Grow Your Baby's Brain

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Grow Your Baby's Brain: the latest neuroscience

OLD Understanding

child helpless

mother clueless

father useless

Grow Your Baby's Brain

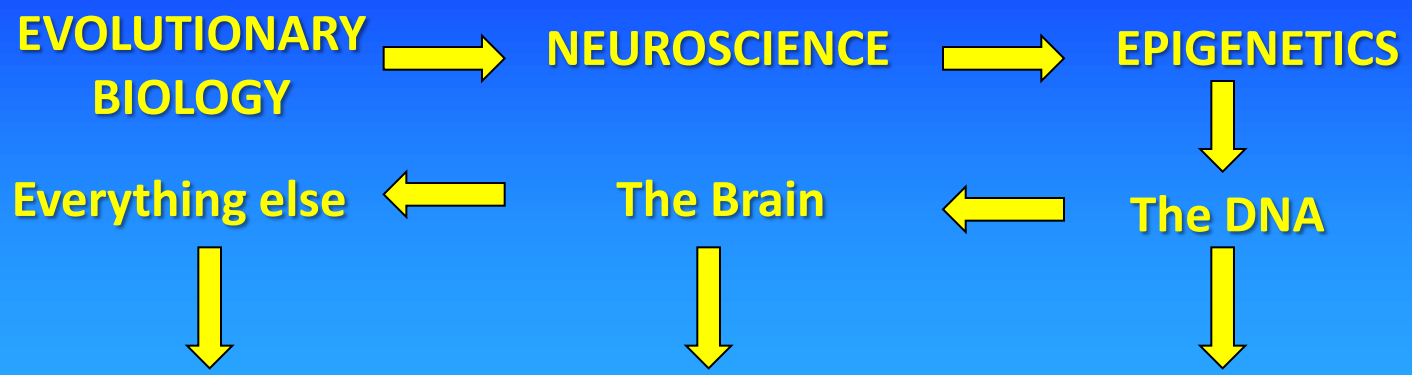
The right start
to life makes
parenting so
much easier !
Parenting is more
enjoyable and fulfulling,
an actively engaging baby is
just much more fun!

INK

Scientific American,
December 2011

Pencil

“Scientific foundation” … a synthesis



The Place FITNESS EXPERIENCE ADAPTATION
ENVIRONMENT

… highly conserved neuro-endocrine behaviors

"Genome" – genes of species

"Genotype" - genes in specimen

INK

"Phenotype" – specimen resulting from gene – environment interaction

Pencil

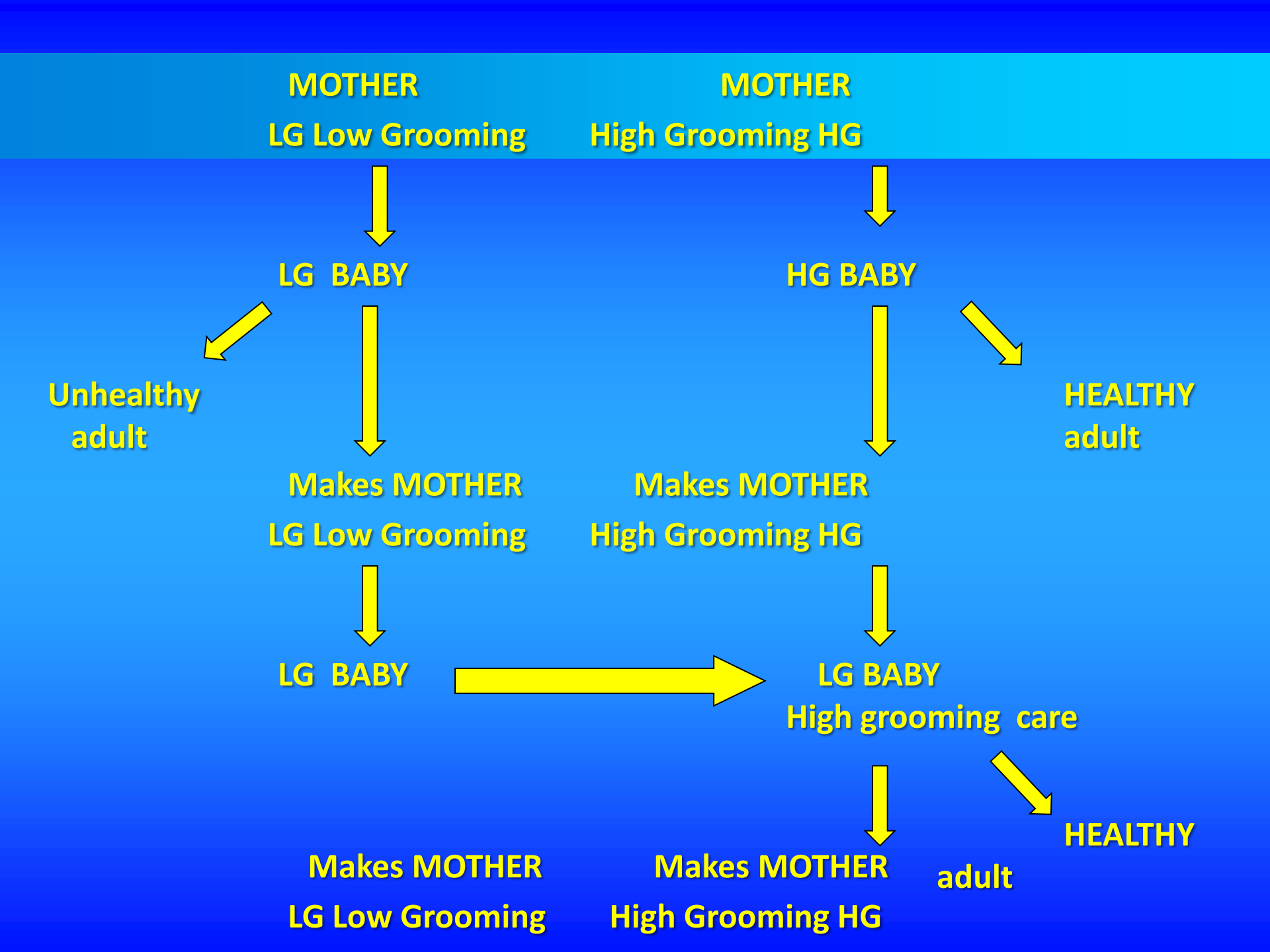
MICHAEL MEANEY

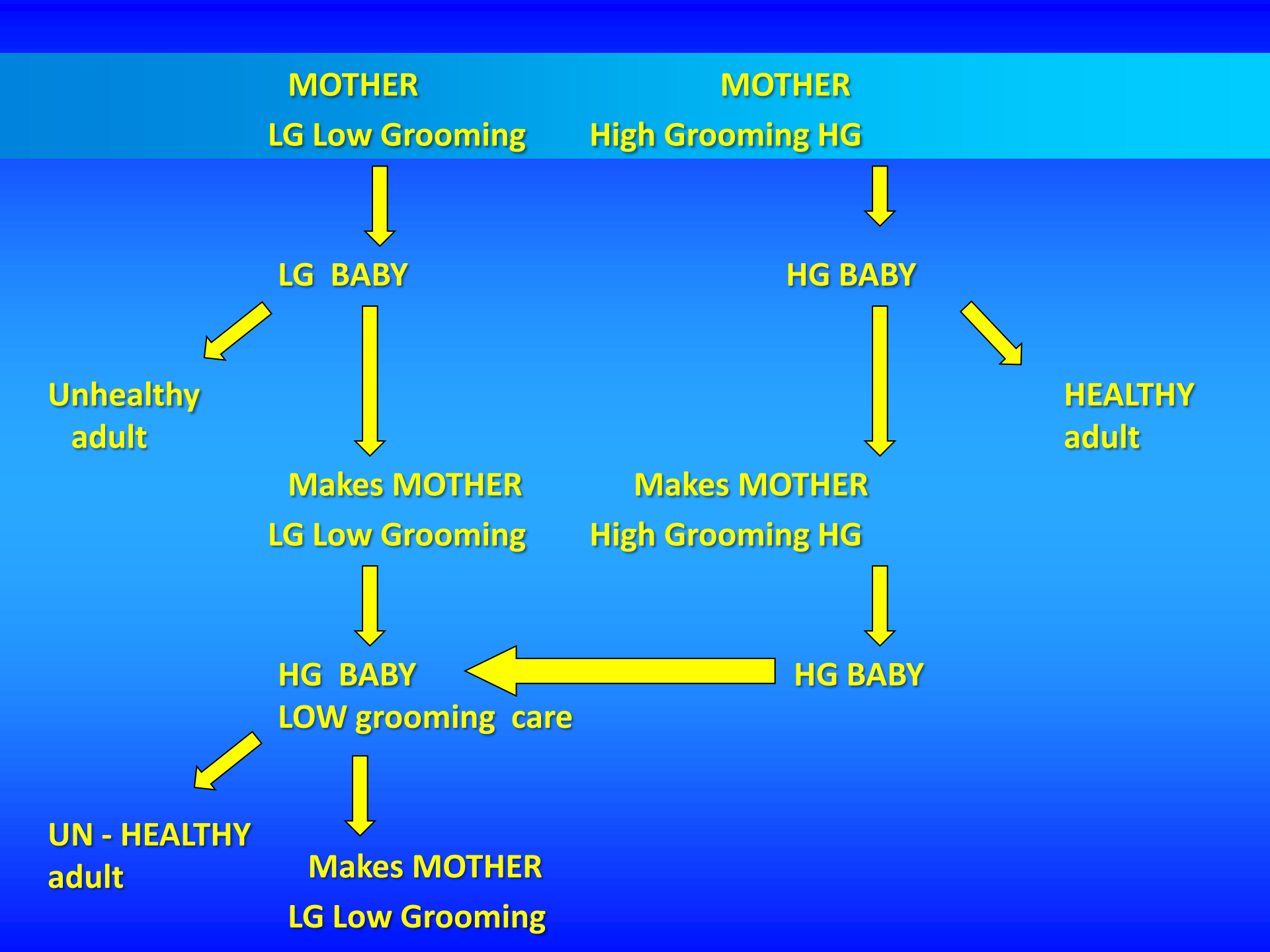
"In response to stress, CRF … and vasopressin are released … anterior pituitary … synthesis release ACTH …glucocorticoids → "

Unsafe environment activates HPA axis (autonomic nervous system, ANS).

MICHAEL MEANEY epigenetics

Early stress alters gene expression, with health impact across lifespan.


MOTHER
LG Low Grooming
MOTHER
High Grooming HG
LG BABY
HG BABY
Unhealthy adult
HEALTHY adult
Makes MOTHER
LG Low Grooming
Makes MOTHER
High Grooming HG
LG BABY
LG BABY
High grooming care
HEALTHY adult
Makes MOTHER
LG Low Grooming
Makes MOTHER
High Grooming HG


MOTHER
LG Low Grooming
MOTHER
High Grooming HG
LG BABY
HG BABY
Unhealthy adult
HEALTHY adult
Makes MOTHER
LG Low Grooming
Makes MOTHER
High Grooming HG
HG BABY
LOW grooming care
HG BABY
UN - HEALTHY adult
Makes MOTHER
LG Low Grooming

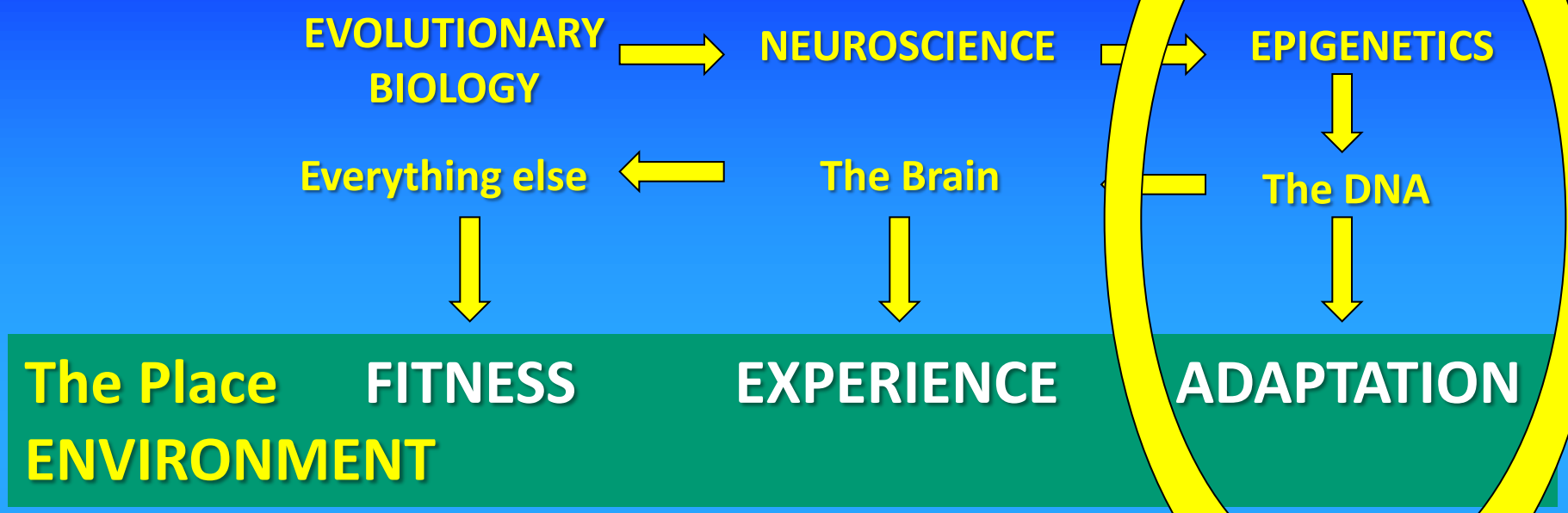
Earliest care at birth matters

Same gene → switched

The Place	FITNESS	EXPERIENCE	ADAPTATION
ENVIRONMENT			

"BIRTH" - earliest environment

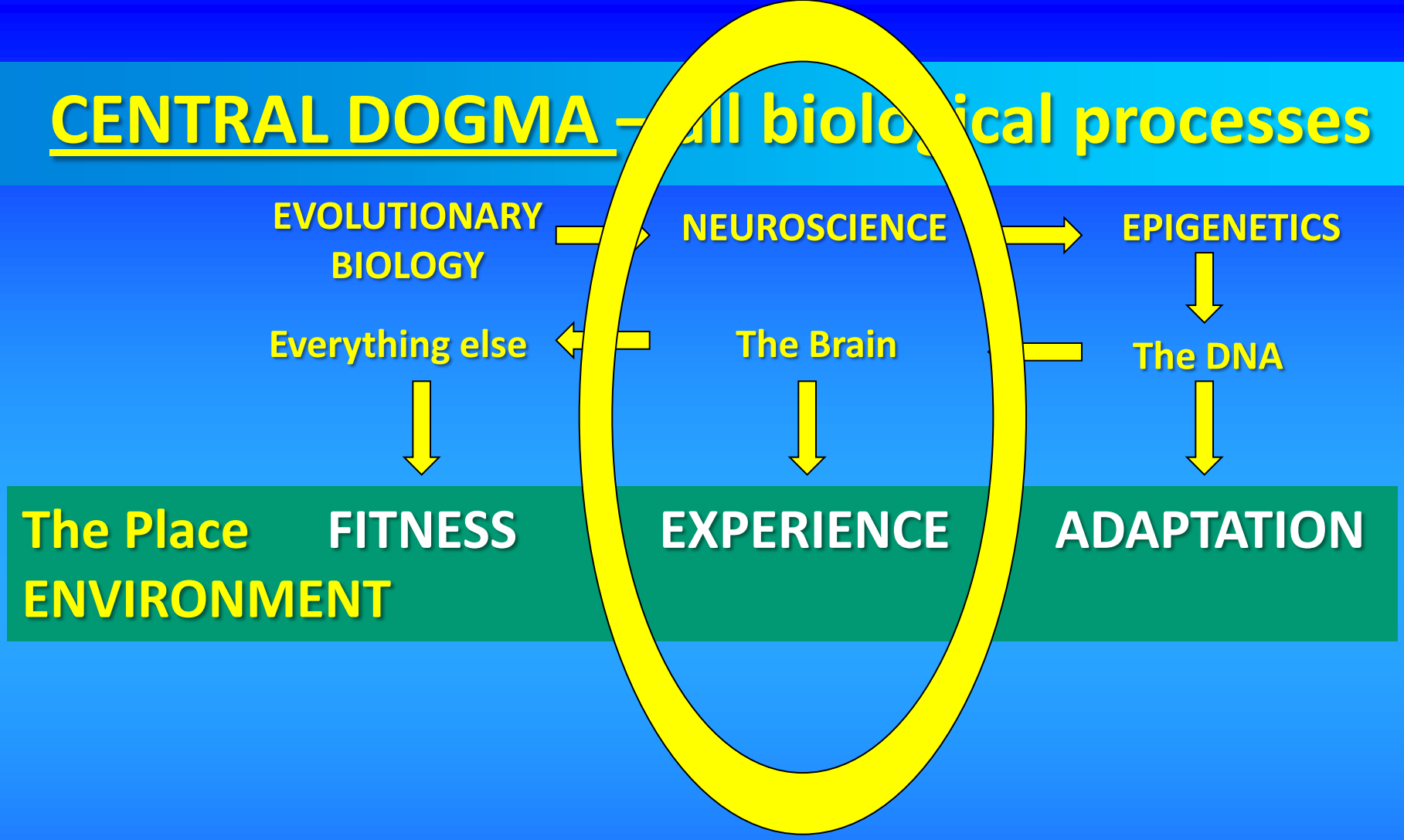
"Scientific foundation" … a synthesis



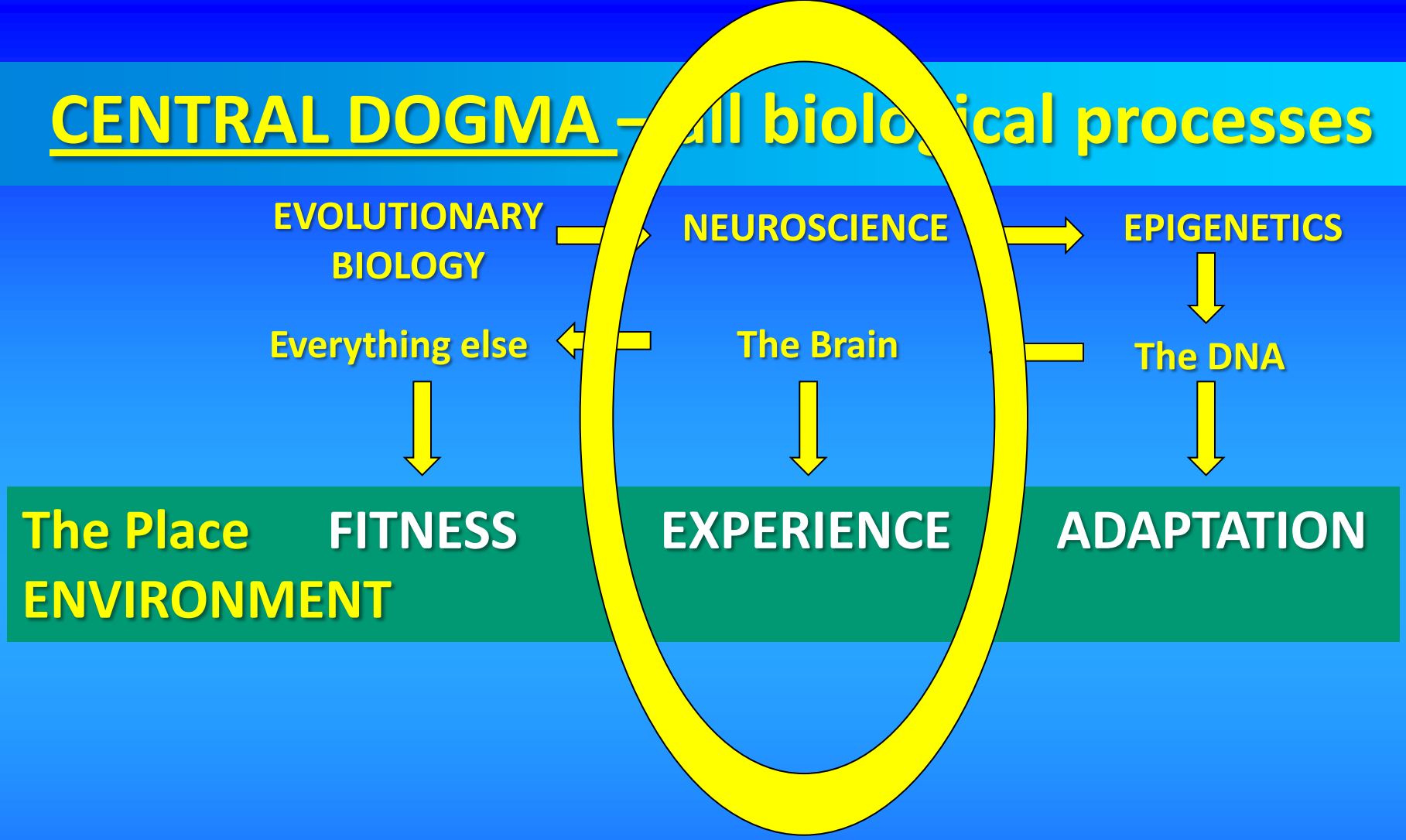
"BIRTH" – earliest environment

Grow Your Baby's Brain: the latest neuroscience

CENTRAL DOGMA – all biological processes



Skin-to-skin = key that unlocks the neuroscience !



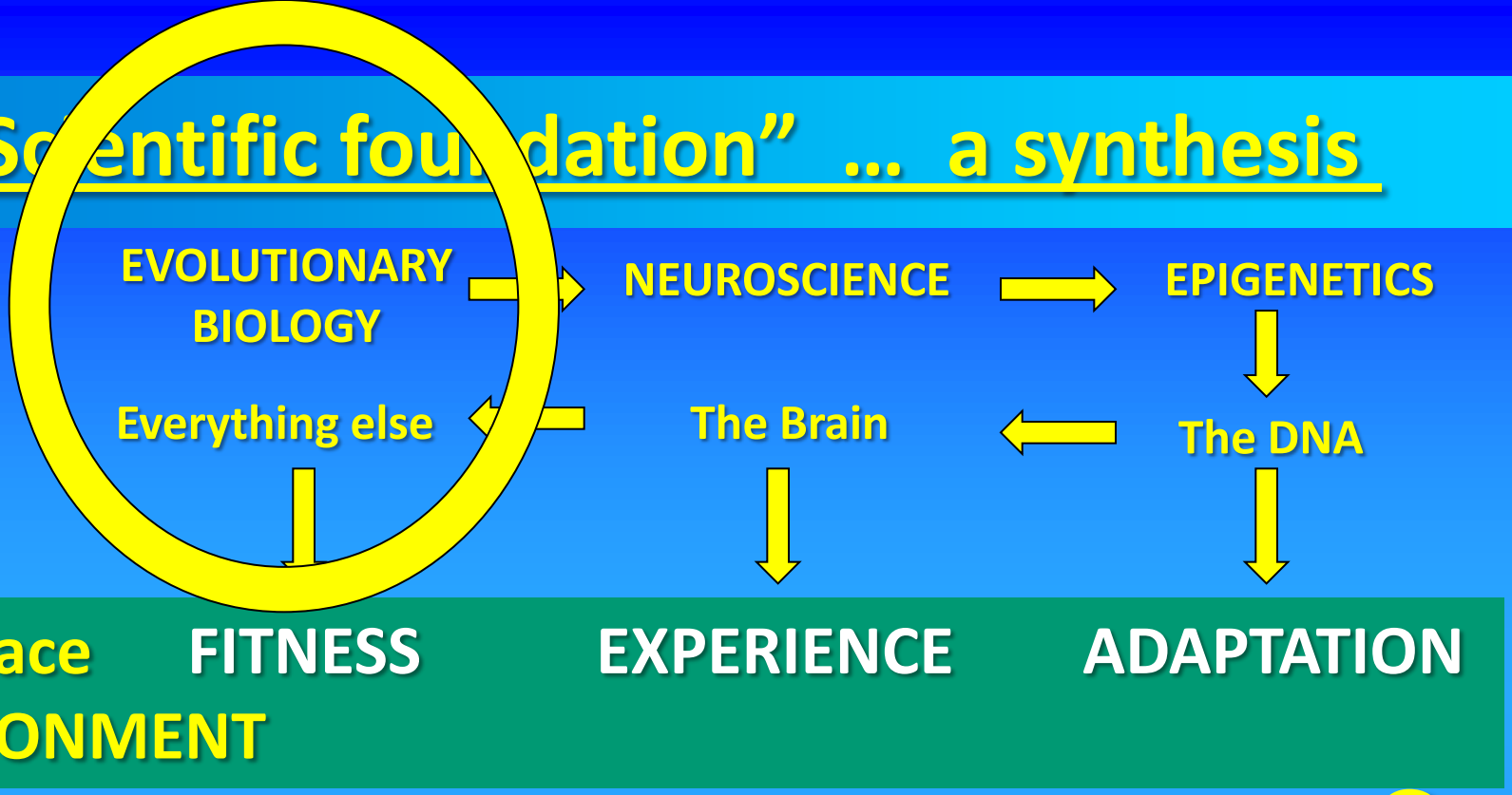
Grow Your Baby's Brain: the latest neuroscience

"For species such as primates, the mother IS the environment."

