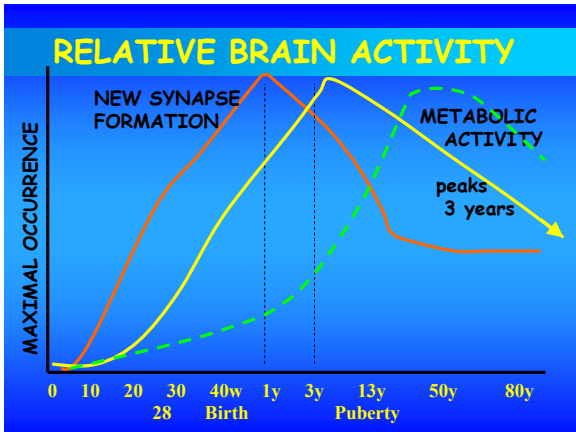
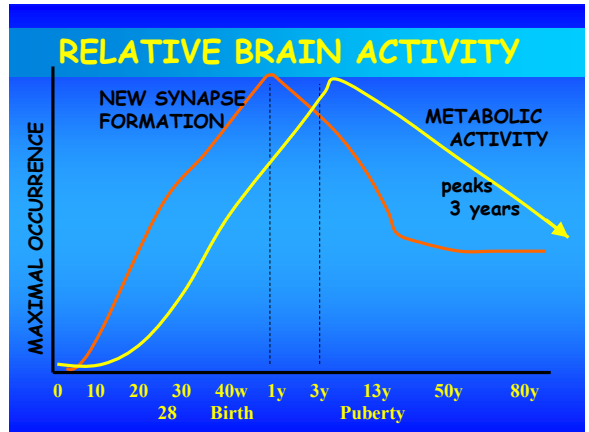
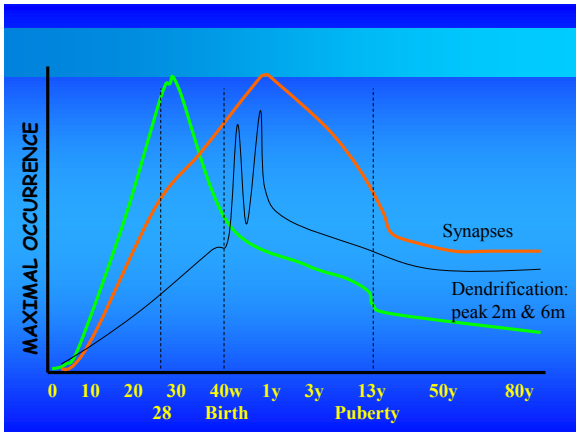
"The perinatal sensorium
is never in chaos

... 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)

"The perinatal sensorium
is never in chaos

DEVELOPMENT IS →
EVER MORE ORDERED



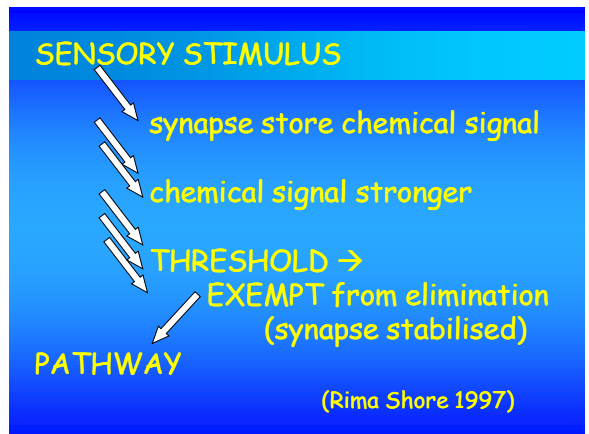


FETAL BRAIN DEVELOPMENT

At birth, the human being has more synapses in its brain than at any other stage of life.

SYNAPSE DEVELOPMENT

Development is a process of "pruning" some, and developing other synapses - creating "neural pathways".



STIMULATION

In utero:

from 8w ? ... → 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)

Marks 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.