Sarah Blaffer Hrdy, Mother Nature (1999)

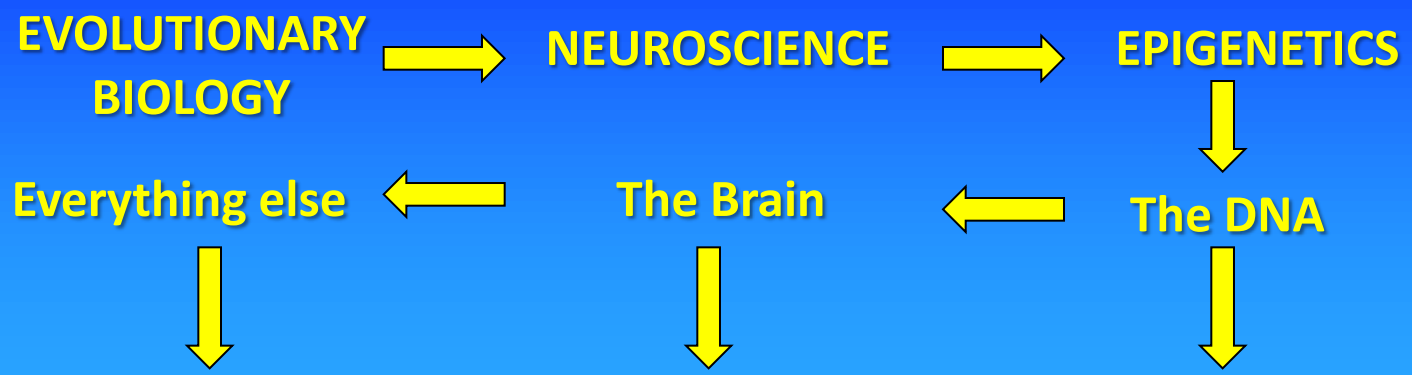
Nothing an infant can or cannot do makes sense, except in light of mother's body

"Scientific foundation" … a synthesis



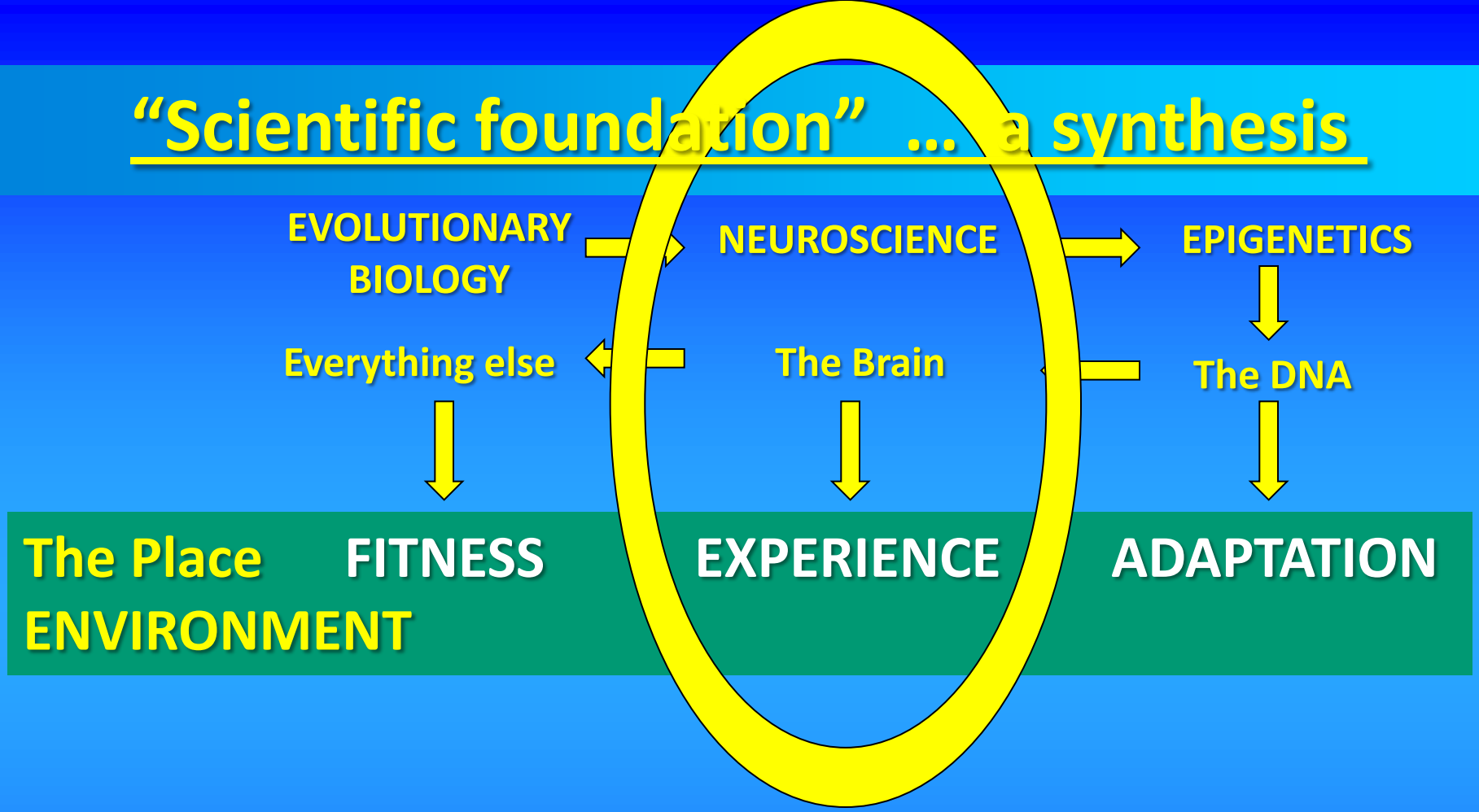
"except in the light of mother's body."

"Scientific foundation" … a synthesis



For the human newborn – this place / environment is Skin-to-skin contact

"Scientific foundation" … a synthesis



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

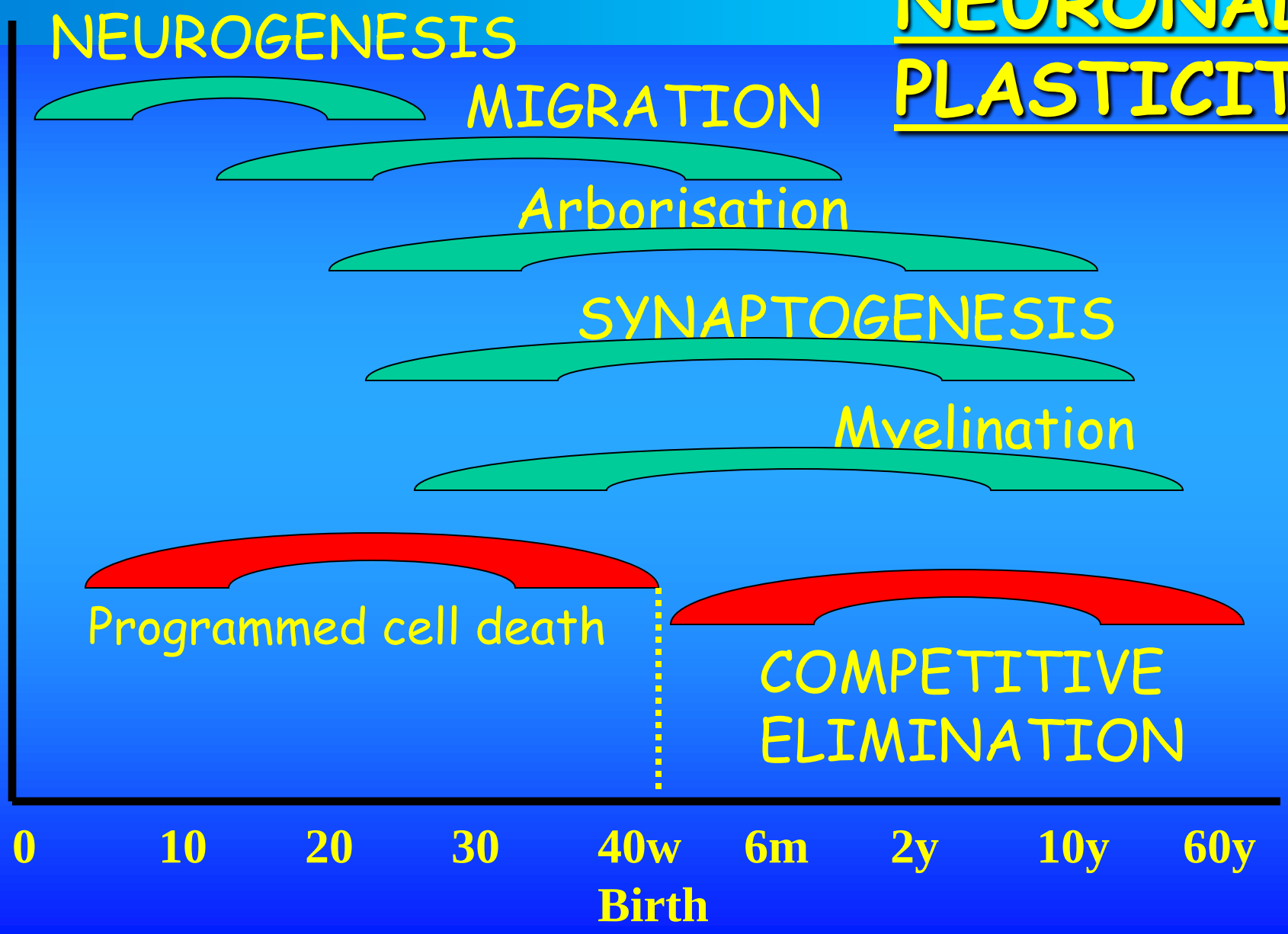
particularly important

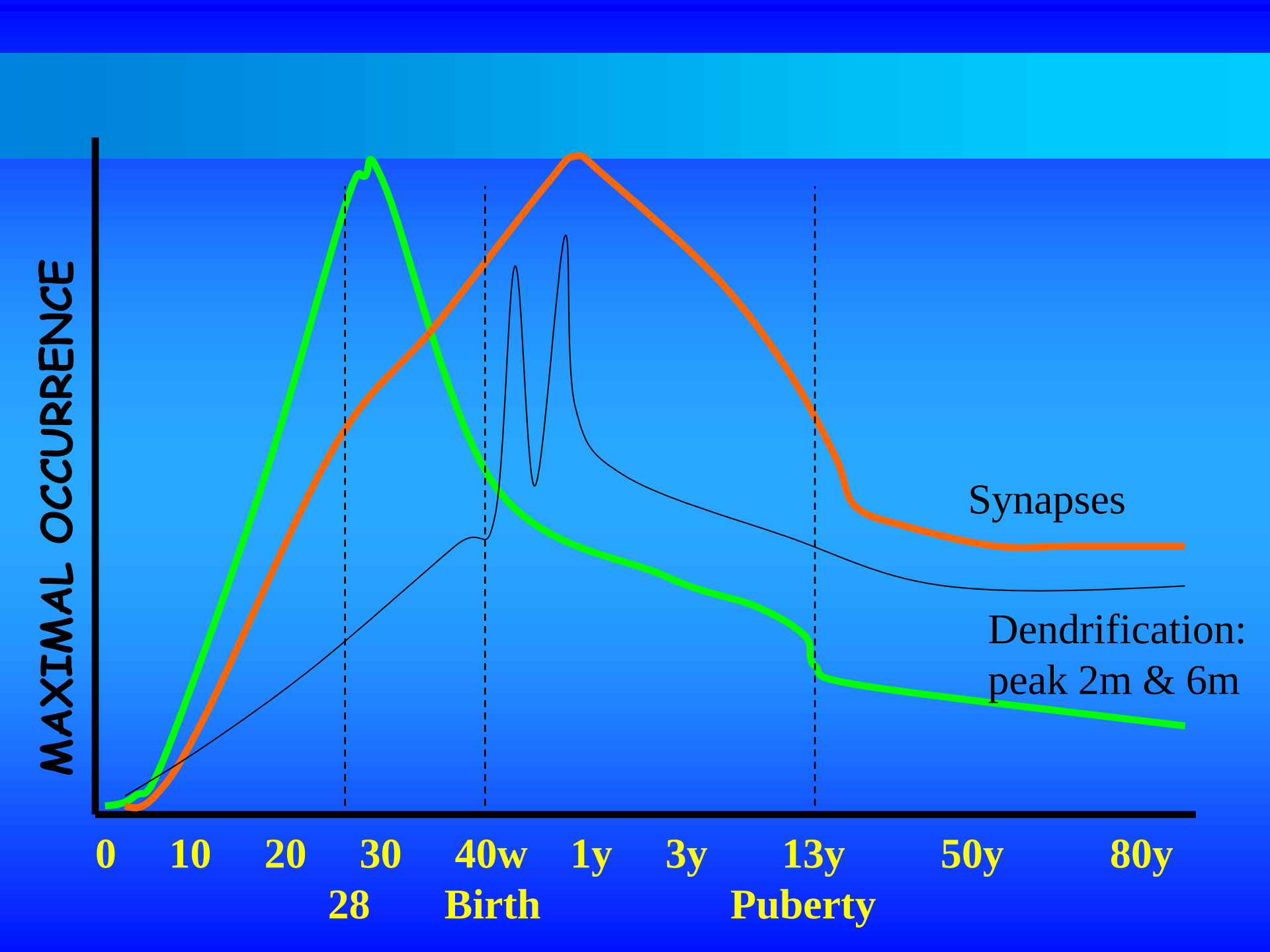
to the developing organism

... spontaneous synchronous firing

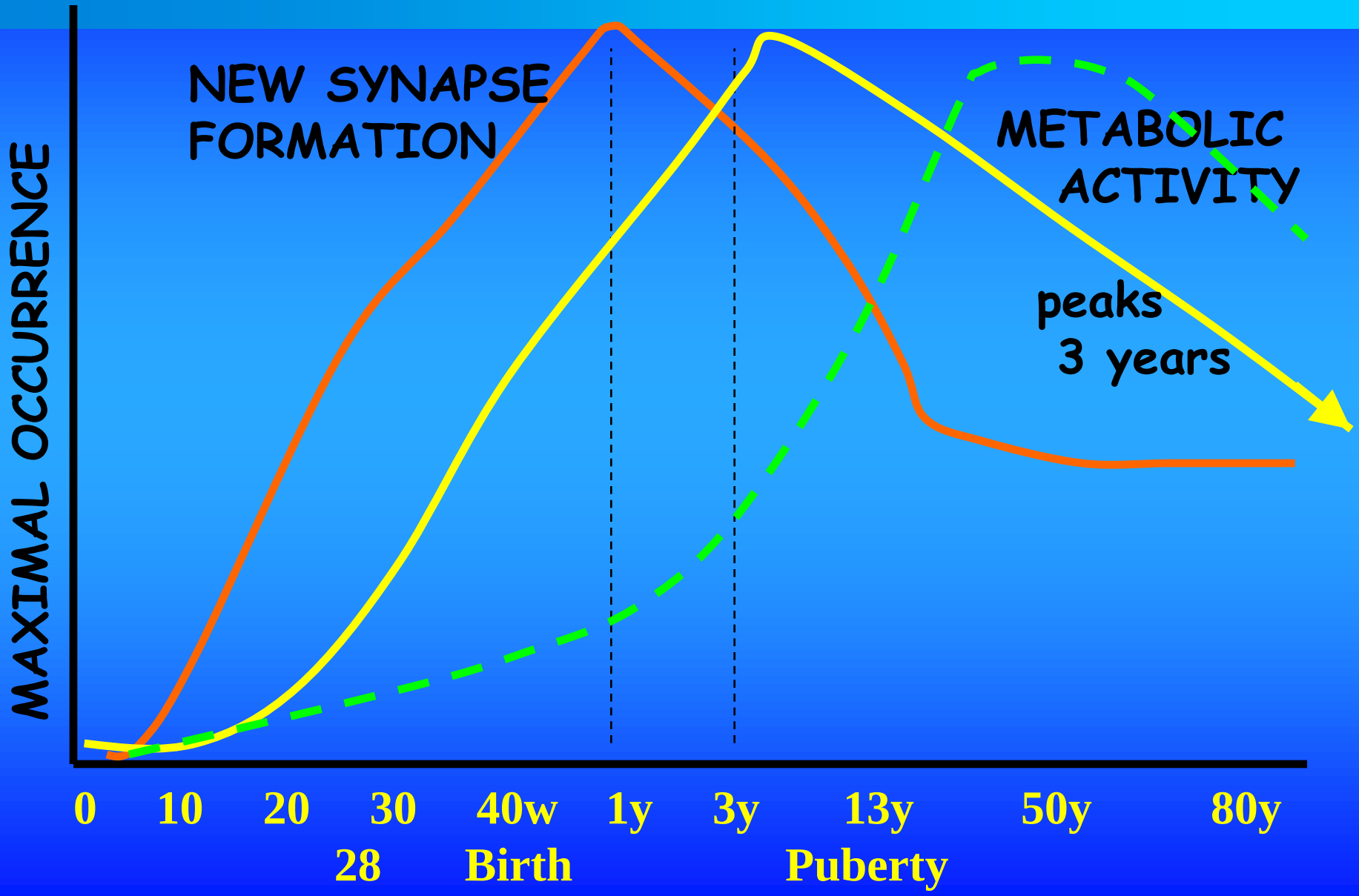
Marks et al 1995

NEURONAL PLASTICITY




MAXIMAL OCCURRENCE
Synapses
Dendrification:
peak 2m & 6m
0
10
20
30
40w
1y
3y
13y
50y
80y
28
Birth
Puberty

RELATIVE BRAIN ACTIVITY



NEURO PHYSIOLOGY

NEURO DEVELOPMENT

NEURO BEHAVIOUR

Gestational age 20w
all structures completed

NEURO PHYSIOLOGY

NEURO DEVELOPMENT

NEURO BEHAVIOUR

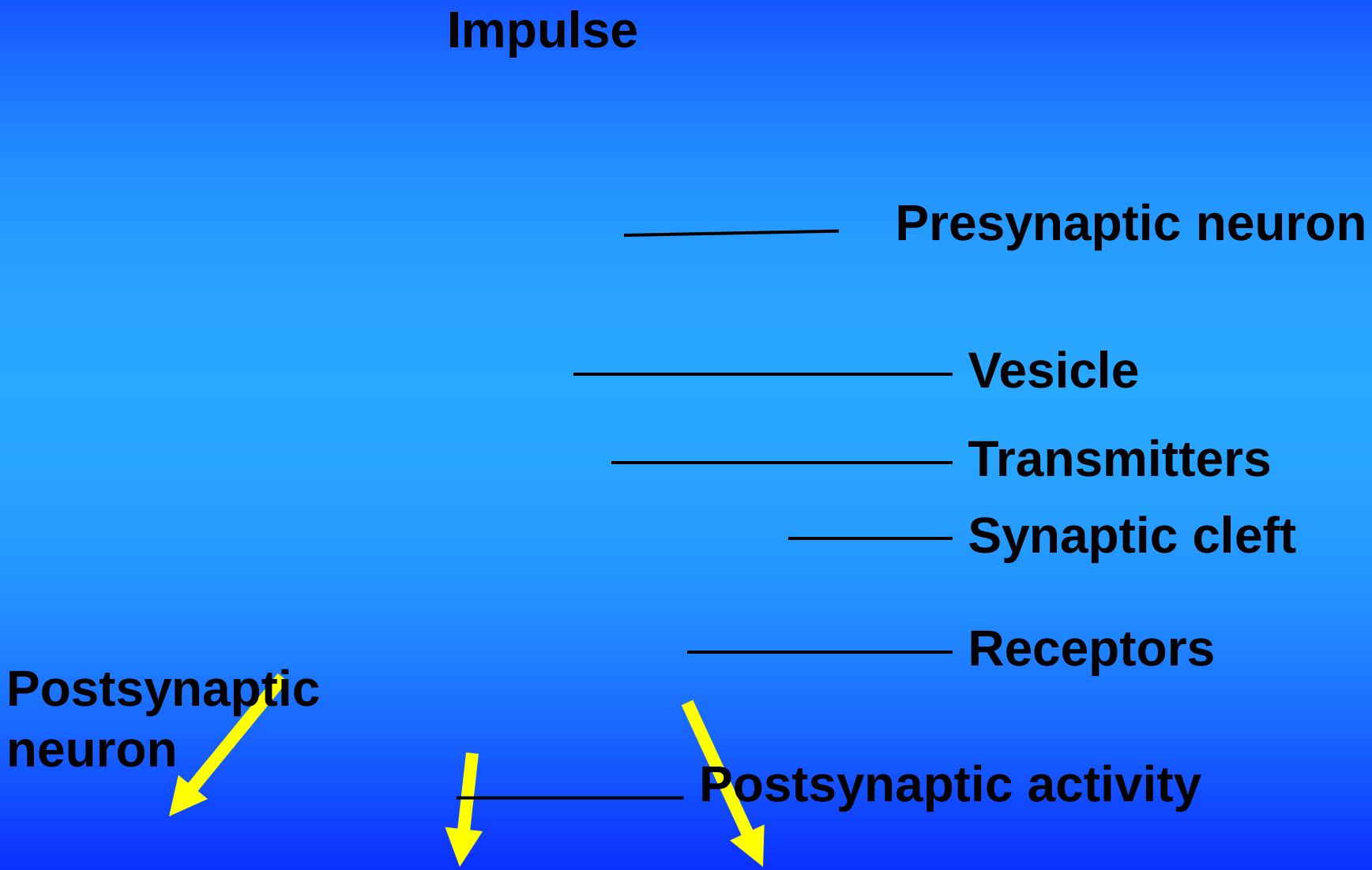
EARLY DEVELOPMENT

Gestational age
20w all structures completed

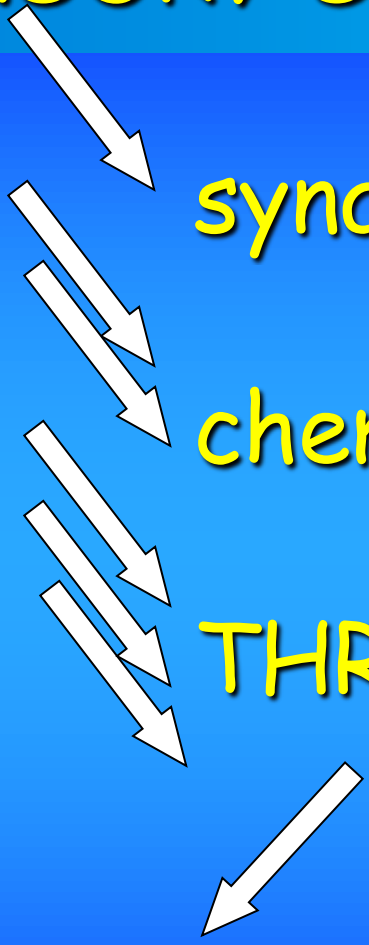
parallel development
of structure & function

(Hugo Lagercrantz 2004)

Brain growth
depends on experiences !!