Marks 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

REM
NR1
NR2
NR3
NR4

ACQUISITION

poly-sensory input
short-term memory
stored cortex

CONSOLIDATION

transfer information
"SNR" strong signals
amygdala /
hippocampus
NREM stage 4

MEMORY FORMATION

P waves
returns info
to neocortex:
organized
REM

Awake and REM
Stanley Graven 2006

FETAL BRAIN DEVELOPMENT

Development is a process of "pruning" some, and developing other synapses - creating "neural pathways".

R Shore

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

Schore

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 CONTACT



connect direct to the amygdala

THE NEWBORN BRAIN

SKIN-TO-SKIN CONTACT fires and wires the amygdala-prefronto-orbital cortical pathway

THE NEWBORN BRAIN

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

efficiently regulated and organised right brain

AMYGDALA: fear and emotion

Behavioural activation system reward-based (dopamine)

Prefrontal cortex approach / avoid



Amodio 2008

Schore

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

FETAL BRAIN DEVELOPMENT

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)

NEWBORN DEVELOPMENT

skin-to-skin contact

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!

NEWBORN 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!

Myron Hofer

... the private realm of sensory stimulation constructed by the mother and infant from numberless exchanges of subtle clues.

(Gallagher 1992)

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)

ATTACHMENT - REGULATION

the objective is to achieve the ability to establish:

'STABILITY THROUGH CHANGE'

The foundation for
INFANT MENTAL HEALTH

SENSORY STIMULATION

EMOTIONAL EXCHANGES

AUTONOMIC
BODY CONTROL

WELL-BEING

HEALTH

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

The First Idea

"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 First Idea (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

SENSORY STIMULATION

EMOTIONAL EXCHANGES

AUTONOMIC
BODY CONTROL

BODY
LANGUAGE

WELL-BEING

COMMUNICATION

HEALTH

SPEECH

SENSORY STIMULATION

EMOTIONAL EXCHANGES

AUTONOMIC
BODY CONTROL

BODY
LANGUAGE

WELL-BEING

COMMUNICATION

HEALTH

SPEECH

DUAL CODING
REGULATION - ATTACHMENT

Greenspan & Shanker 2006

ATTACHMENT - REGULATION

the objective is to achieve the ability to establish an efficiently regulated right brain:

'STABILITY THROUGH CHANGE

The foundation for
INFANT MENTAL HEALTH

Schore 2001a

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 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

Article Preview

'Intelligence genes' reveal their complexity

29 November 2007 Andy Coghlan Magazine issue 2632

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

effects are so small that for the most part they are barely detectable. This does not mean, however, that intelligence is not inherited.

The research, led by Robert Plomin of the Institute of Psychiatry in London, identified six genes that were strongly associated with high or low intelligence, but even the most powerful of these accounted for just 0.4 per cent of the variation in intelligence between individuals. The six together accounted for about 1 per cent of the 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

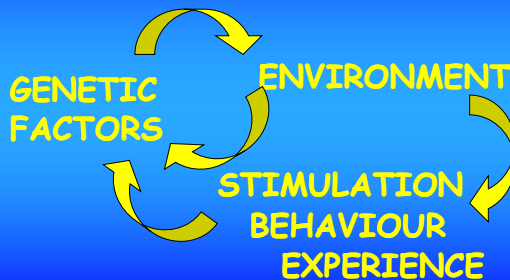
Avshalom Caspi, Benjamin Williams*, Julia Kim-Cohen*, et al

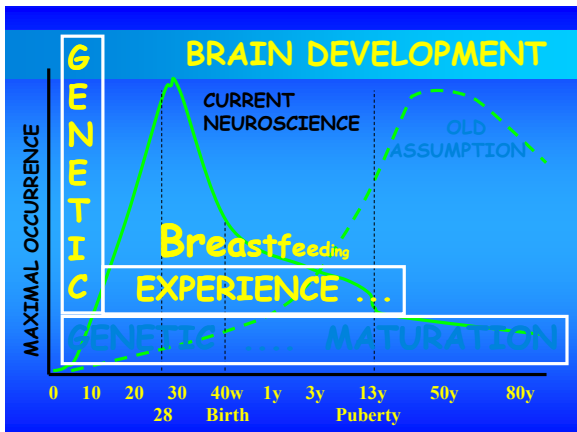
BUT:

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

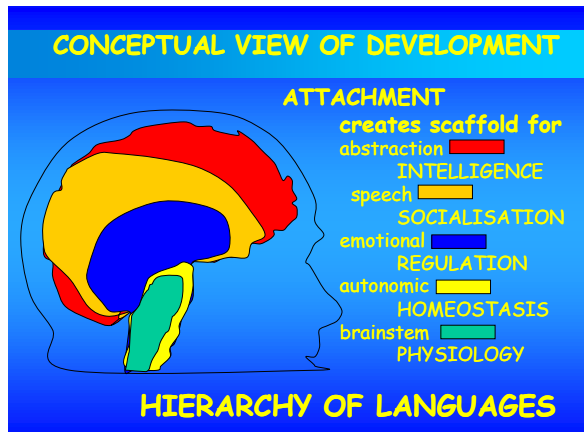
Caspi 2007

NATURE VS NURTURE





WELL-BEING
created
defined



CONCEPTUAL HIERARCHIES

ATTACHMENT scaffold for

abstraction	█	INTELLIGENCE	INTEGRATION
speech	█	SOCIALISATION	RELATIONSHIP
emotional	█	REGULATION	BEHAVIOUR
autonomic	█	HOMEOSTASIS	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

Neuronal Plasticity

"the first three years are decisive"

→ platform for subsequent development of higher cognitive functions.

Stanford Report, July 12, 2006

Forget the latest toys: All kids really need is love

Authors say public policy should focus on helping children have good experiences in their earliest years



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

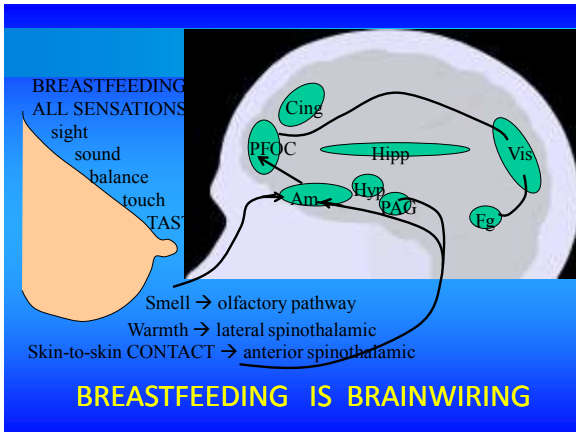
"the wiring of the brain's pathways is best supported when it can integrate quality sensory input through several pathways at once, particularly during critical periods of development." *(McCain 1999)*

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

(Hofer in Gallagher 1992)

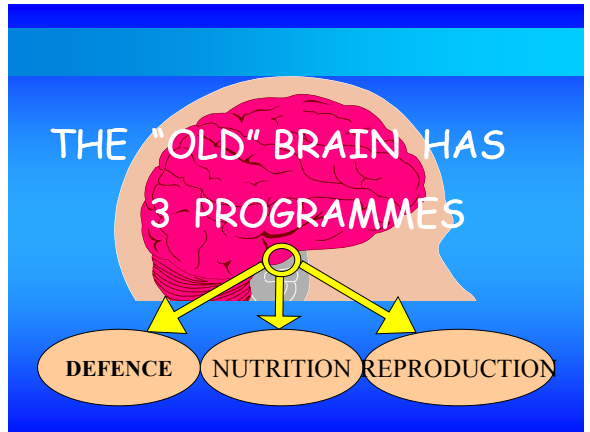
The brain is a

SENSORY ORGAN
BREAST - FEEDING
=
BRAIN - WIRING
SOCIAL ORGAN



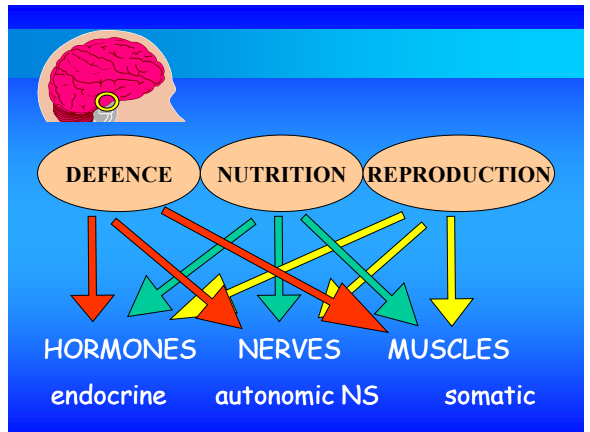
“The brain is designed to be sculpted into its final configuration by the effects of early experiences”

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)



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.

All mammals have set sequence of behaviours at birth



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



R Shore

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.

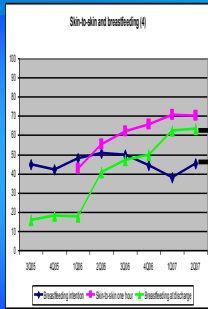
Target #1 for 2005:

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.



Babies breastfeeding
 Mothers intending to breastfeed

Used with permission: Ruth Stanhiser, MD

ATTACHMENT
 REGULATION
 WELL-BEING

SKIN-TO-SKIN CONTACT

BREASTFEEDING

A GLOBAL
 NEUROBEHAVIOUR,
 MUCH MORE THAN
 NUTRITION ...

SKIN-TO-SKIN CONTACT

BREASTFEEDING

REGULATION

...ATTACHMENT

WELL-BEING

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

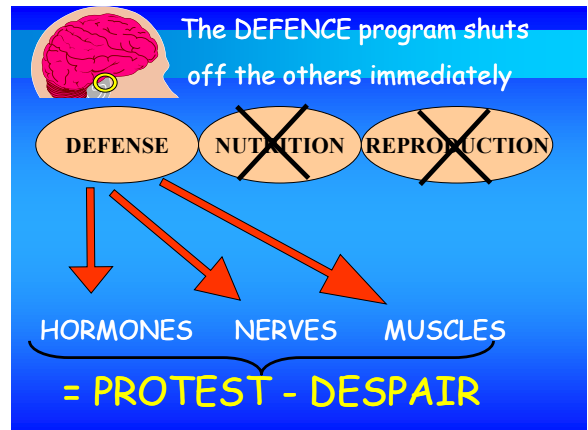
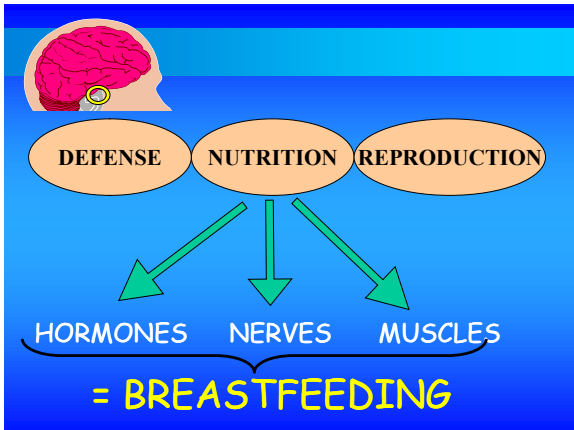
Clinics in Perinatology,
June 2004, Vol 31(2) p293
Robert White
"Mothers' arms – the past and
future locus of neonatal care ?"

... the baby must spend most
of its time in its mothers arms to
get the full benefit of her sensory
environment as experienced
throughout our evolution"

HUMANITY FIRST

Baby Stohm, 780g

TECHNOLOGY SECOND



SEPARATION is
LIFE
THREATENING
(WRONG PLACE)

Universal response to
separation (wrong habitat):

protest -

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

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 quite 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 sloouched posture (Mimela and Suomi, 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 (Laudenslager *et al.*,

DYSREGULATION

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

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**.



DEFENSE

Protest - despair is also called

HYPERAROUSAL - DISSOCIATION

HYPERAROUSAL - (Schorre 2001)

hypermetabolic state

sympathetic system activated, increasing HR, BP, tone, vigilance,

distress is expressed first in crying ... then

screaming, then "fear-terror"

DISSOCIATION (Schorre 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 (Schorre 2001)

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

HYPERAROUSAL - DISSOCIATION (Schorre 2001)

"in the developing brain, states organize neural systems, resulting in enduring traits."