Impulse
Presynaptic neuron
Vesicle
Transmitters
Synaptic cleft
Receptors
Postsynaptic neuron
Postsynaptic activity

SENSORY STIMULUS



synapse store chemical signal

chemical signal stronger

THRESHOLD →
EXEMPT from elimination
(synapse stabilised)

PATHWAY

(Rima Shore 1997)

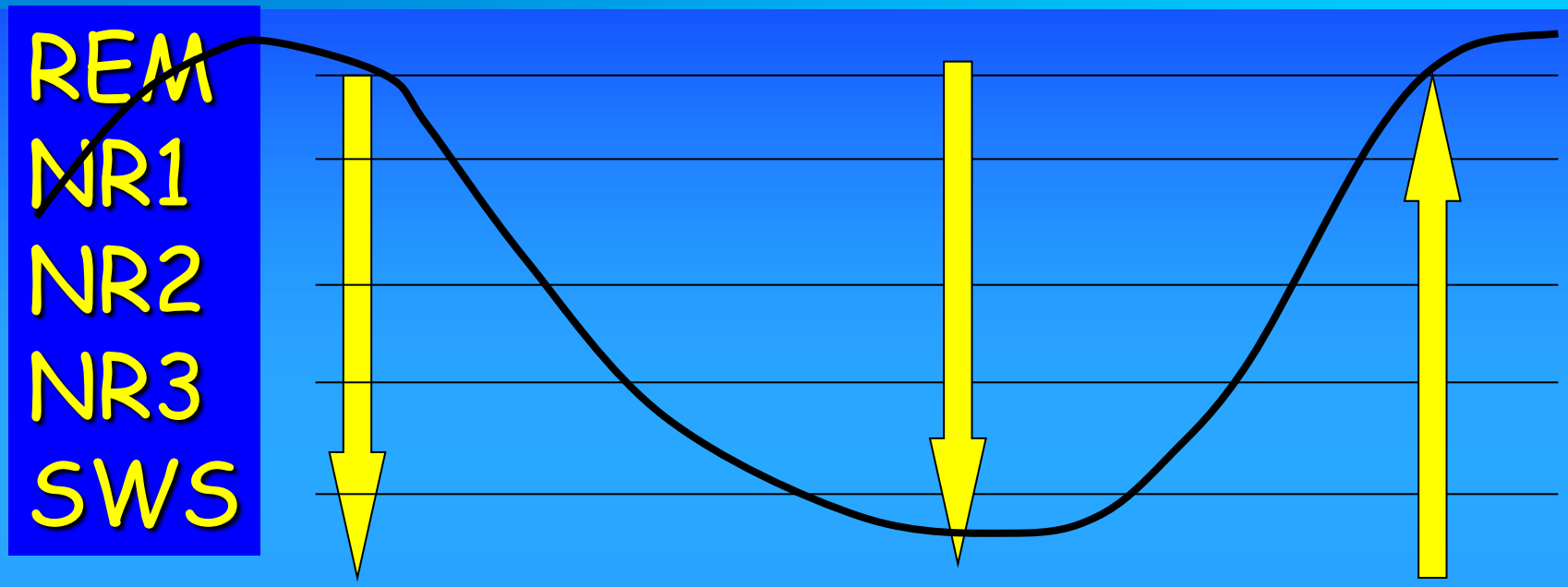
fetal REM sleep

(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

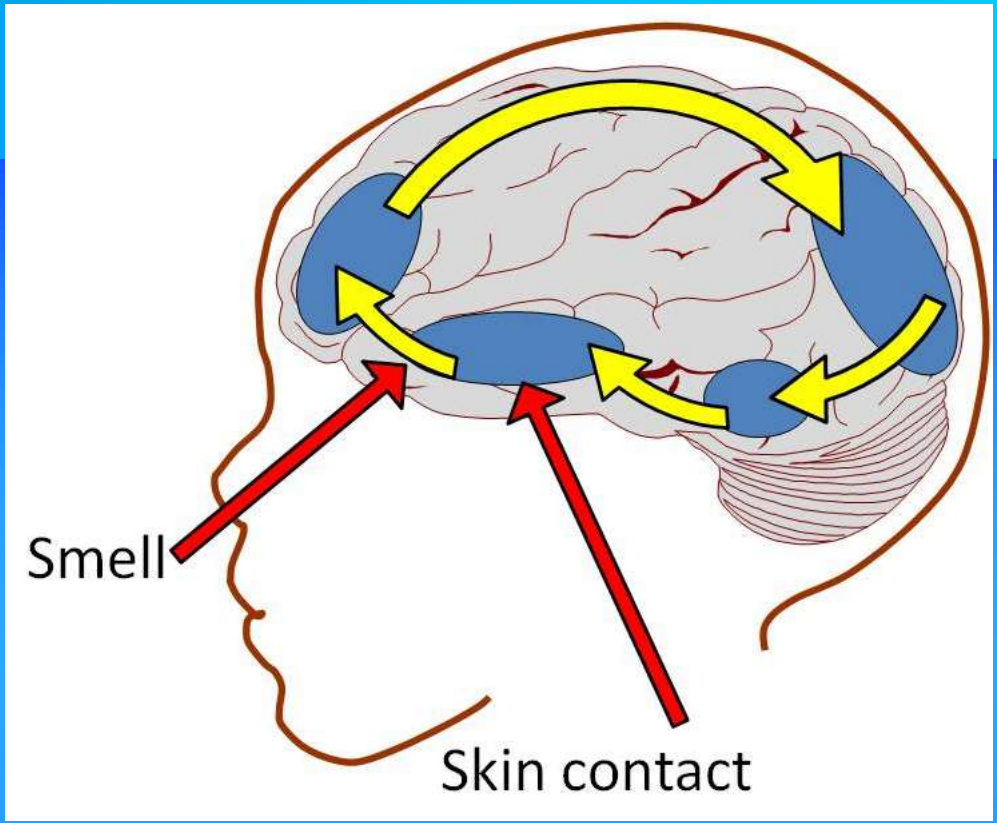
transfer information
"SNR" strong signals
amygdala /
hippocampus
NREM stage 4

MEMORY FORMATION

P waves
returns info
to neocortex:
organized
REM

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

Schaal 2004

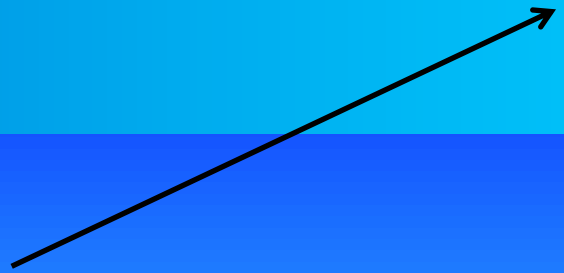
DOUCET

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

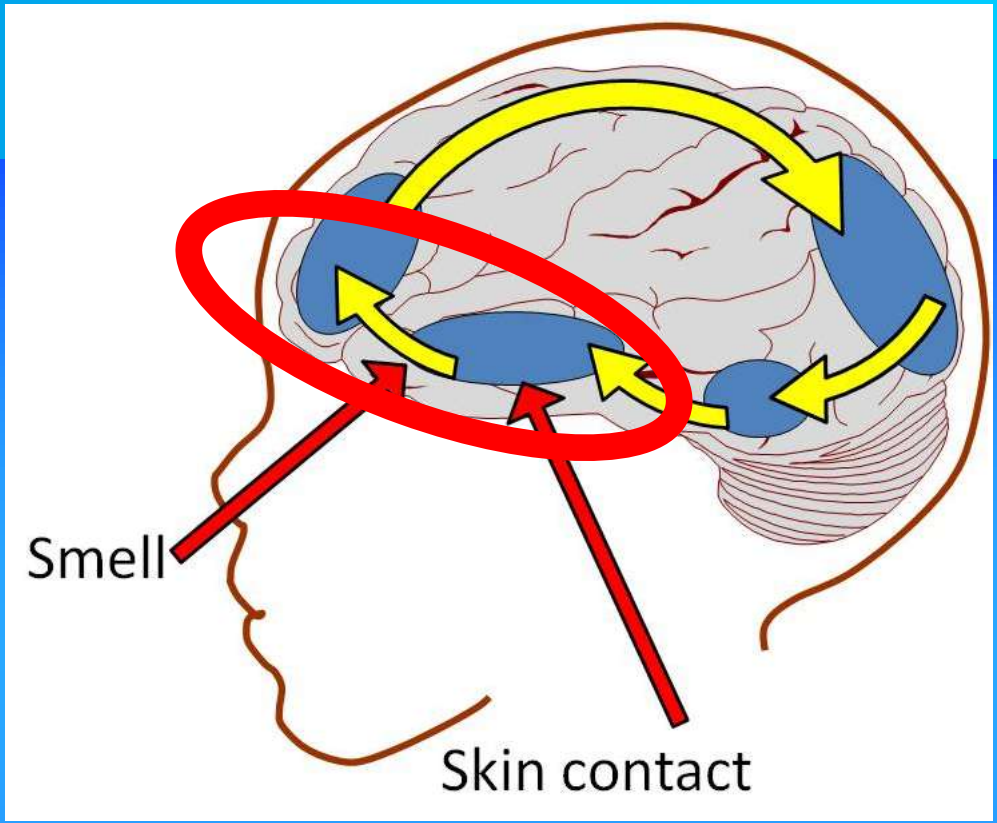


"In early ontogeny the sleeping brain may thus remain sentient of an organism's odor environment."

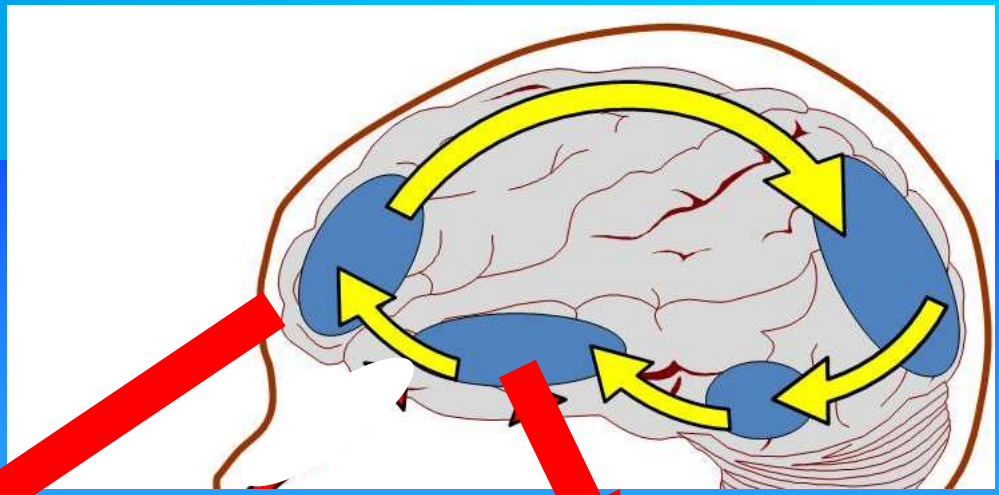
Doucet 2009

THE NEWBORN BRAIN

SKIN-TO-SKIN CONTACT fires and wires



the amygdala-prefronto-orbital cortical pathway **(PFOC)**

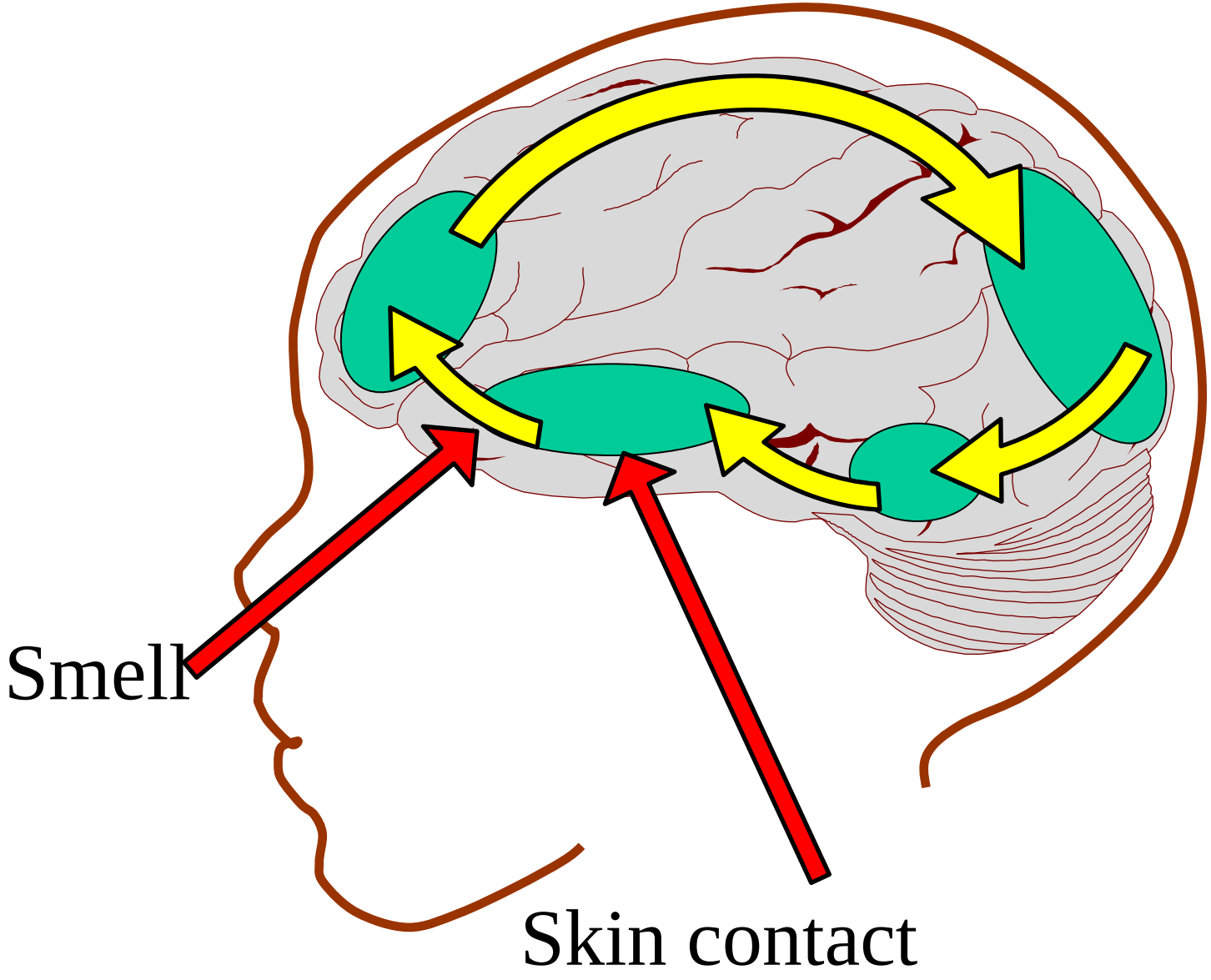


Prefrontal cortex
Executive function

AMYGDALA:
Emotional Processing Unit

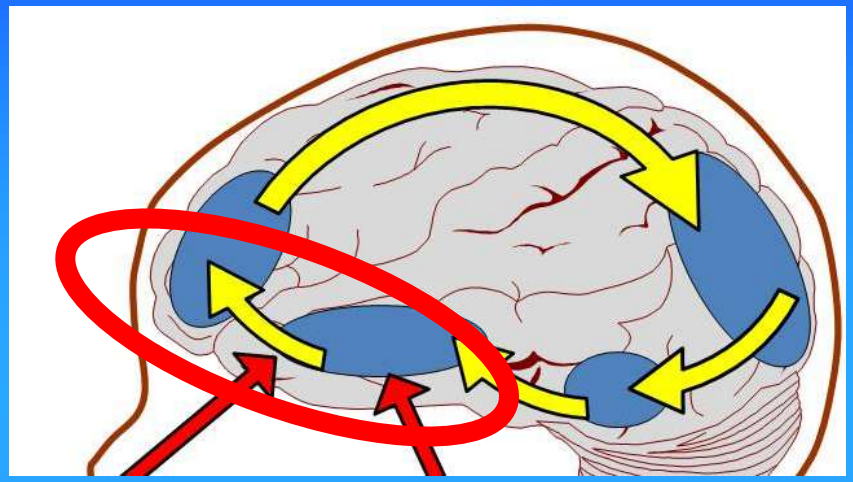
CPU

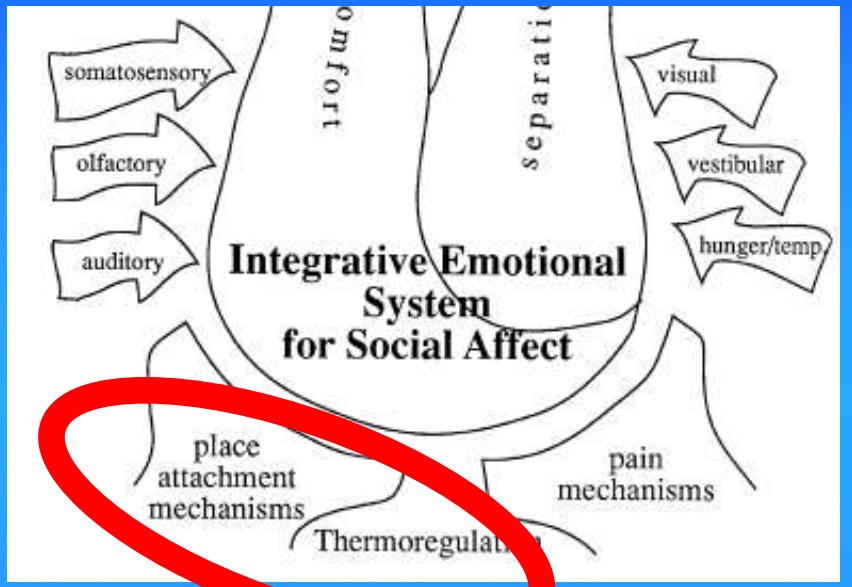
SOCIAL and EMOTIONAL INTELLIGENCE


Smell
Skin contact

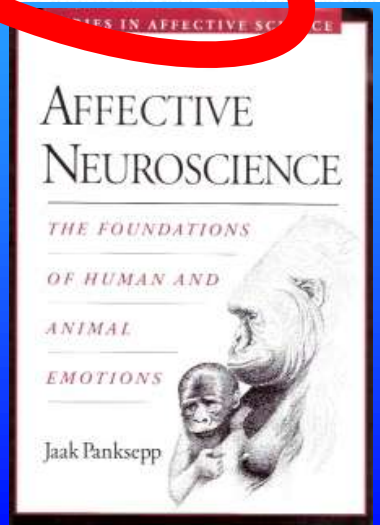
SOCIAL INTELLIGENCE

EMOTIONAL INTELLIGENCE





Behavioural activation system reward-based (dopamine)



Psychobiological Roots of Early Attachment

Myron A. Hofer

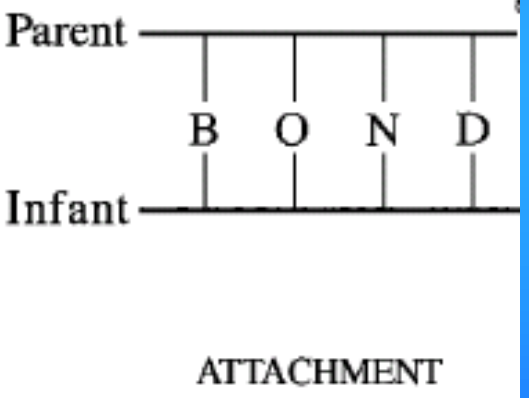
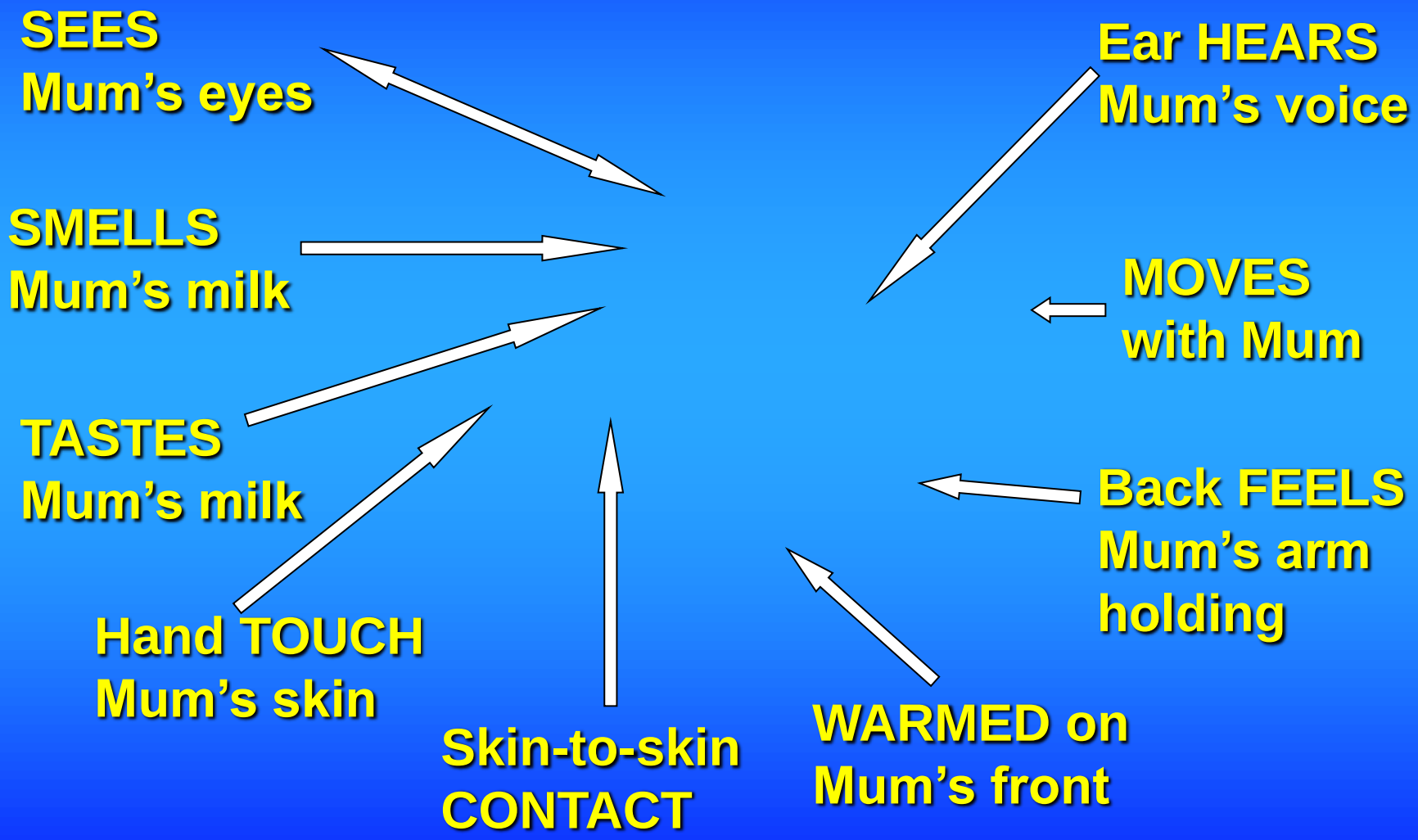


Fig. 1. Schematic repres
responses based on the c
John Bowlby (Bowlby, 19

SENSATIONS THAT WIRE BRAIN



Slide from JILL BERGMAN

a kind of invisible hothouse

Through
"hidden maternal regulators" …
" physiological set points "

… through several pathways at once …

Psychobiological Roots of Early Attachment

Myron A. Hofer

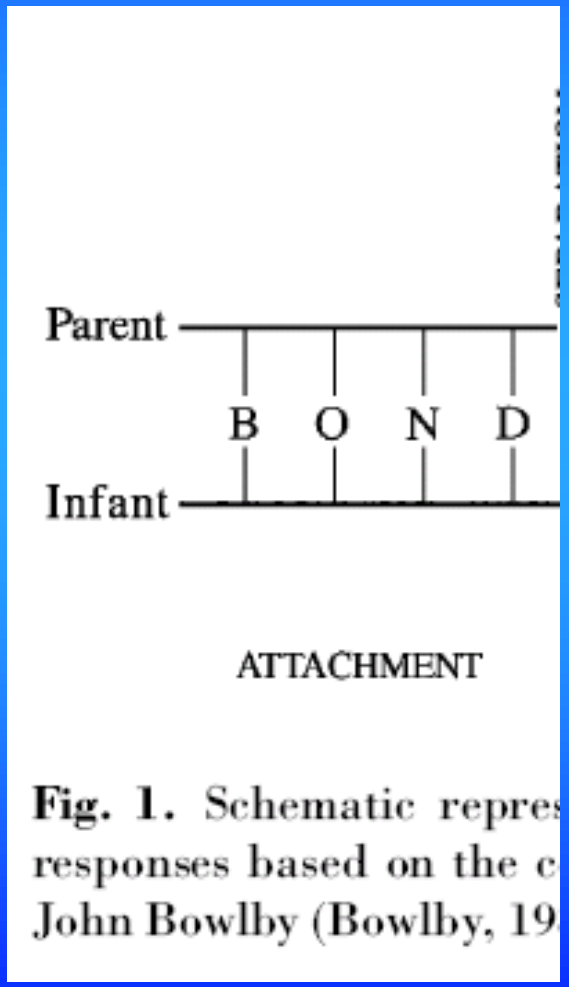


Fig. 1. Schematic repres
responses based on the c
John Bowlby (Bowlby, 19

REGULATION

The BOND
is made up of the
sensory inputs
from the parent
to the infant

Bowlby 1969, 1973, 1980

SEPARATION →

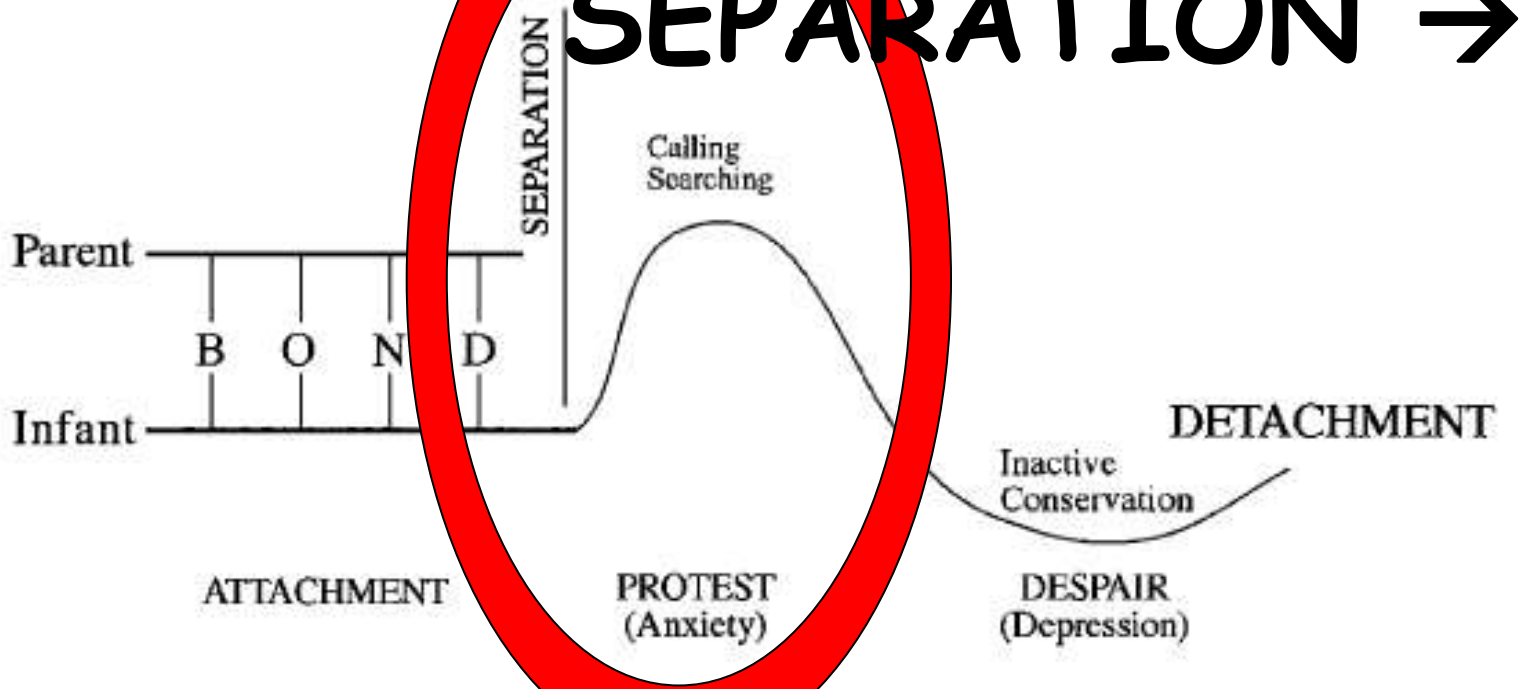


Fig. 1. Schematic represent[illegible] the dynamics of early-separation responses based on the concept of an attachment bond as described by John Bowlby (Bowlby, 1982).

WHY IS EARLY MATERNAL SEPARATION STRESSFUL?

SEPARATION DYSREGULATES

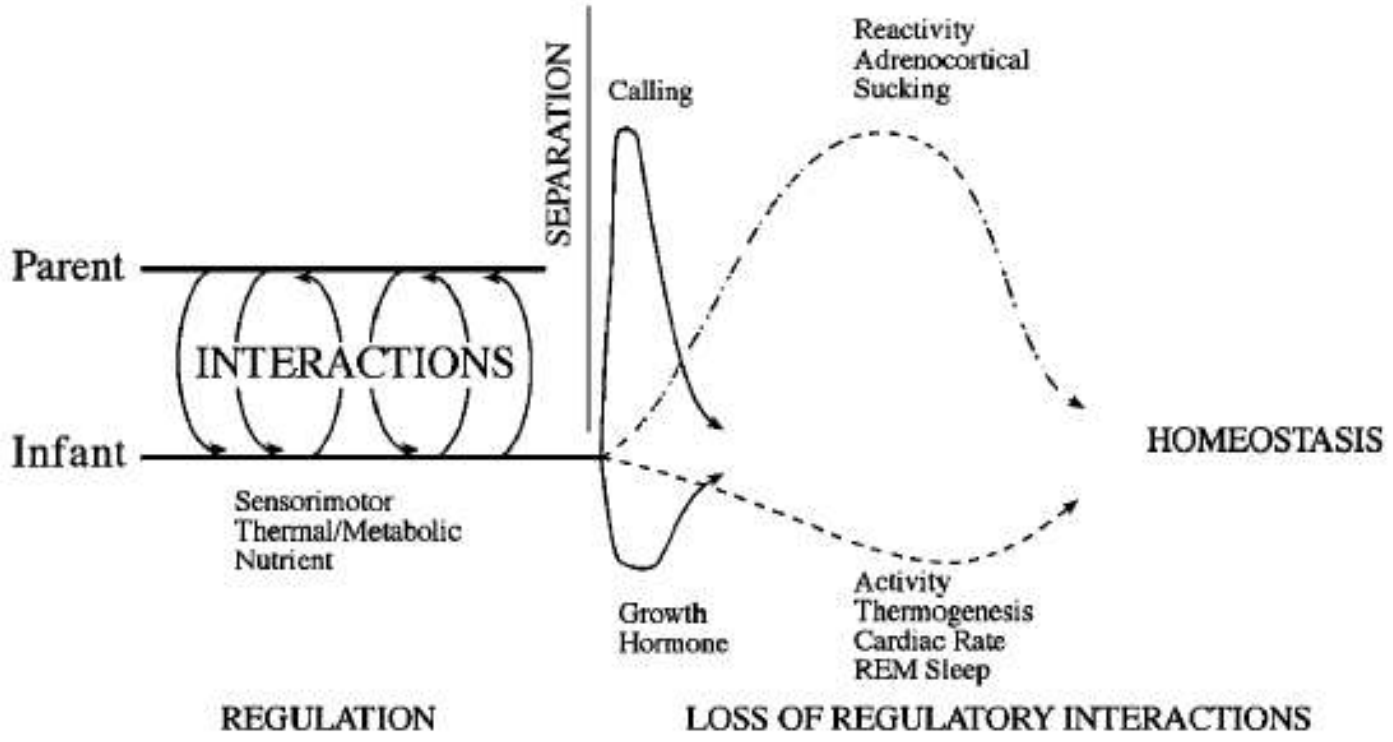
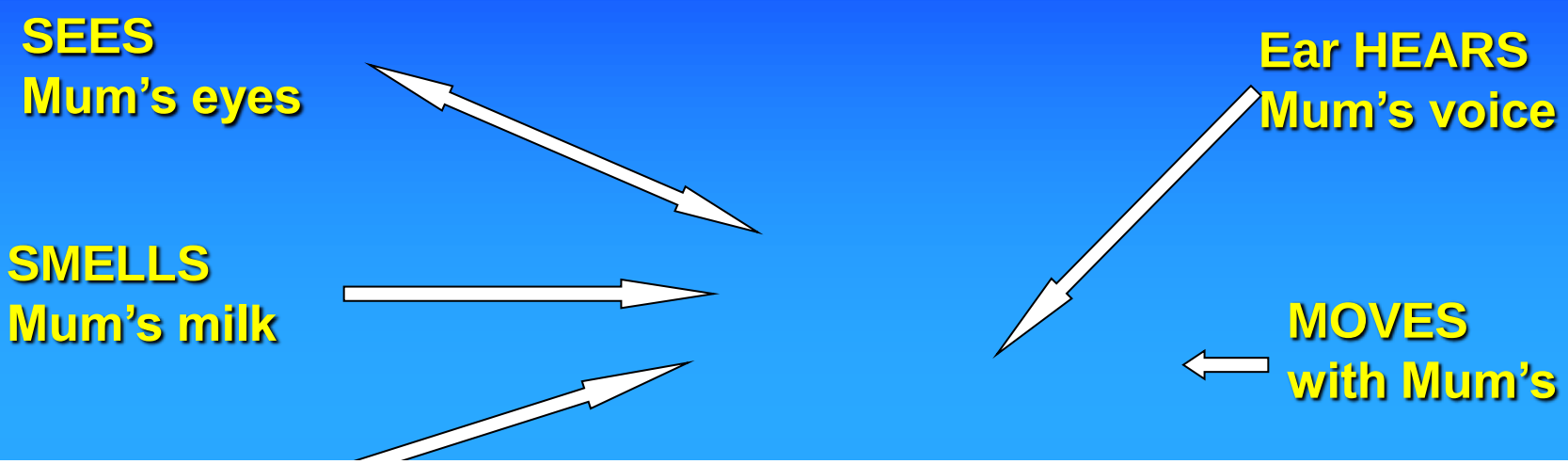


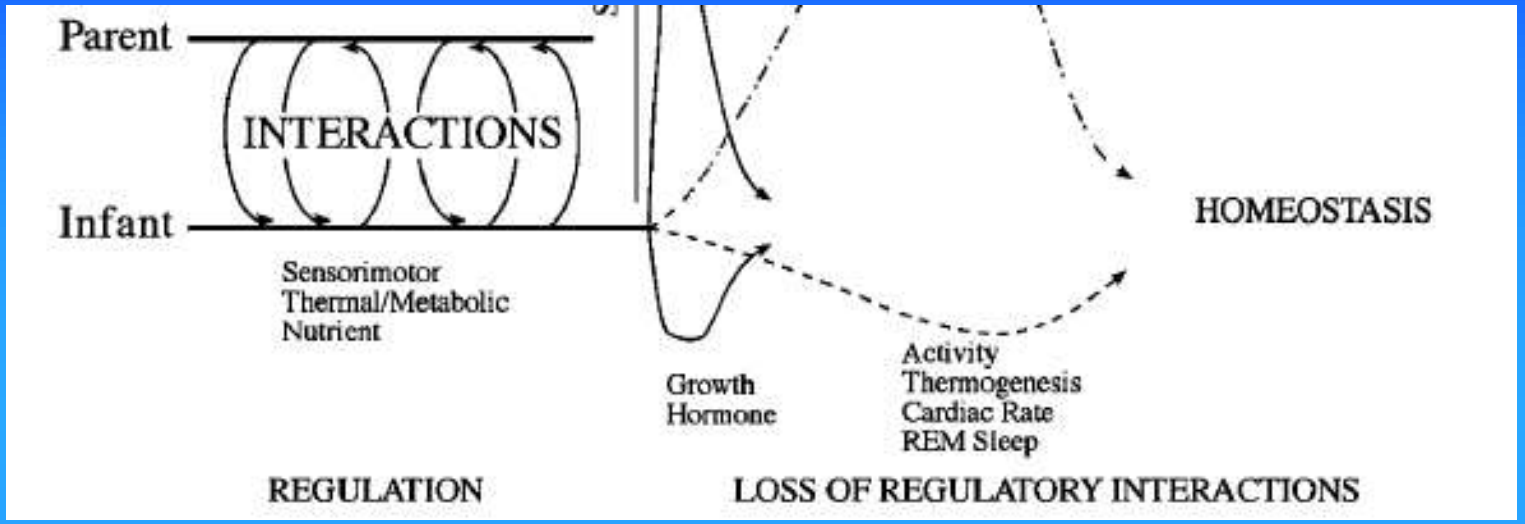
Fig. 2. Schematic representation of the dynamics of early-separation responses resulting from the loss of regulatory interactions within the mother–infant relationship.



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)

Skin-to-skin
CONTACT

WARMED on
Mum's front



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)

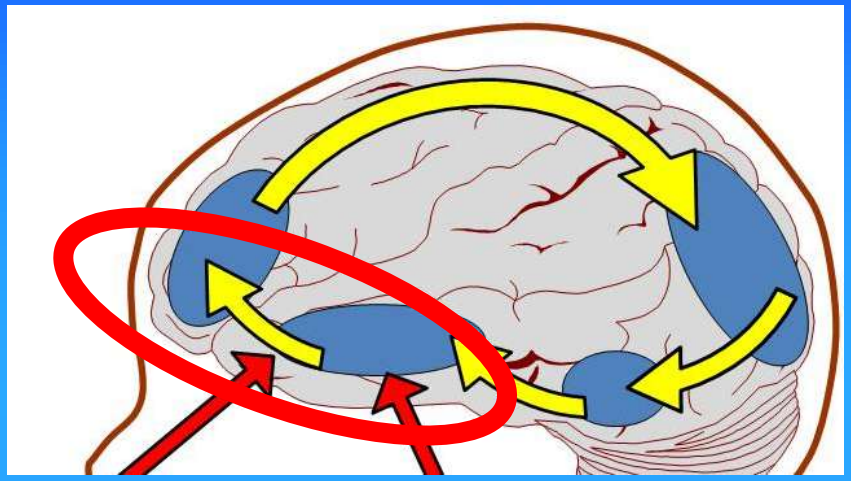
PROTEST – DESPAIR

is accompanied by

DYSREGULATION

SOCIAL INTELLIGENCE

EMOTIONAL INTELLIGENCE



Behavioural activation system reward-based (dopamine)

As shown in several nonhuman primate and rodent models, early environmental exposures can alter physiological regulator systems in permanent ways. Early life

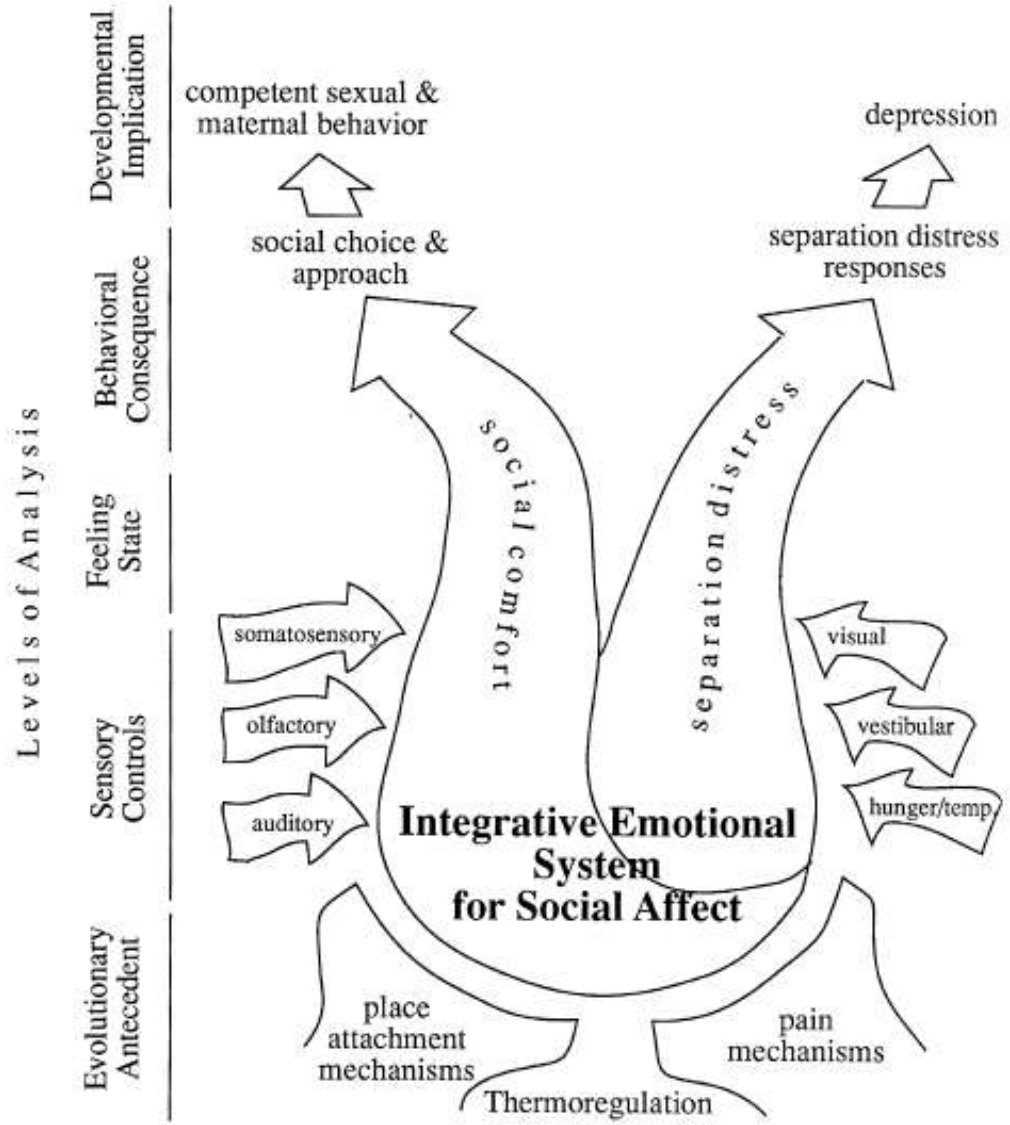


FIG. 1. Schematic depiction of the neurobiological foundations, inputs, and consequences of attachment and affiliative behavior in mammals. Figure reprinted with permission of the New York Academy of Sciences.

Nelson & Panksepp 1998

… highly conserved neuro-endocrine behaviors

"Genome" – genes of species

"Genotype" - genes in specimen

INK

"Phenotype" – specimen resulting from gene – environment interaction

Pencil

BARKER 'thrifty phenotype'

"Fetal programming hypothesis"

Developmental Origins of
Health and Disease
DOHaD

Epigenetic processes operate
in the human fetus, and beyond.