CELLS THAT FIRE, WIRE

Schorre

Critical period concept :

"brain is exquisitely susceptible to adverse factors" at particular times or stages

Schorre

Critical period :

"Early interpersonal events positively and negatively impact the **structural organisation of the brain.**"

Contemporary neuroscience ...

currently exploring early beginnings of adult brain pathology ...

... alterations in the functional organisation of the human brain ...
... correlated with the absence of early learning experiences.

Contemporary neuroscience

"social stressors are far more detrimental than nonsocial aversive stimuli"

"infant's immature brain exquisitely vulnerable to early adverse experiences, including adverse social experiences."

HYPERAROUSAL - DISSOCIATION (Schoore 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

↓
EMOTIONAL EXCHANGES

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

The Fetal Matrix:

Genome	species
Genotype	specimen
	Environment (expected or harsh)
	Adaptation → homeostasis
	→ Prediction
	(fetal programming)
	Prediction = environment
	<u>Expected</u> <u>Harsh</u>
Phenotype A	healthy dis-ease
Phenotype B	dis-ease healthy

Gluckman & Hanson 2005

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

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

Separation tolerance in HUMANS is NOT measured

PUBMED

(National Library of medicine)
Search "separation tolerance"

QUOTED PHRASE NOT FOUND

Googlewhack:
Your search –
"neonatal separation tolerance"
did not match any documents.

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

	REST (Adult Male)	VIGILANCE	FREEZE	FLIGHT	FIGHT
Adaptive Response	REST (Male Child)	VIGILANCE (Crying)	RESISTANCE Freeze	DEFIANCE 'Posturing'	AGGRESSION
Hyperarousal Continuum	REST (Female Child)	AVOIDANCE (Crying)	COMPLIANCE Freeze	DISSOCIATION 'Numbing'	FAINTING 'Mini-psychosis'
PRIMARY secondary Brain Areas	NEOCORTEX Subcortex	SUBCORTEX Limbic	LIMBIC Midbrain	MIDBRAIN Brainstem	BRAINSTEM Autonomic
Cognition	ABSTRACT	CONCRETE	'EMOTIONAL'	REACTIVE	REFLEXIVE
Mental State	CALM	AROUSAL	FEAR	TERROR	

Schore:

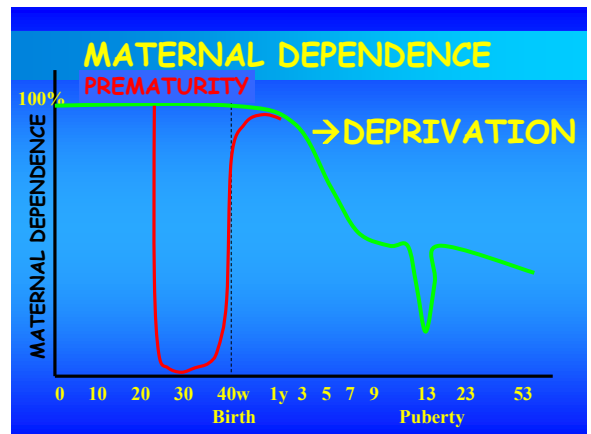
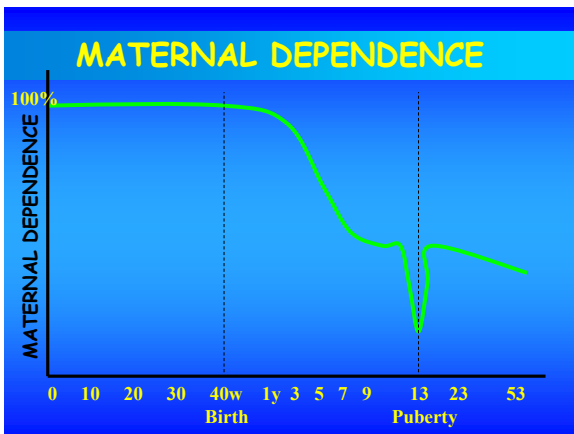
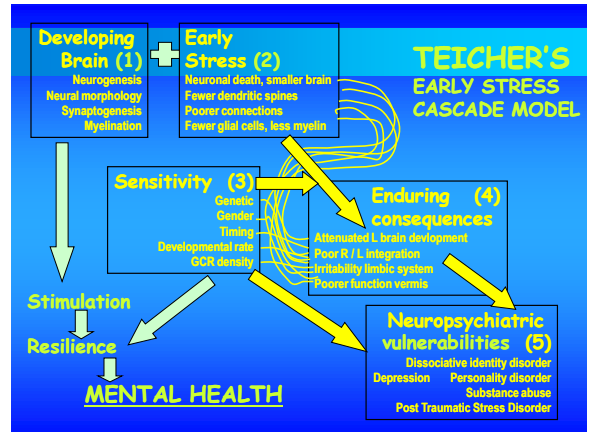
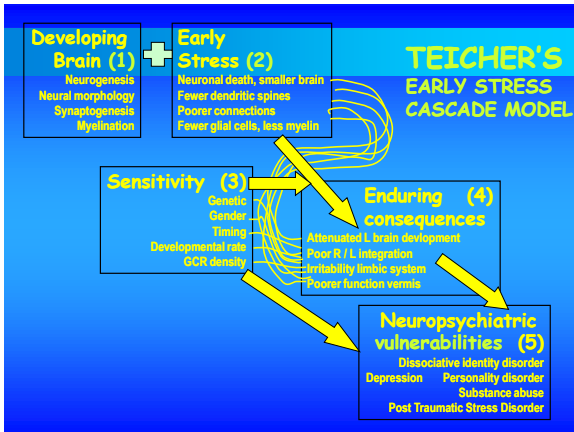
"Infant trauma will interfere with critical period limbic organisation ...