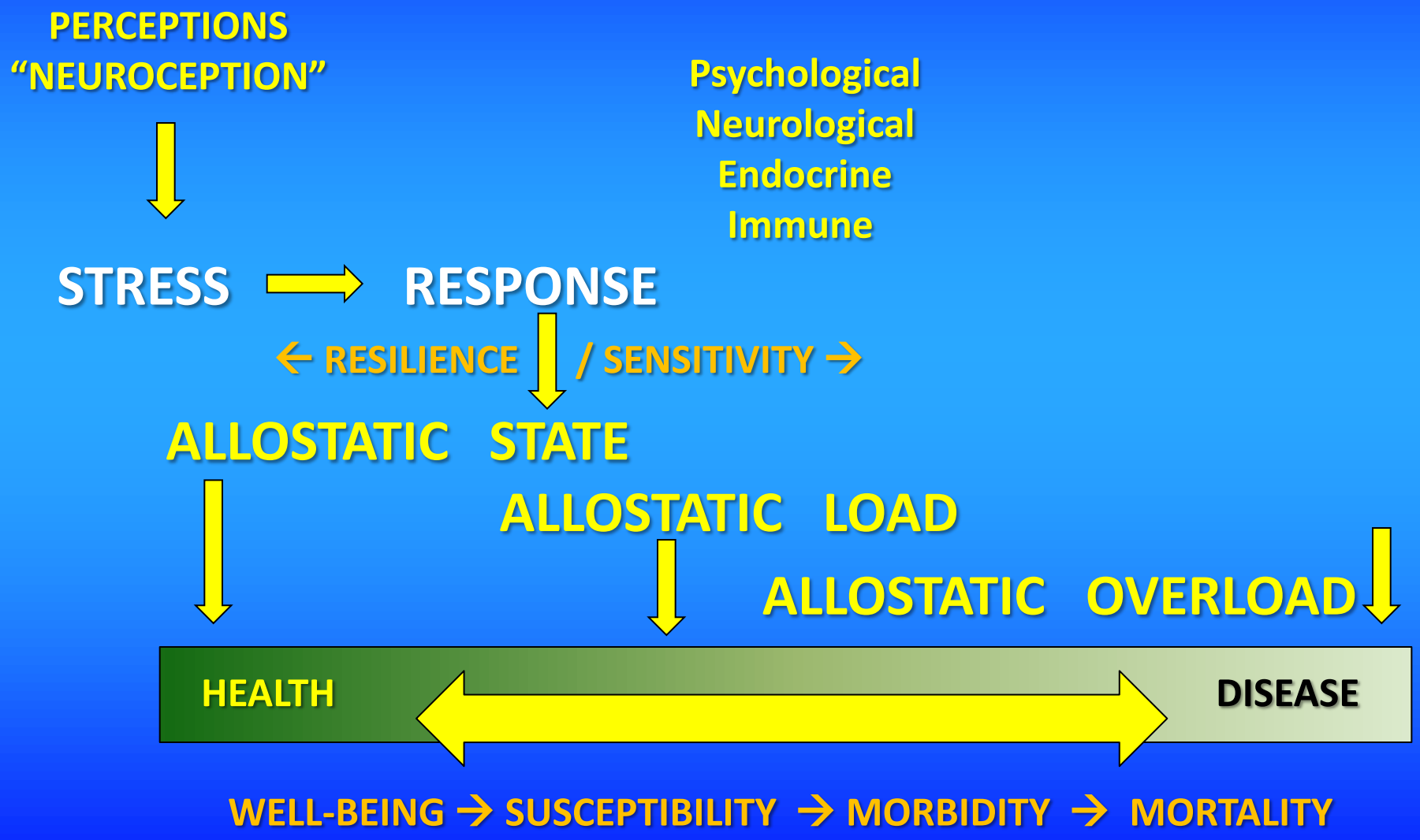
Allostasis the mechanism by which homeostatic systems are maintained in balance …

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

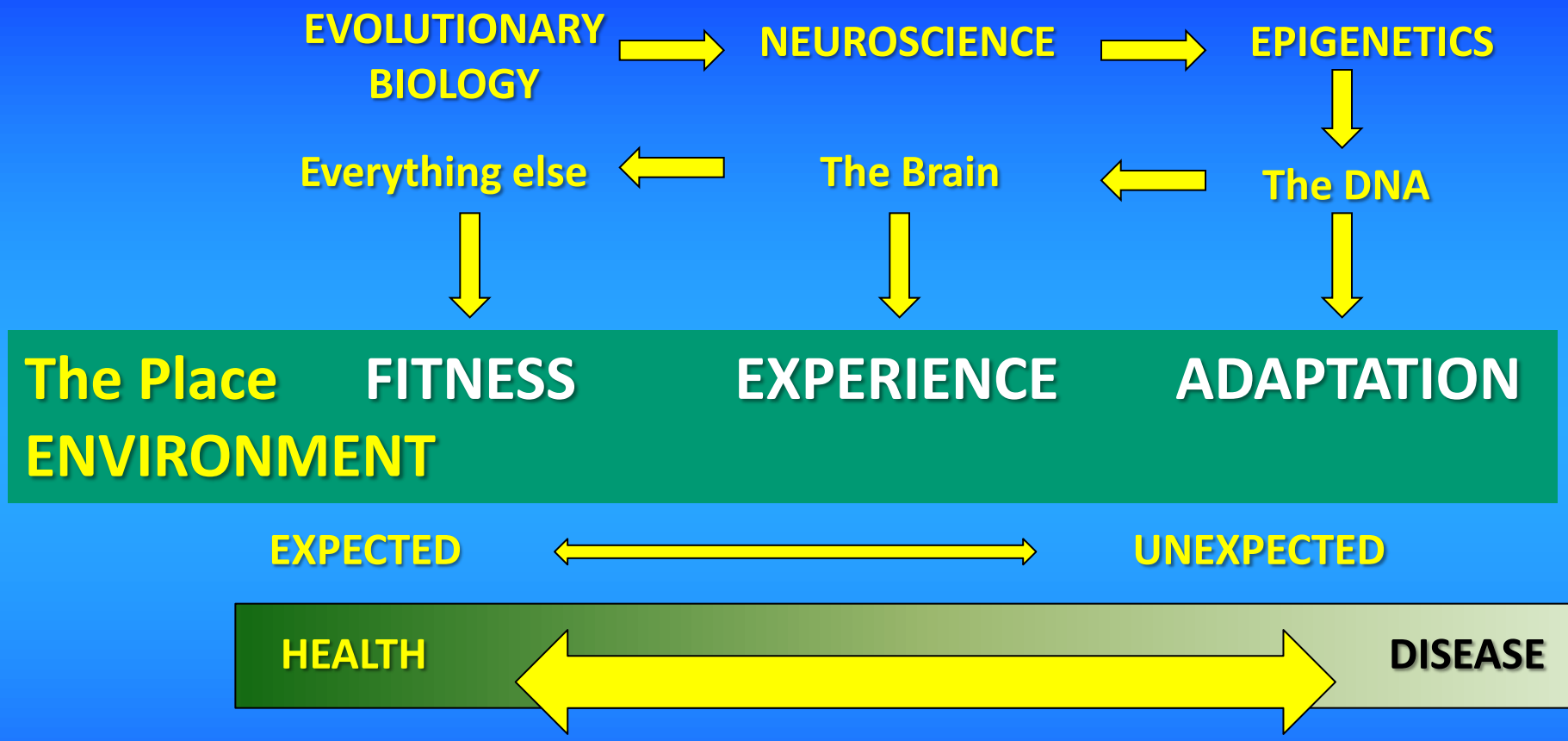
Allostatic load elevated activity – sustained over time, or severe …

→ changes target cells of mediators,
and so changes the "set points" for homeostasis
(e.g. increasing blood pressure,
change in cholesterol level)

ALLOSTASIS


PERCEPTIONS
"NEUROCEPTION"
Psychological
Neurological
Endocrine
Immune
STRESS
RESPONSE
← RESILIENCE / SENSITIVITY →
ALLOSTATIC STATE
ALLOSTATIC LOAD
ALLOSTATIC OVERLOAD
HEALTH
DISEASE
WELL-BEING → SUSCEPTIBILITY → MORBIDITY → MORTALITY

"Scientific foundation" … a synthesis



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

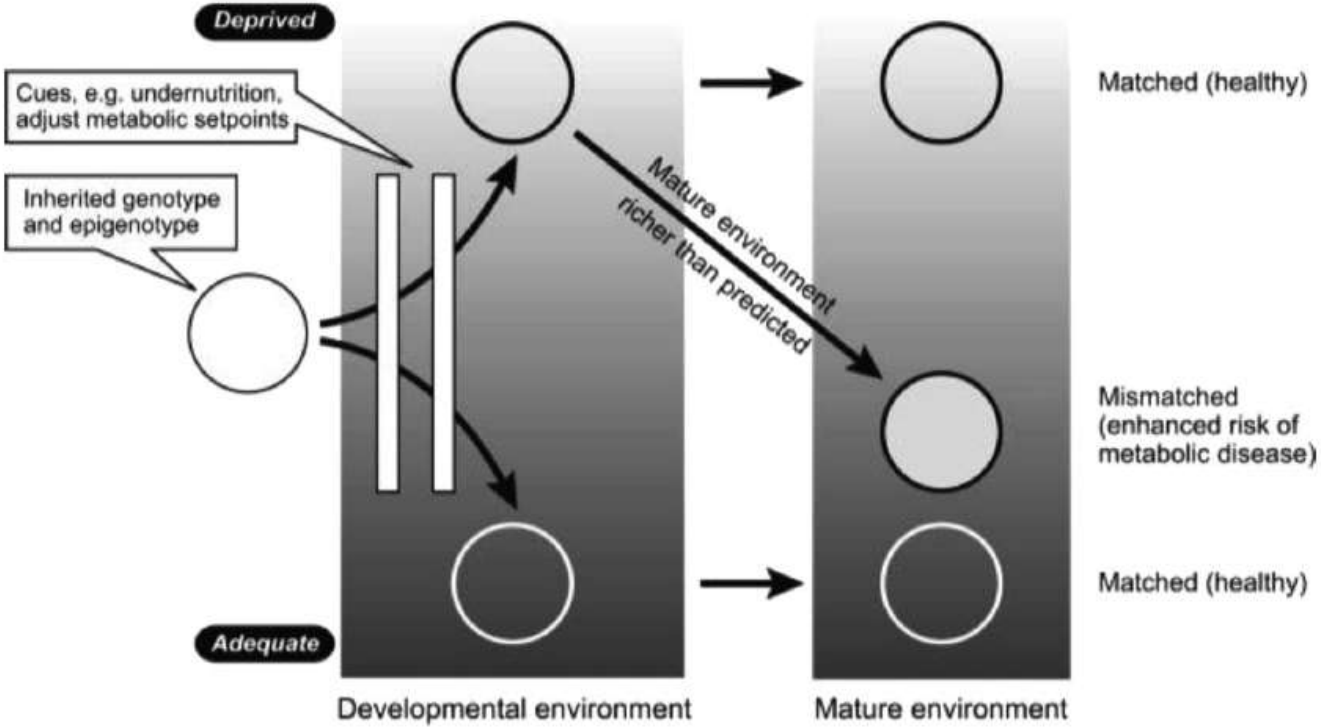


FIG. 2. The match-mismatch paradigm of metabolic disease. The developing organism senses maternally transmitted environmental cues, such as undernutrition, during prenatal and early postnatal life. Developmental plasticity in response to these cues modifies the default trajectory defined by the inherited 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

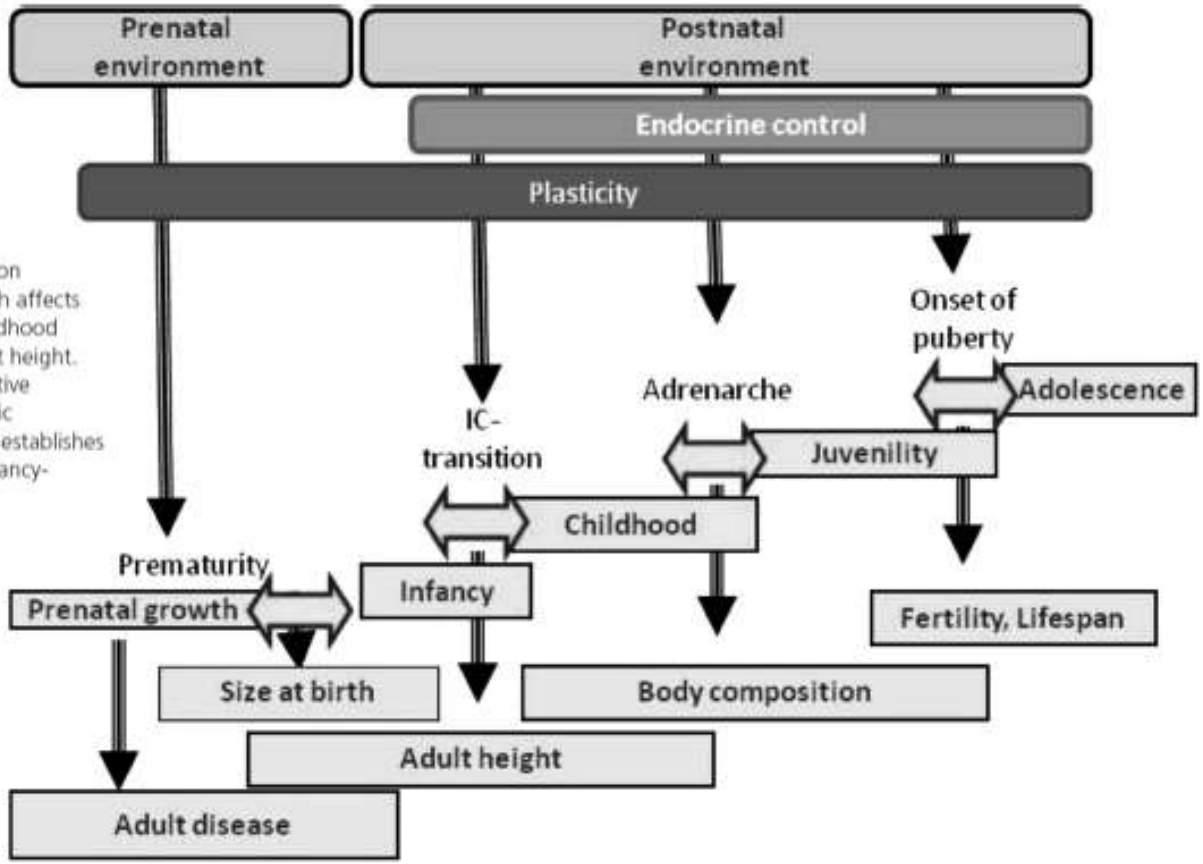


FIG. 1. Preadult periods of adaptive plasticity in the transition between life-history phases (*double arrows*). Prenatal growth affects adult health and disease. The transition from infancy to childhood confers a predictive adaptive response that determines adult height. The transition from childhood 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).

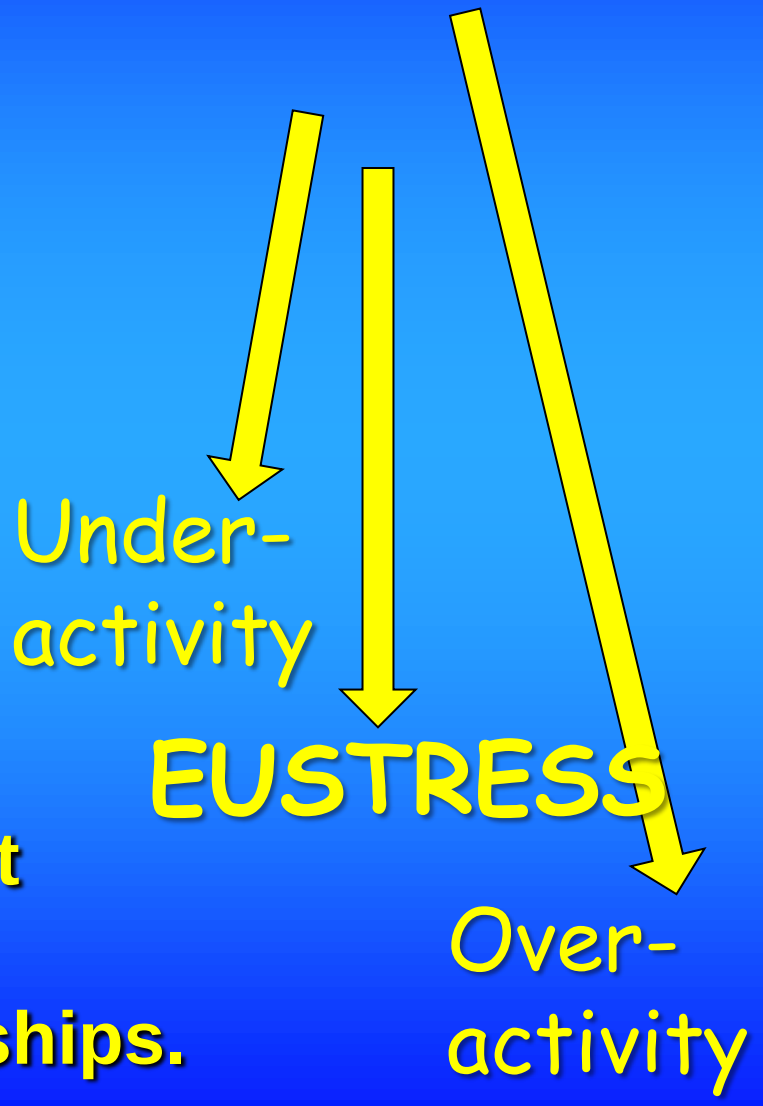
Positive Stress

- **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.**

Slide by: Jack P. Shonkoff, M.D.

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.**

Slide by: Jack P. Shonkoff, M.D.

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."

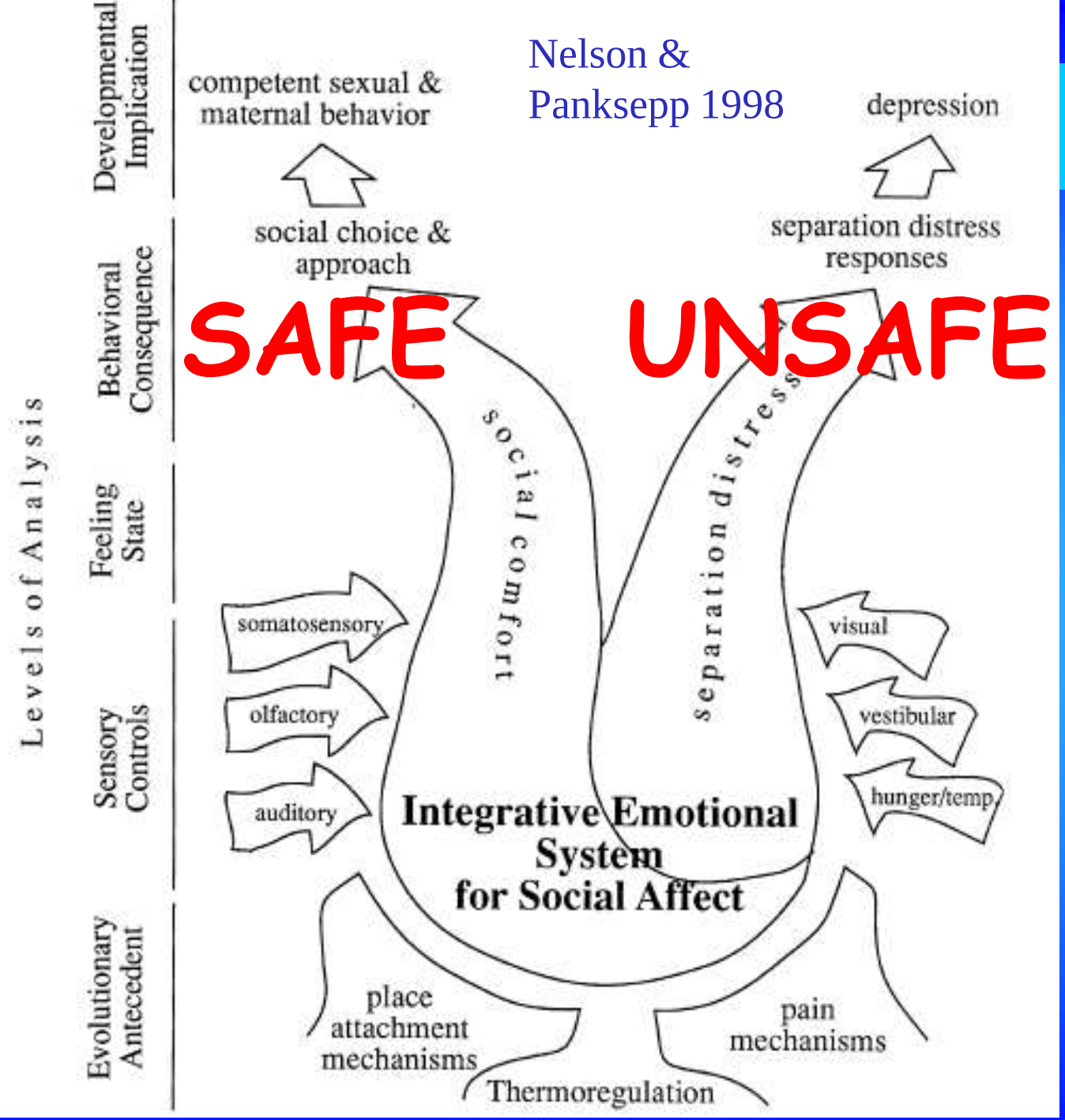
(Ziabreva 2003)
South American
small rodent

South American small rodent

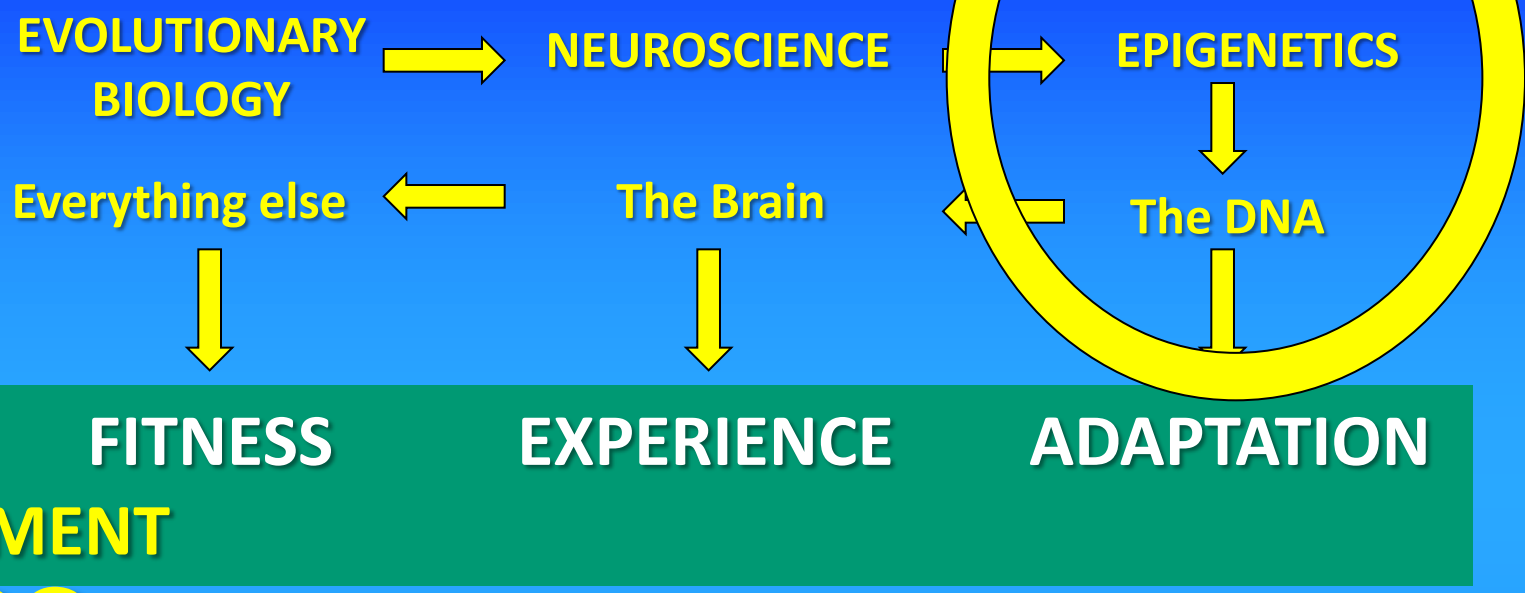
separated for 6 minutes only twice daily from d8 to d10

→ altered aminergic function in hippocampus and amygdala
→ (modulated by mother's voice)

Separation tolerance in mammals is measured in minutes

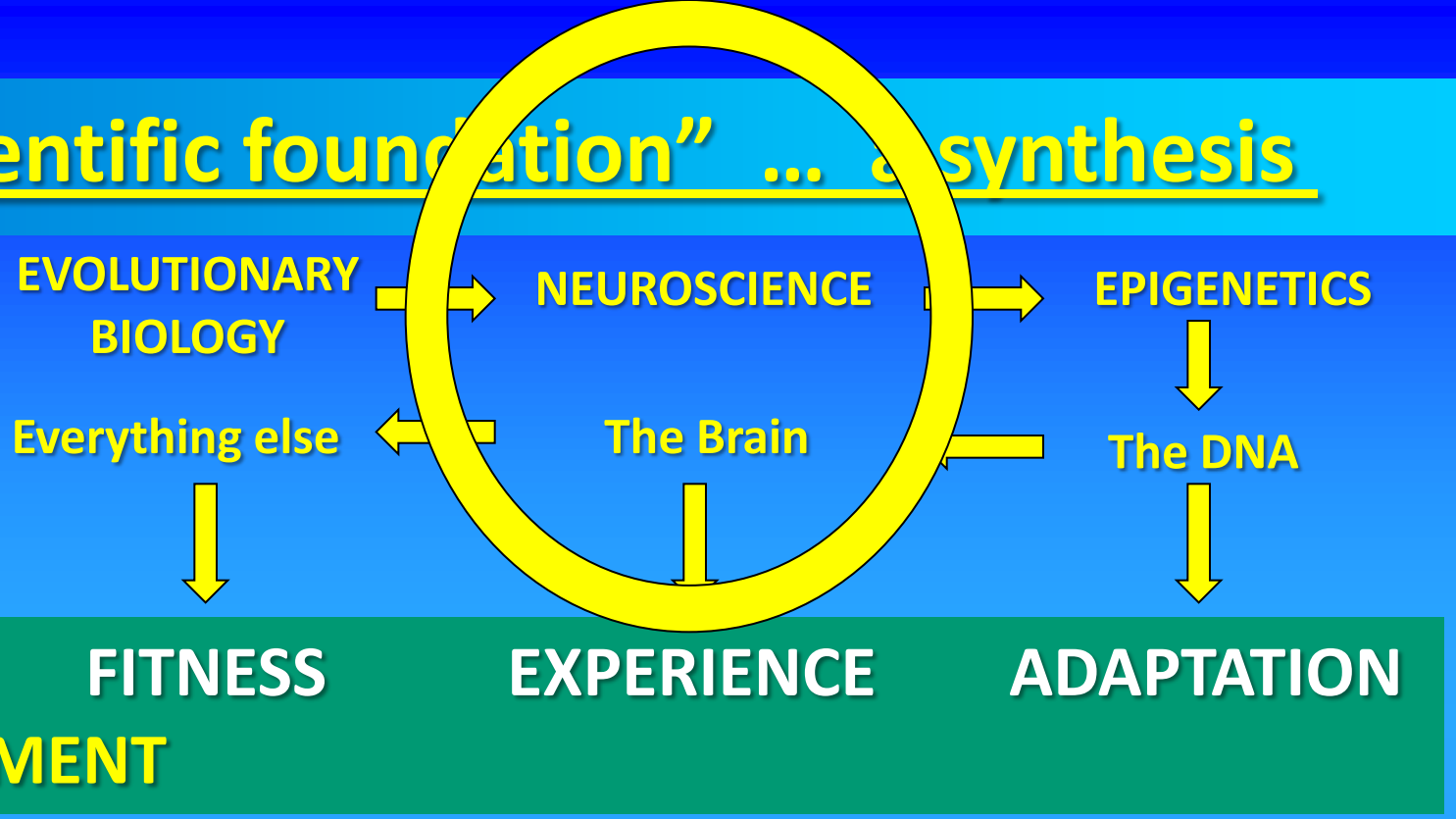

Nelson &
Panksepp 1998
Levels of Analysis
Evolutionary Antecedent
Sensory Controls
Feeling State
Behavioral Consequence
Developmental Implication
competent sexual & maternal behavior
depression
social choice & approach
separation distress responses
SAFE
UNSAFE
social comfort
separation distress
somatosensory
olfactory
auditory
visual
vestibular
hunger/temp
Integrative Emotional System for Social Affect
place attachment mechanisms
Thermoregulation
pain mechanisms

"Scientific foundation" … a synthesis



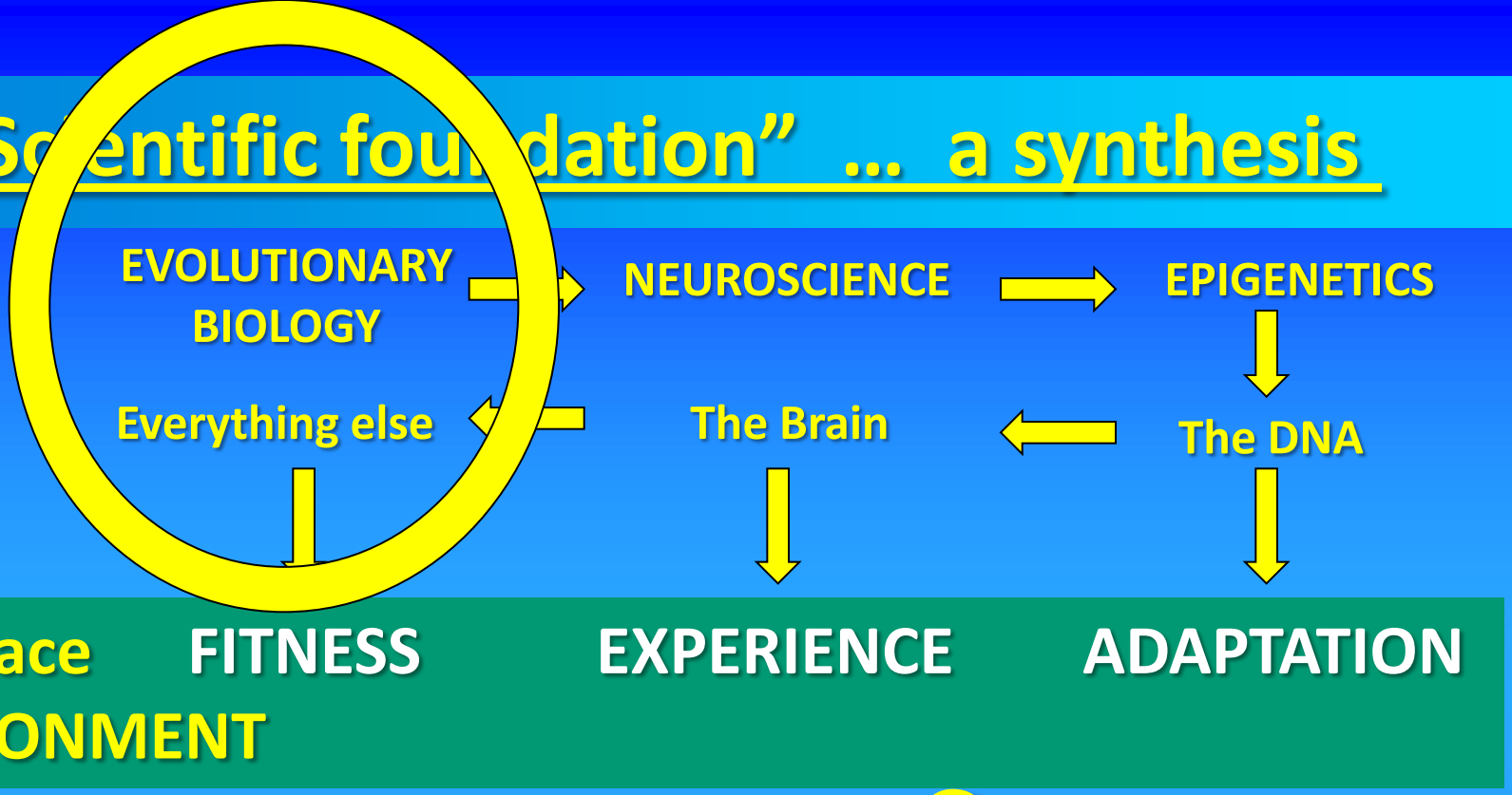
"buffering protection of adult support"

"Scientific foundation" ... a synthesis



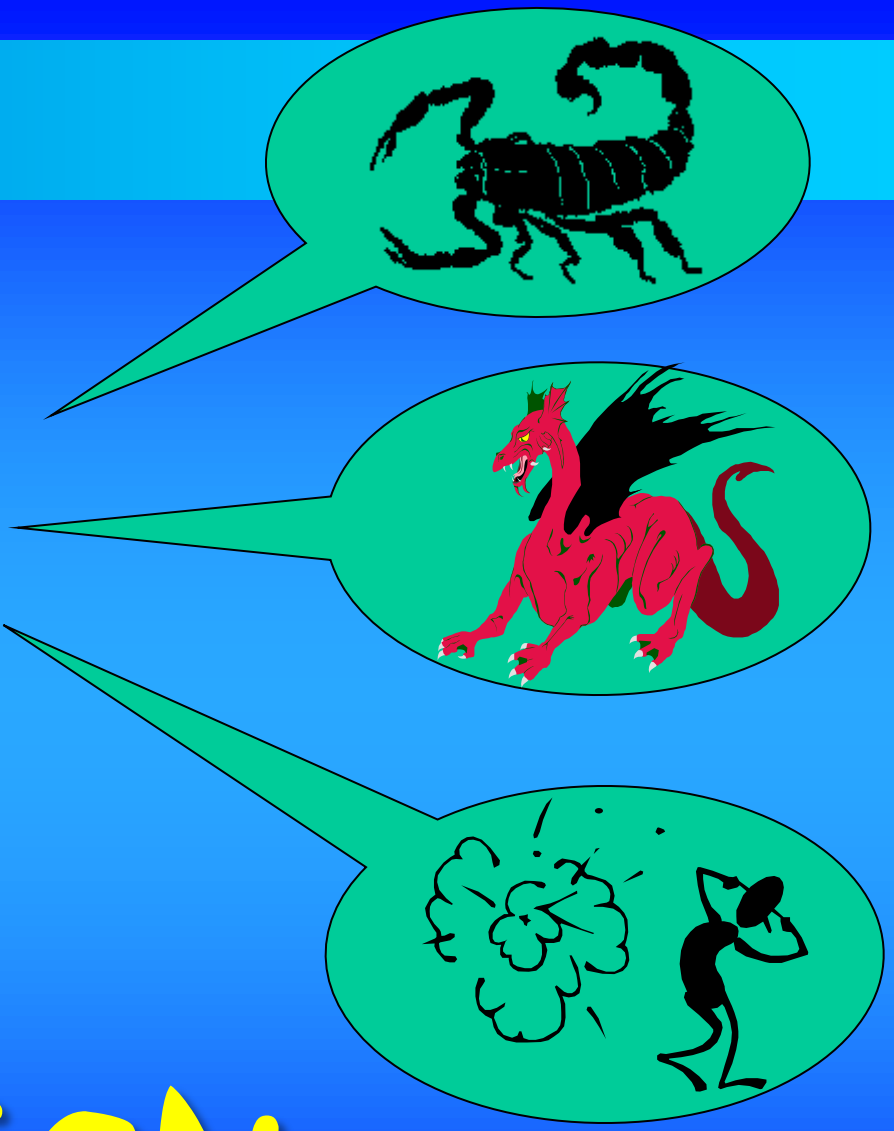
"needed neural processes"

"Scientific foundation" … a synthesis

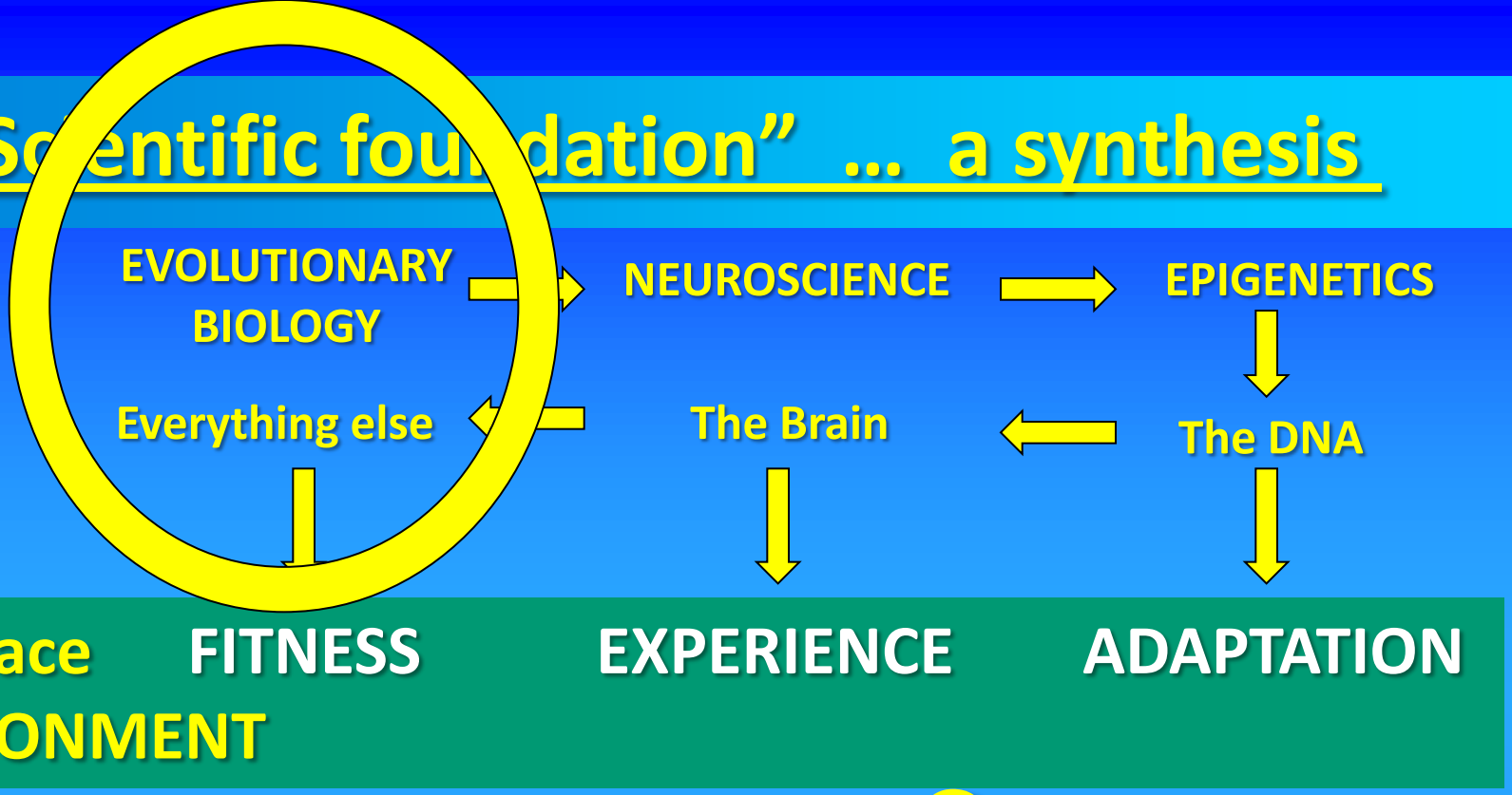


"in the light of mother's body."

ZERO SEPARATION



"Scientific foundation" … a synthesis



"in the light of mother's body."

Journal of Neuroendocrinology 20, 515–525

REVIEW ARTICLE

Reproduction-Induced Neuroplasticity: Natural Behavioural and Neuronal Alterations Associated with the Production and Care of Offspring

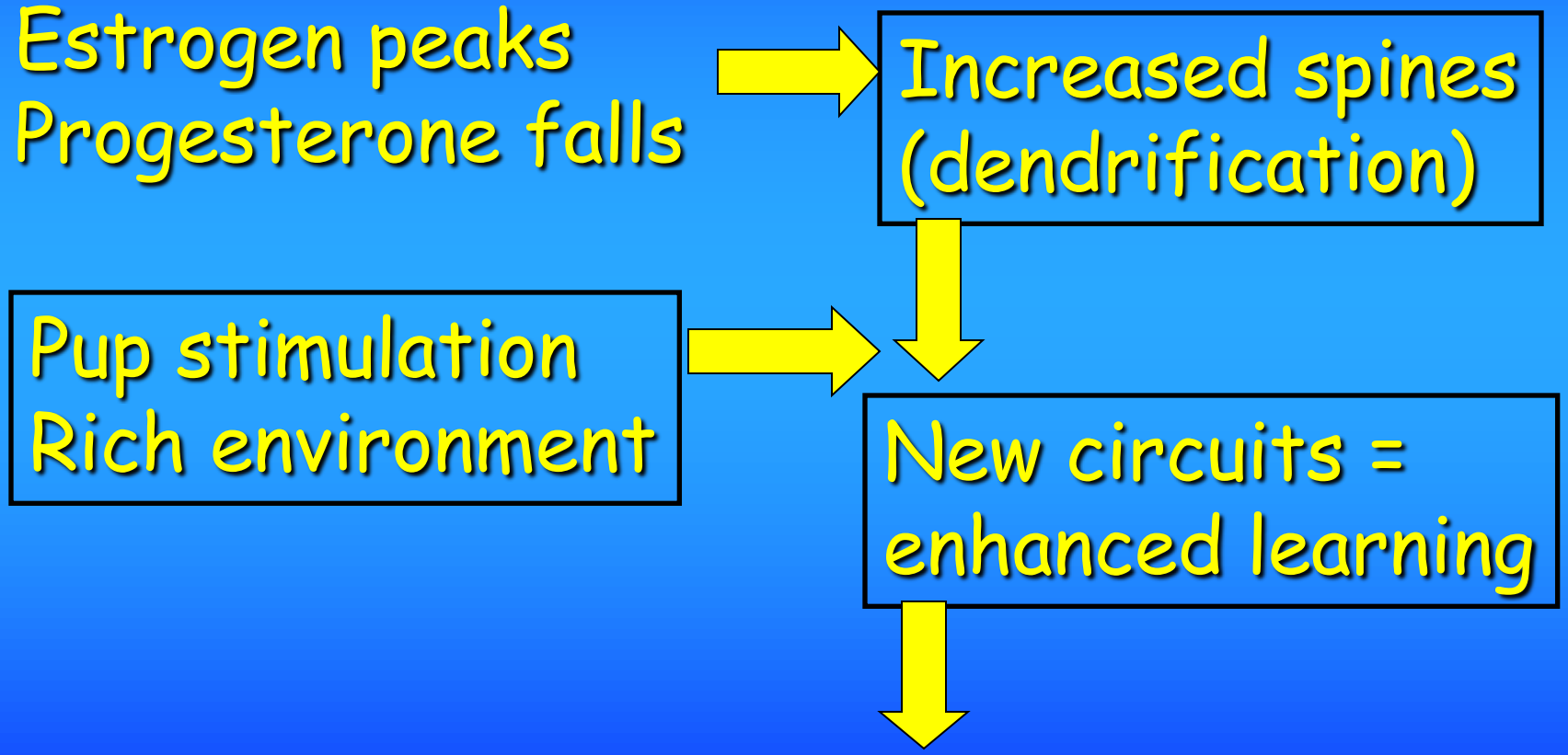
Craig H. Kinsley* and Kelly G. Lambert†

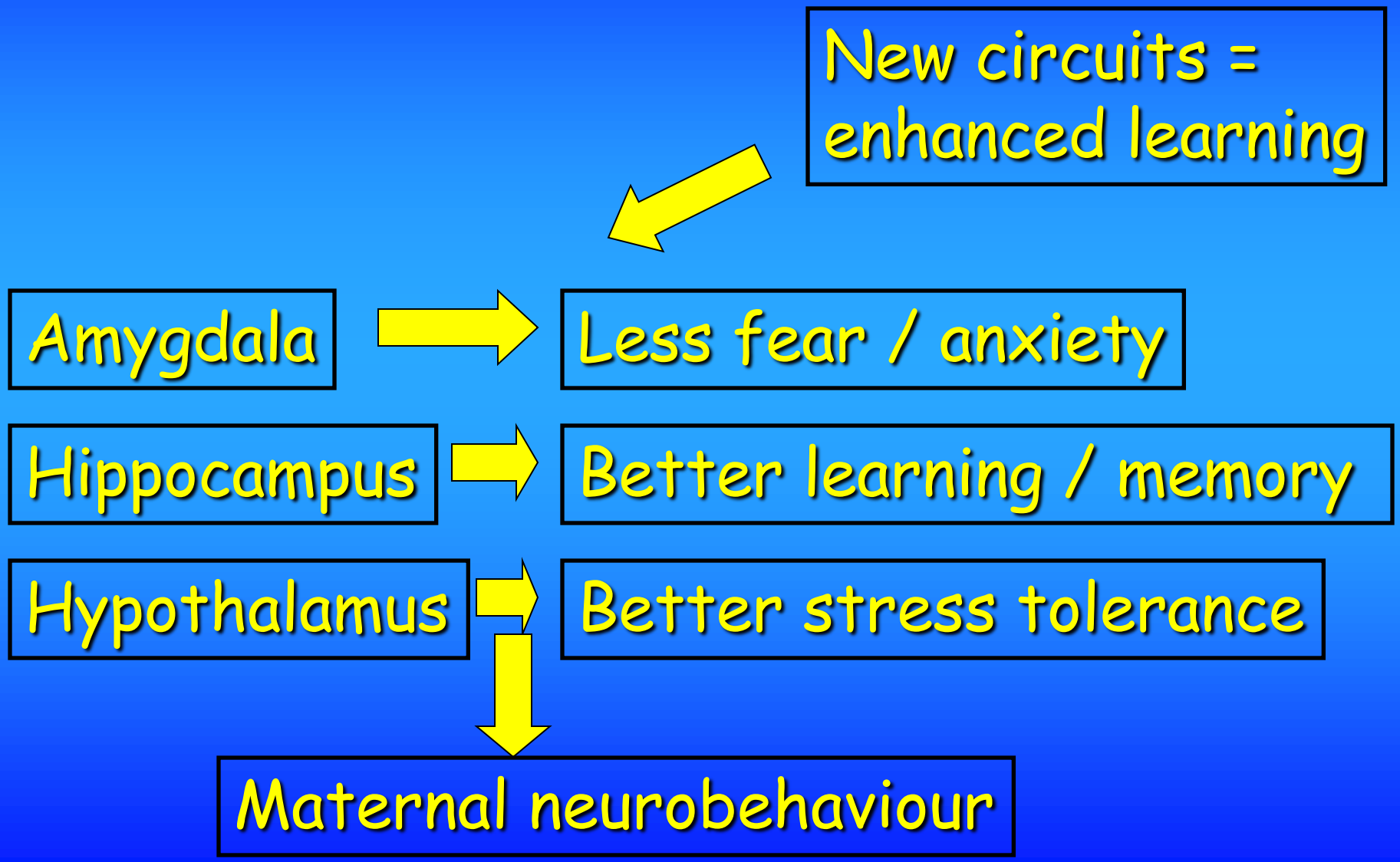
*Department of Psychology, Center for Neuroscience, University of Richmond, Richmond, VA, USA.