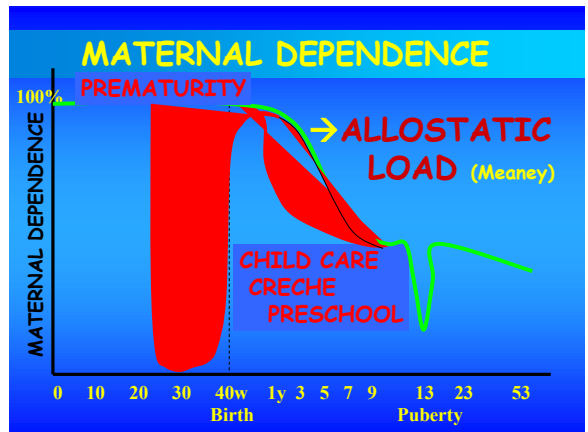
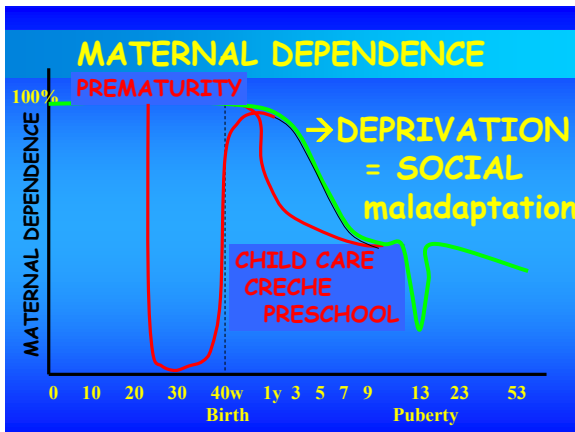
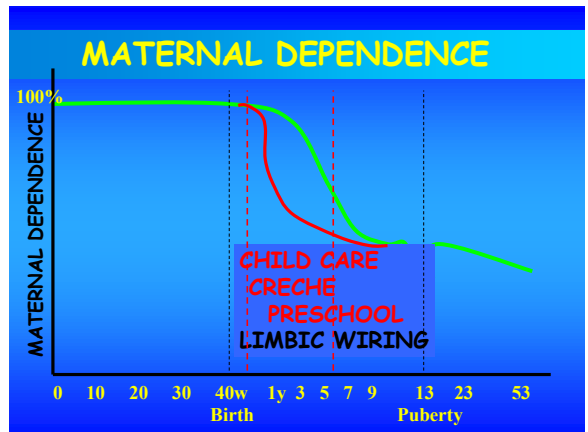
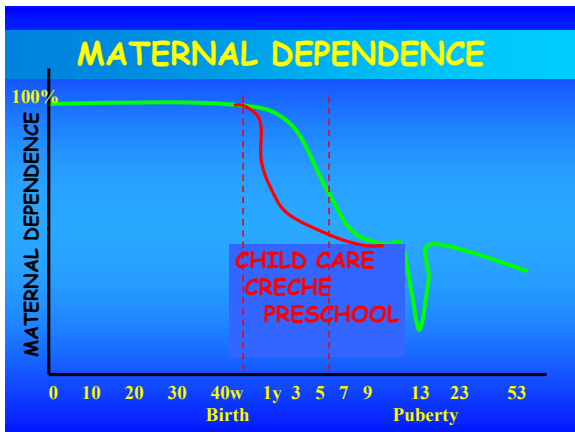
future capacity to adapt ... correlated with maladaptive adult mental health"

Schore:

"long term alterations brain function

"risk for developing severe psychopathologies at later stages of life."





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.

... prolonged and repeated neonatal stress ... and pain exposure may alter self-regulation in multiple systems ...

... changes may underlie long term ...difficulties in this population.

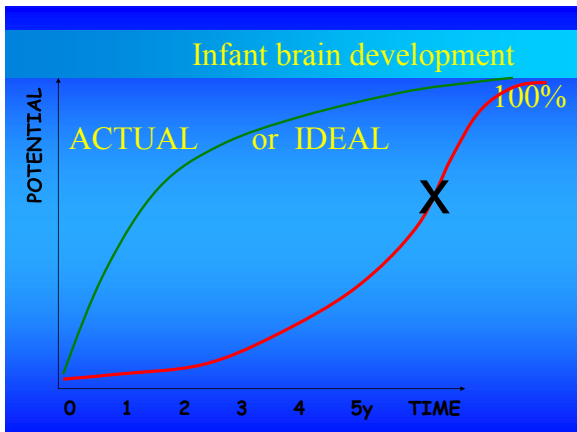
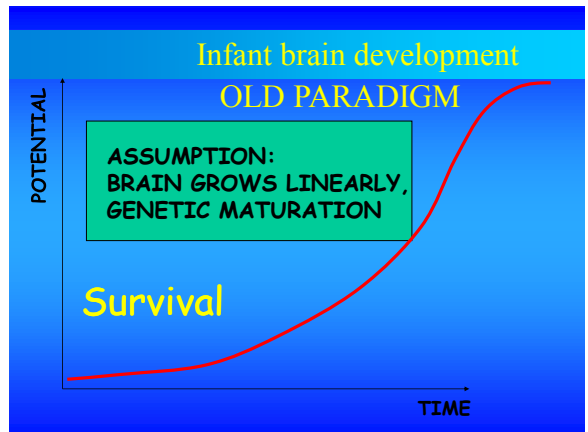
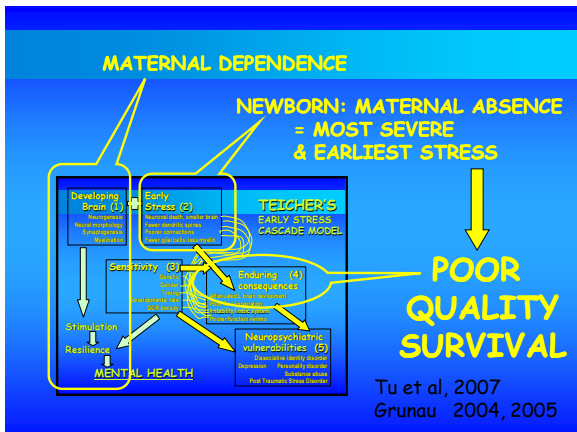
Page, J o Perinatal Education 2004; 13(3): 10-17
Are there long-term consequences of pain in newborn or very young infants?