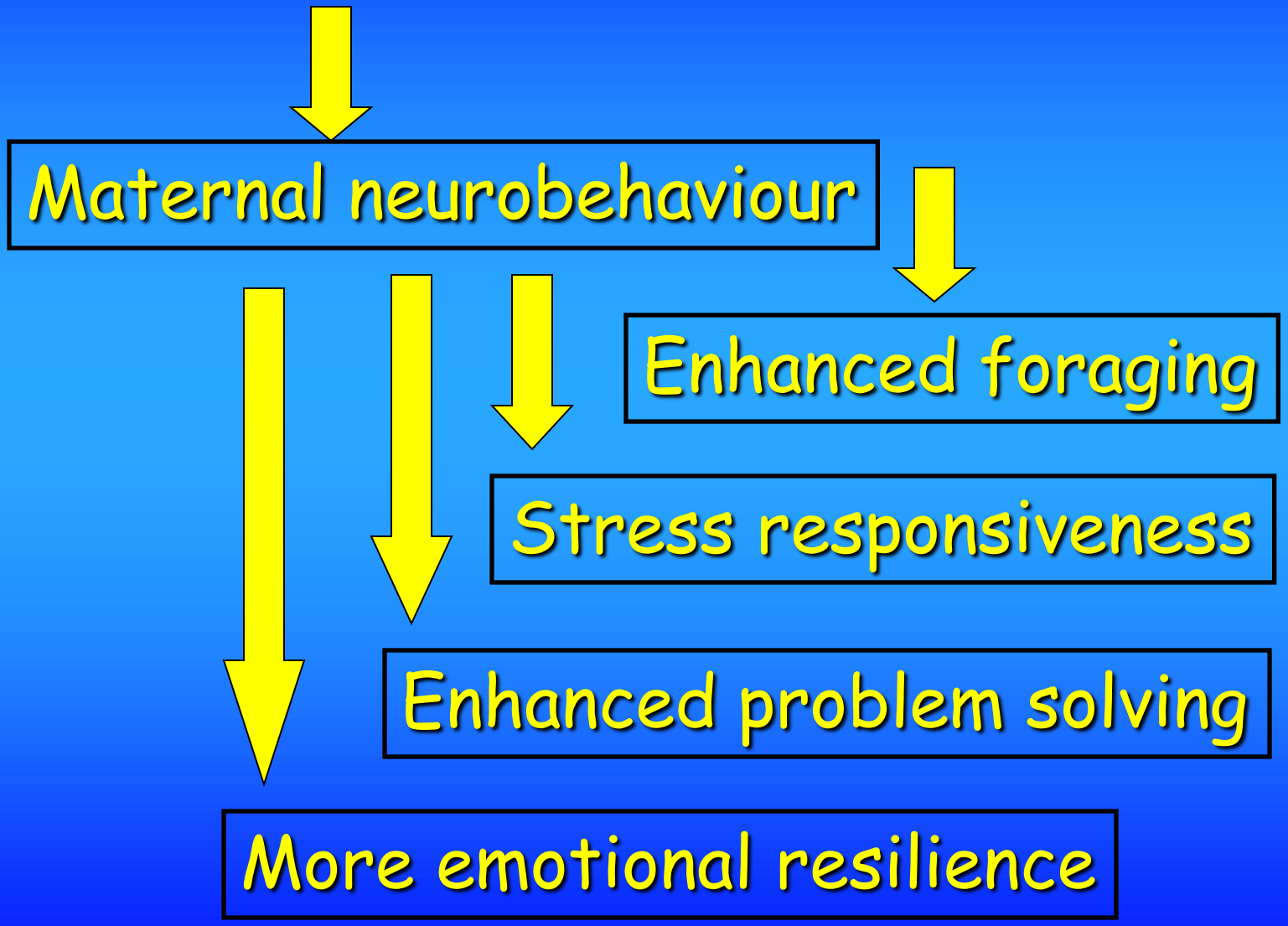
†Department of Psychology, Randolph-Macon College, Ashland, VA, USA.

MICE

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

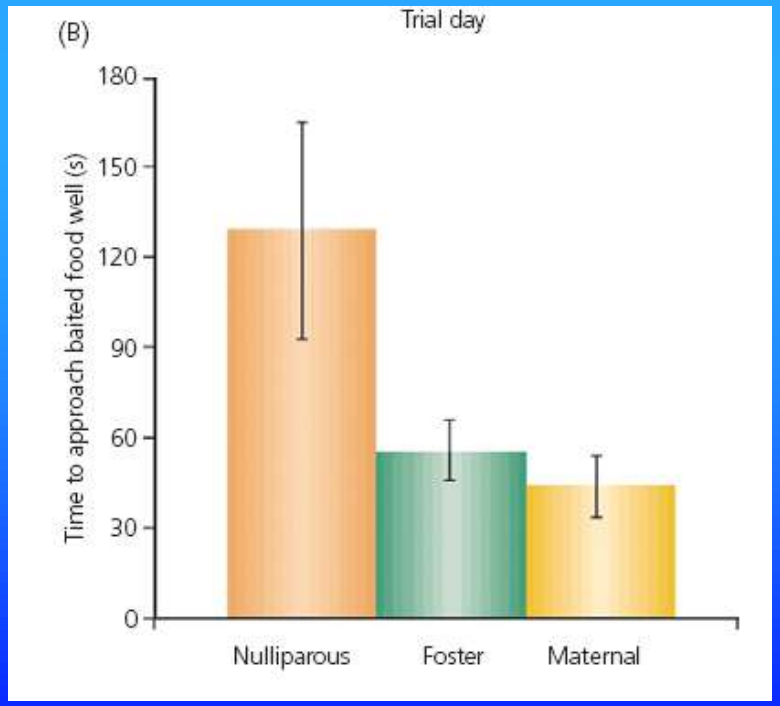

Estrogen peaks
Progesterone falls
Increased spines
(dendrification)
Pup stimulation
Rich environment
New circuits =
enhanced learning

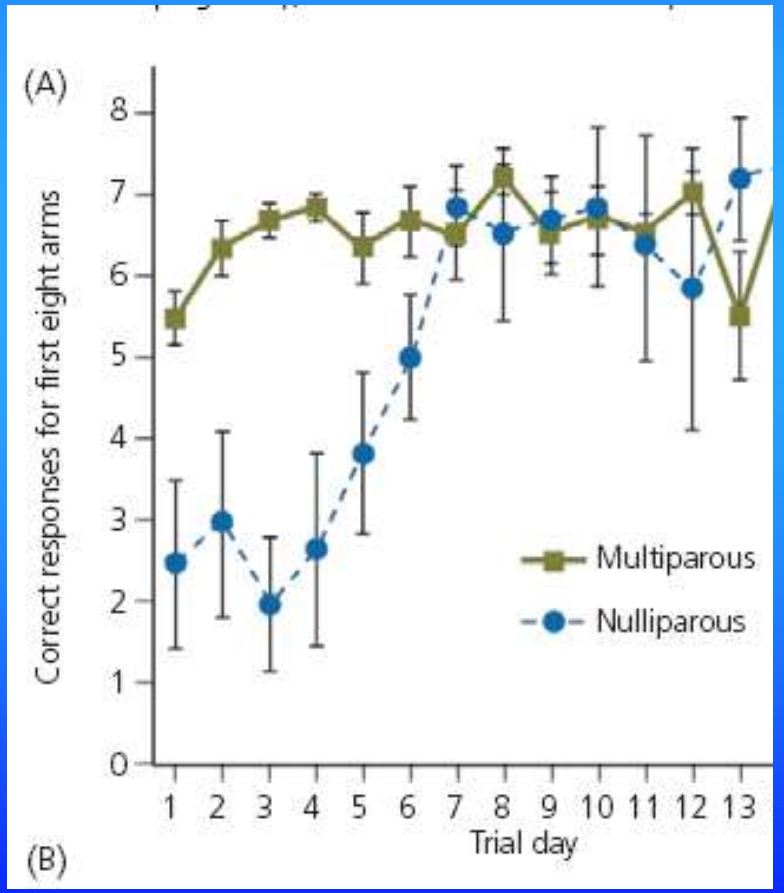

New circuits = enhanced learning
Amygdala
Less fear / anxiety
Hippocampus
Better learning / memory
Hypothalamus
Better stress tolerance
Maternal neurobehaviour


Maternal neurobehaviour
Enhanced foraging
Stress responsiveness
Enhanced problem solving
More emotional resilience

Enhanced problem solving

Enhanced foraging





Stress responsiveness

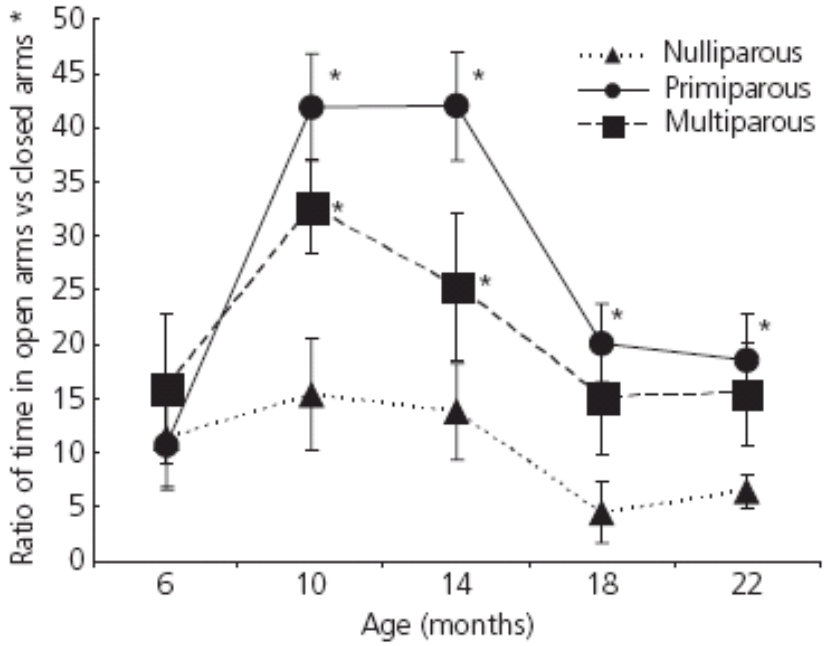


Fig. 3. Parity regulation of anxiety across the lifespan. Percentage of time spent in open arms in the elevated plus maze in age-matched nulliparous (NP), primiparous (PP) and multiparous (MP) Long Evans females tested at various ages post-reproduction (in PP and MP). *Conveys significant difference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

More emotional resilience

PROLACTIN rises
OXYTOCIN rises

→ LACTATION

↓ MEMORY permanently improved

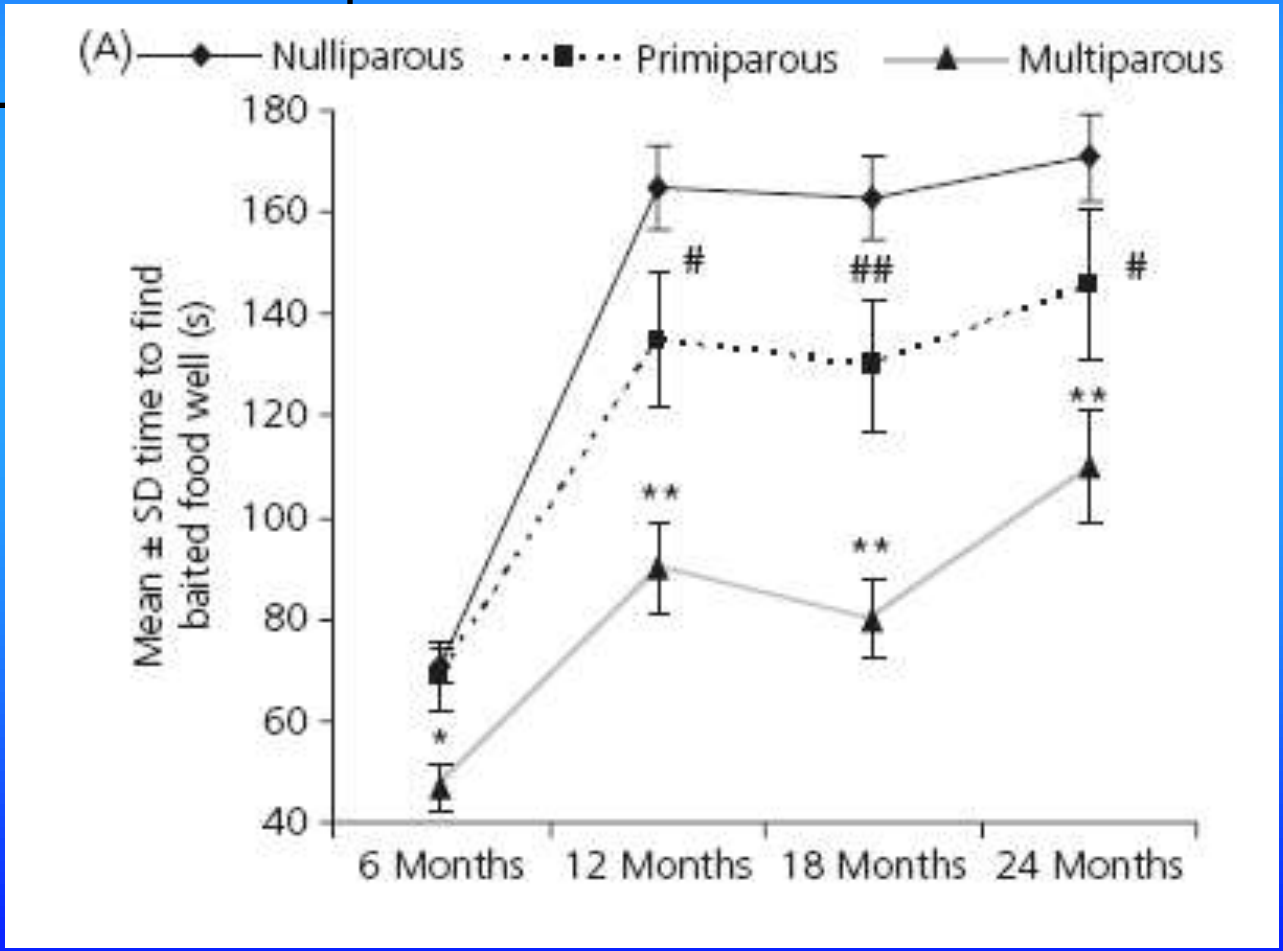
↓ BDNF (=Brain Derived Neurotropic Factor)

Opioids
Glucocorticoids
Norepinephrine
Vasopressin

→ etcetera .....

(fathers specially)

MEMORY permanently improved



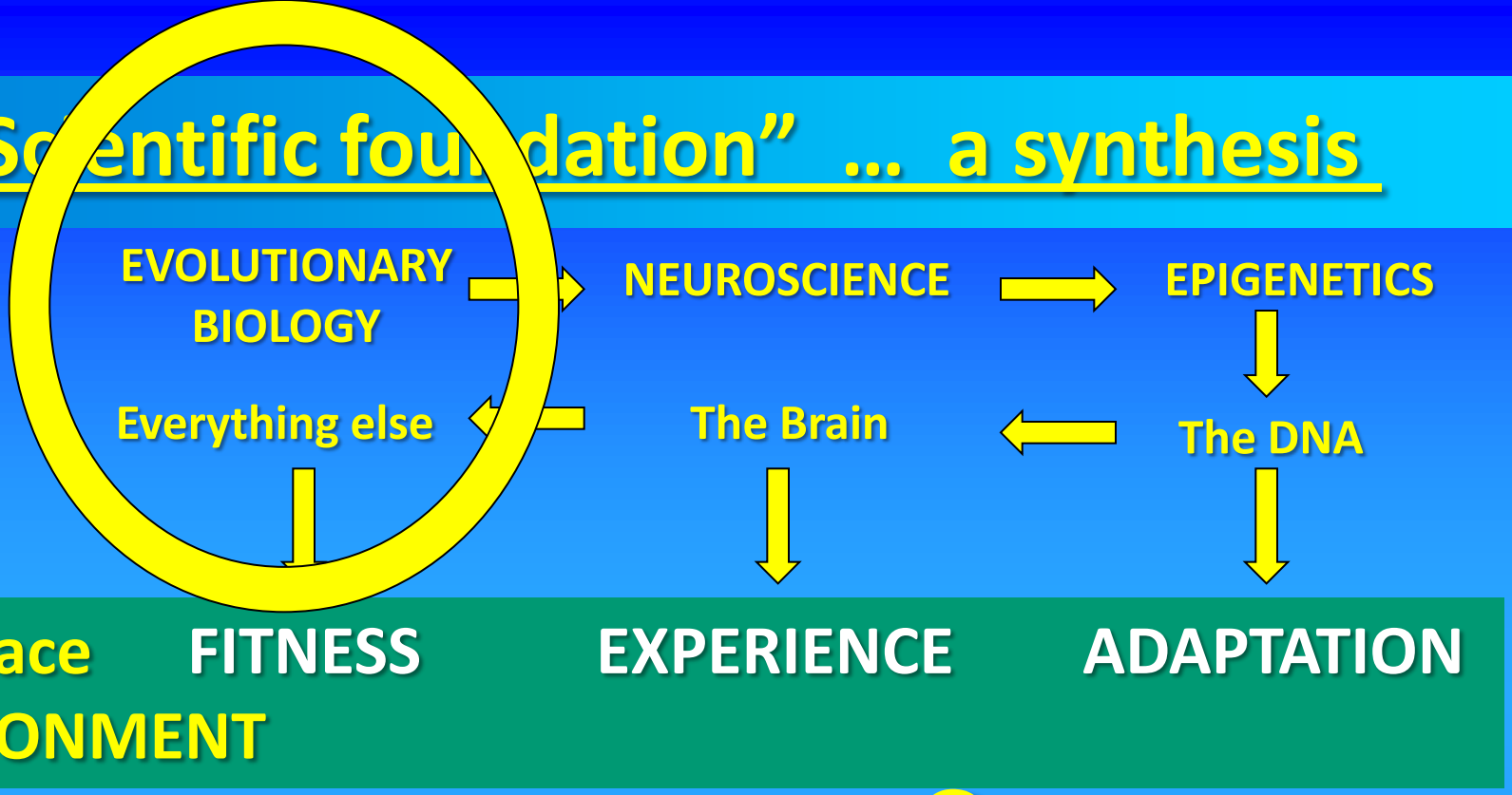
BDNF (=Brain Derived Neurotropic Factor)

"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



"in the light of mother's body."

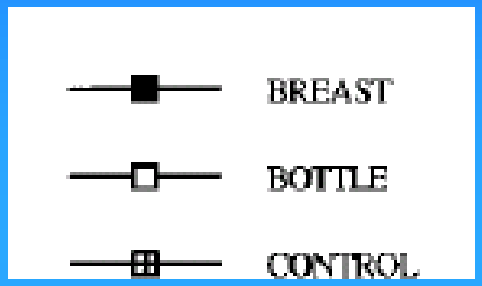
Clinics in Perinatology,
June 2004, Vol 31(2) page 210
Stanley Graven
Early neurosensory visual development of fetus and newborn.

"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.

Responses to Laboratory Psychosocial Stress in Postpartum Women

Margaret Altemus, MD, Laura S. Redwine, PhD, Yeung-Mei Leong, PhD, Cheryl A. Frye, PhD, Stephen W. Porges, PhD, and C. Sue Carter, PhD

SUE CARTER



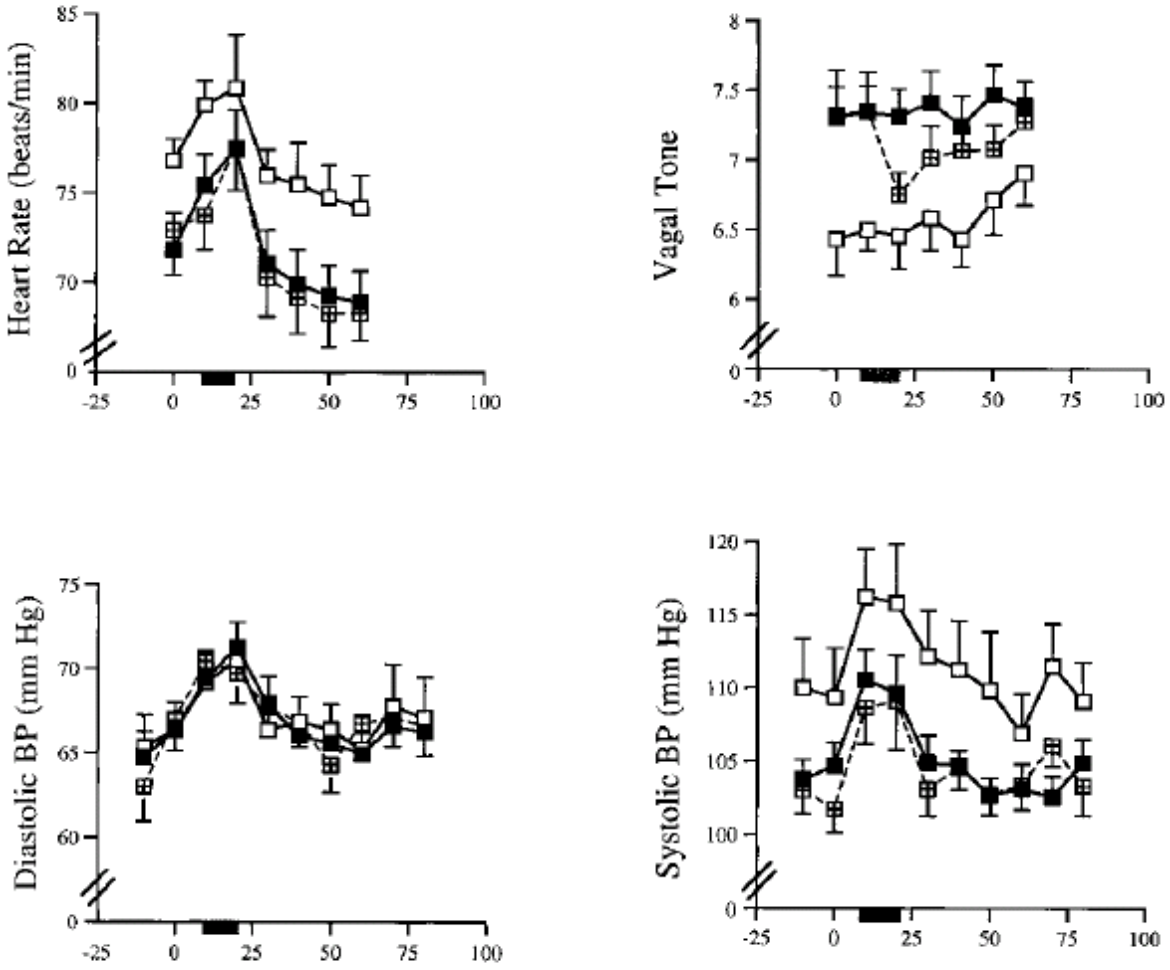
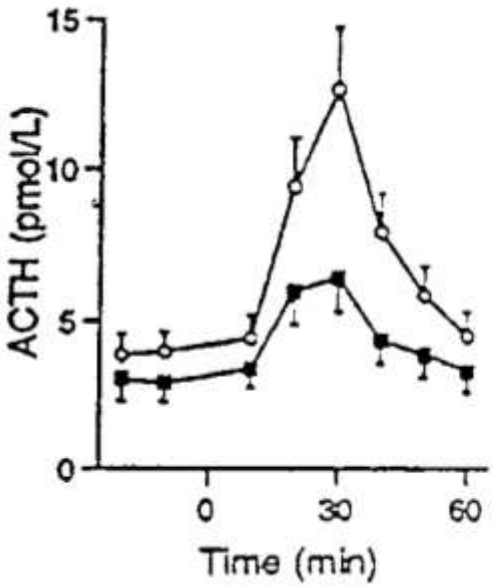
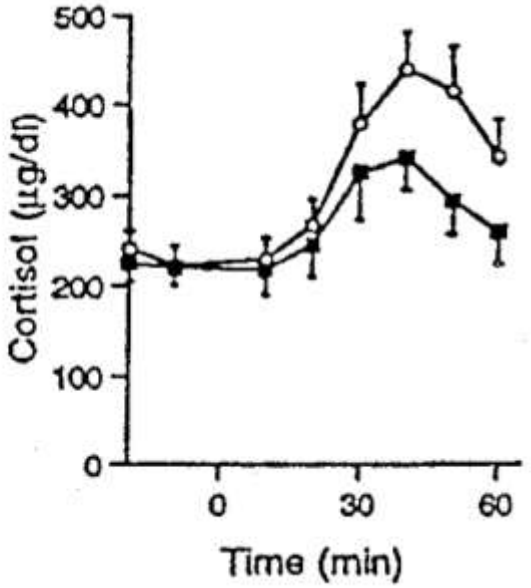


Fig. 1. Hormonal and physiologic responses to Trier Social Stress Test in lactating, nonlactating, and nonpostpartum women. Period of stress test (time +10 to +20 minutes) is represented by the shaded gray bar. Values are mean ± SEM.

FIG. 1. Hormonal and metabolic responses to treadmill exercise in lactating (■) and nonlactating (○) women. Values are means ± SEM. Ten subjects in each group performed 20 min of graded maximal treadmill exercise. Significant differences between groups in pattern of response over time were found for adrenocorticotropin ($P < 0.001$), cortisol ($P < 0.05$), glucose ($P < 0.001$), and prolactin ($P < 0.001$).