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



- 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)

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

- 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
- = FALSE ASSUMPTION !!**

IN THE PAST,

WE BELIEVED

BRAIN DEVELOPMENT :

- | | |
|---------------------------|------------------|
| 1. genetically determined | EXPERIENCE |
| 2. linear development | CRITICAL periods |
| 3. acitivity increases | MAX 3 years |
| 4. Mother not essential | MOTHER WIRES |
| 5. deficits correctable | FIXED 3 years |

= 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

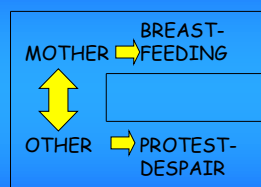
VIOLATES

THE INNATE AGENDA
OF MOTHER
AND NEWBORN

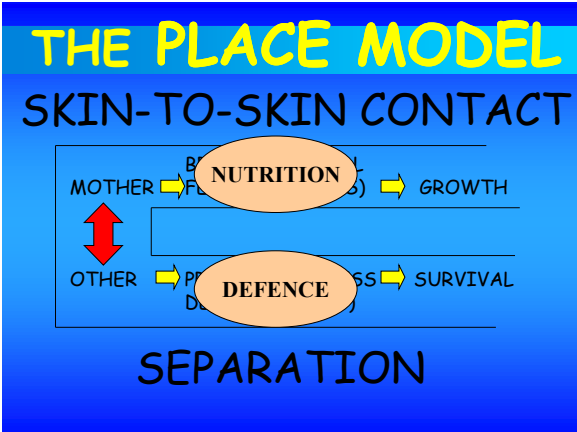
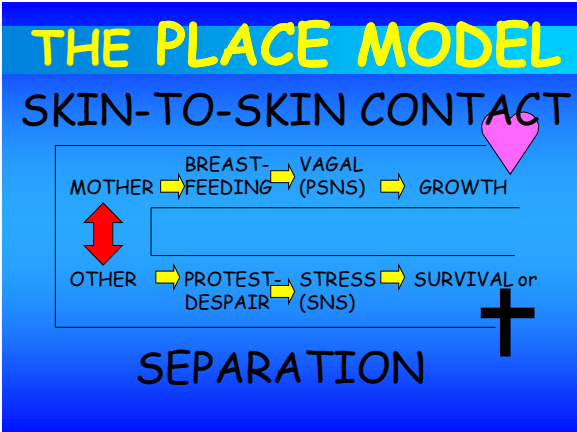
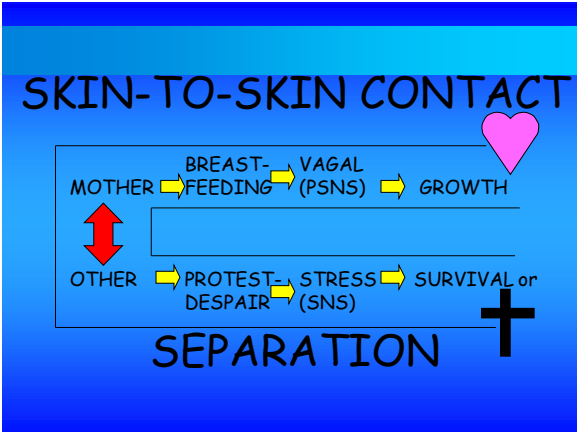
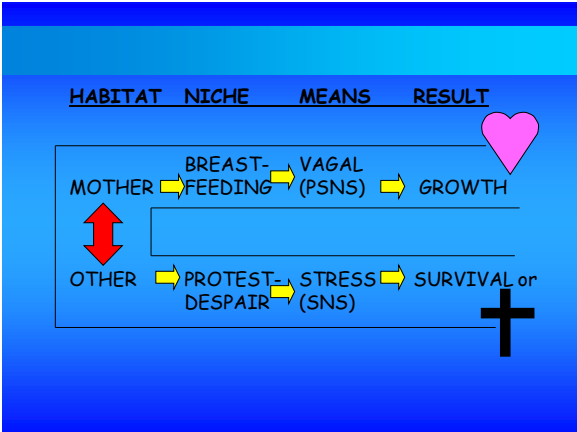
For the human newborn,
it is the **habitat** which
determines which brain
programme is operating,
which then determines
the **behaviour** (niche).

MATERNAL DEPENDENCE

HABITAT NICHE



MATERNAL SEPARATION



SEPARATION VIOLATES THE INNATE AGENDA OF MOTHER AND NEWBORN

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