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

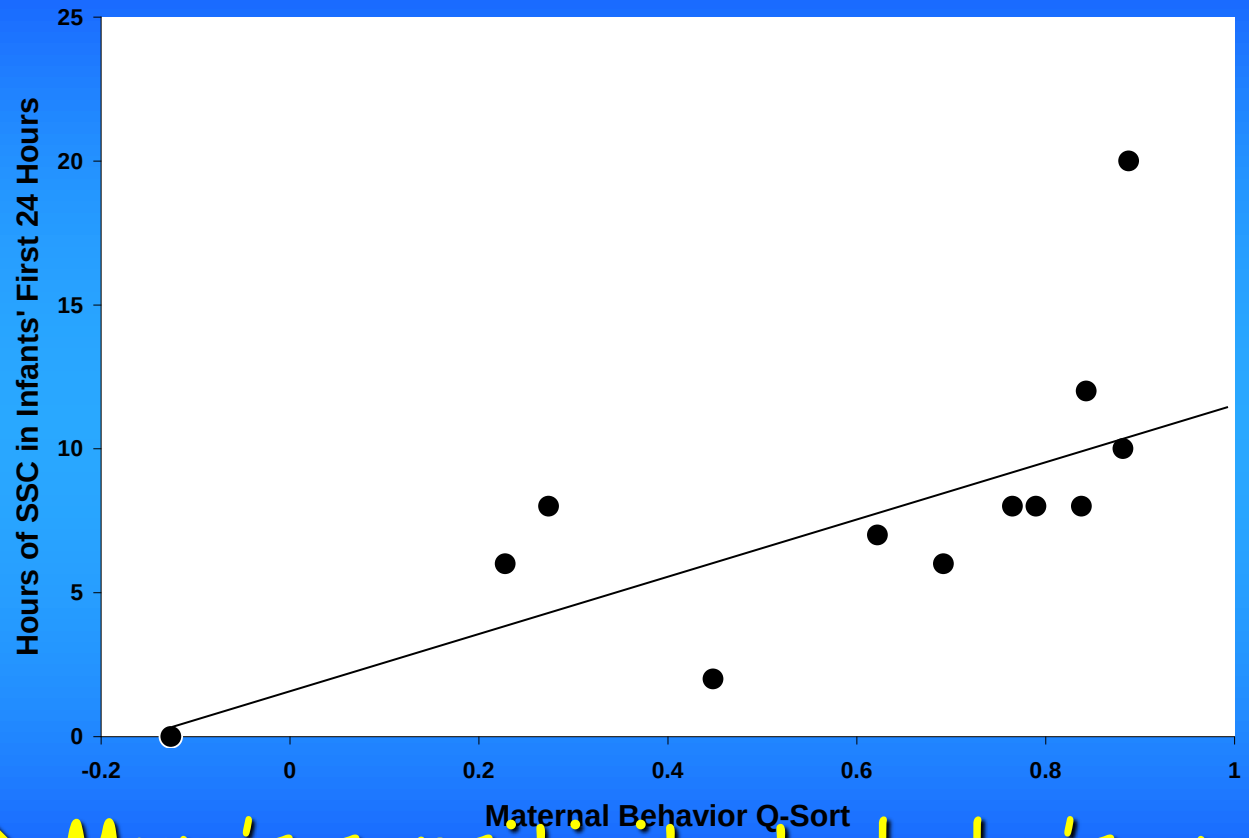
The Relation of Early Mother-Infant Skin-to-Skin Contact to Later Maternal Sensitivity in South African Mothers of Low Birth Weight Infants

Ann E. Bigelow, et al ()

From Bergman et al 2004 RCT

SSC time first 24 hr correlated with SSC time first month.

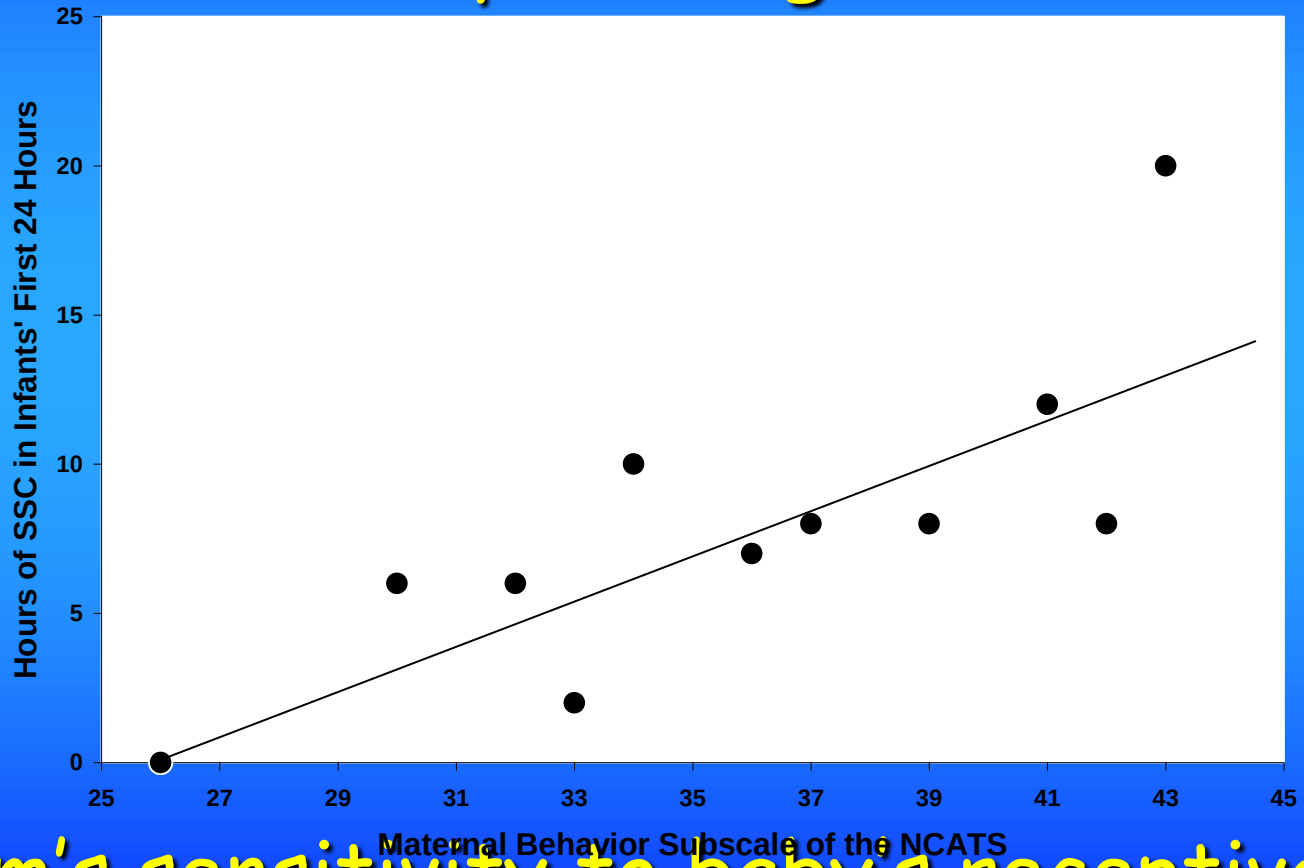
Maternal behaviour Q Sort
Predicts attachment security



→ 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.

Specifying the Neurobiological Basis of Human Attachment: Brain, Hormones, and Behavior in Synchronous and Intrusive Mothers

Neuropsychopharmacology (2011), 1–13

Shir Atzil[1,2], Talma Hendler[2,3] and Ruth Feldman*,[1]

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.

Journal of Child Psychology and Psychiatry 49:10 (2008), pp 1042–1052 doi:10.1111/j.1469-7610.2008.01963.x

Maternal brain response to own baby-cry is affected by cesarean section delivery

James E. Swain,[1] Esra Tasgin,[2] Linda C. Mayes,[1,3] Ruth Feldman,[1,4] R. Todd Constable,[5] and James F. Leckman[1]

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..

… 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.

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 fulfulling,
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!

http://www.imhaanz.org.nz/peter-cooks-mothering-denied-available-internet

'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:

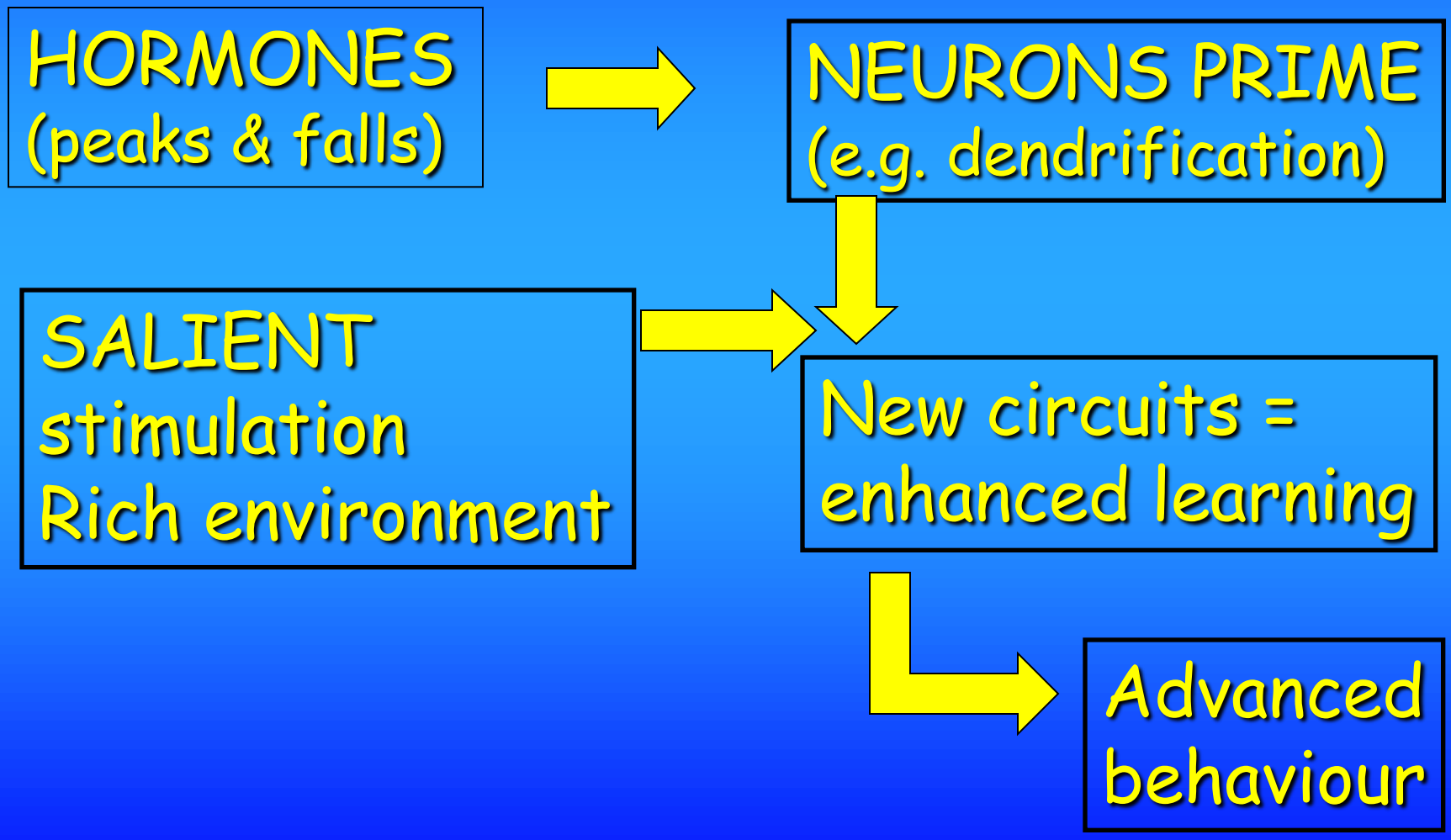
For mothers, the premature birth created a feeling of powerlessness and they experienced the immediate postnatal period as surreal and strange. The fathers experienced the birth as a shock, but were ready to be involved immediately.

"involved immediately"

'MOTHERING' = biological definition

basic needs of infants arise from their biology

Mothering is biology


HORMONES
(peaks & falls)
NEURONS PRIME
(e.g. dendrification)
SALIENT
stimulation
Rich environment
New circuits =
enhanced learning
Advanced
behaviour

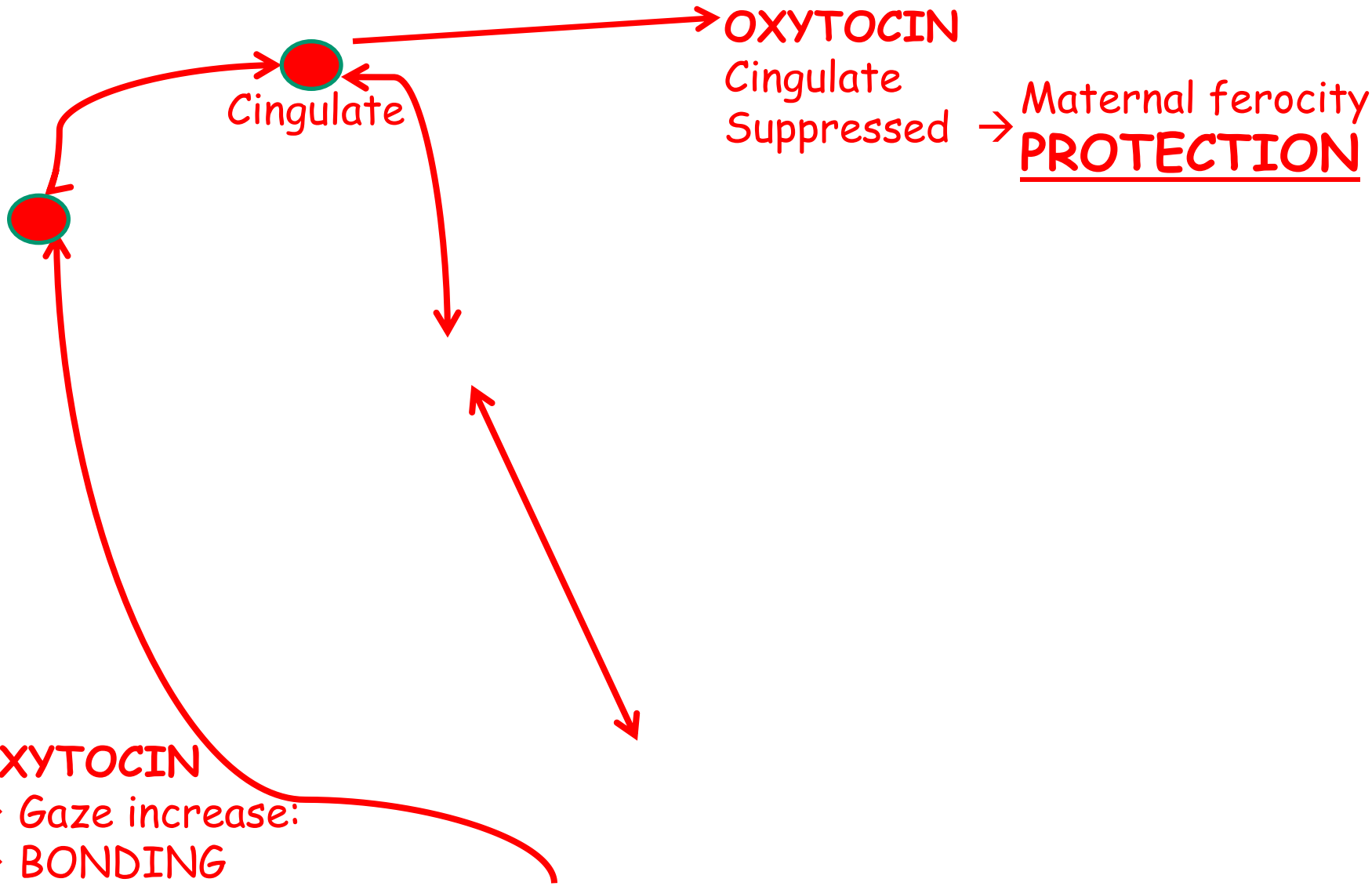
Is this feeding ??

"The newborn may appear helpless, but skin-to-skin contact

stimulates prolactin

stimulates oxytocin

stimulates cholecystokinin


OXYTOCIN
Cingulate
Suppressed
Maternal ferocity
PROTECTION
Cingulate
OXYTOCIN
→ Gaze increase:
→ BONDING

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."

Centrally released oxytocin coordinates the onset of maternal nurturing behavior at parturition and plays a role in mother-infant bonding.

Ross 2009

Brain-to brain
Face-to-face
Eye-to-eye
voice,
hands,
movements

Ross 2009

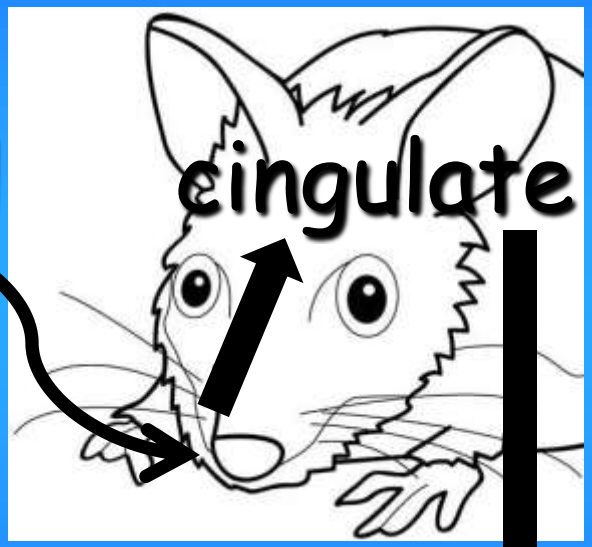
Interpersonal awareness
Emotions

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



FEAR
FREEZE

+ OXYTOCIN

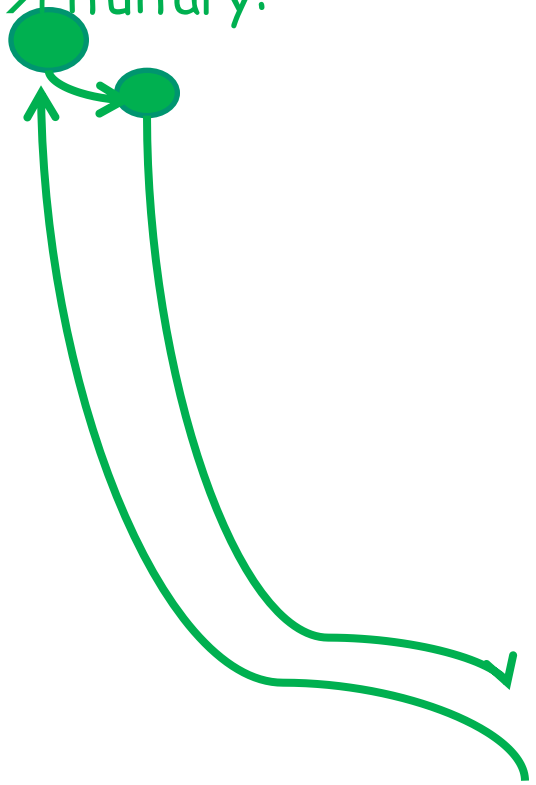
cingulate suppressed

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

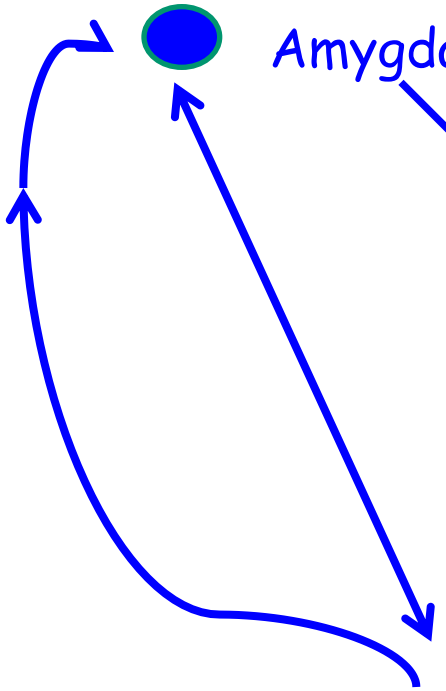
Measure of
"good mammal mother" :
FEROCITY OF
DEFENCE OF YOUNG.

Hypothalamus
→Pituitary:



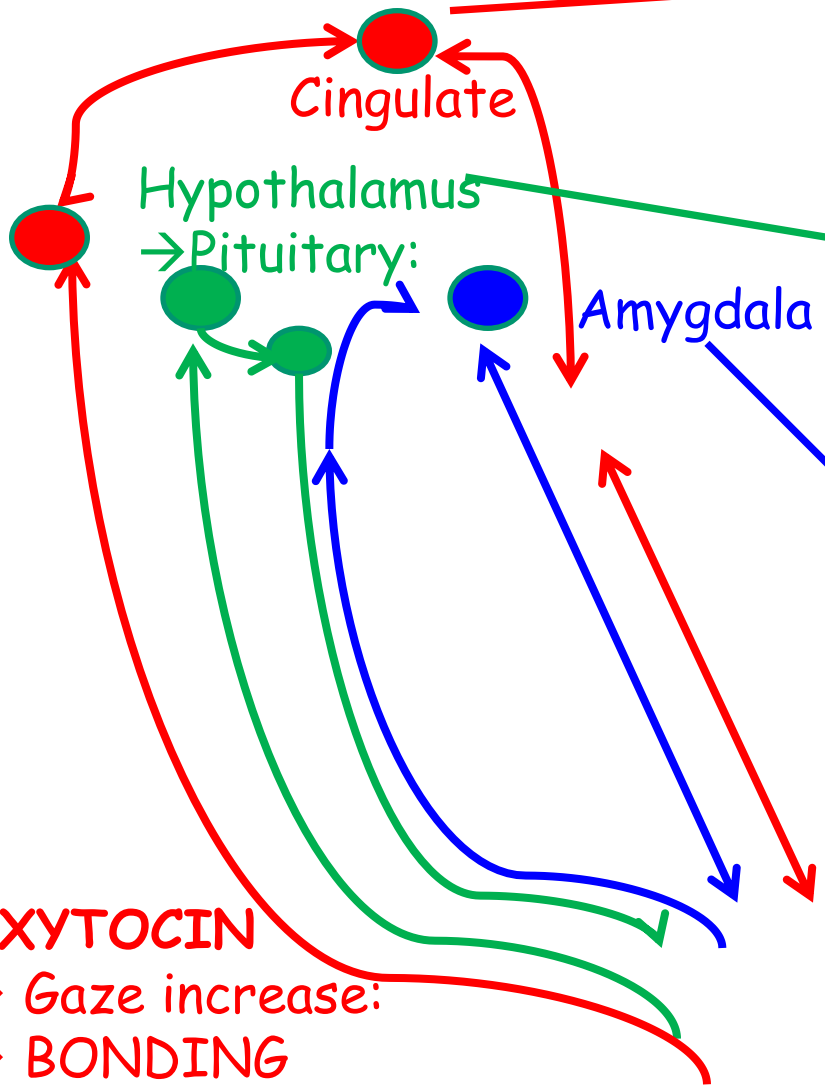
Hypothalamus
→Pituitary:
PROLACTIN →Milk production

NUTRITION



Amygdala:
CHOLECYSTOKININ
→ Emotion / satiety

REGULATION



OXYTOCIN
Cingulate
Suppressed → Maternal ferocity
PROTECTION

Hypothalamus
→Pituitary:
PROLACTIN → Milk production
NUTRITION

Amygdala:
CHOLECYSTOKININ
→ Emotion / satiety
REGULATION

OXYTOCIN
→ Gaze increase:
→ BONDING

“The newborn may appear helpless, but skin-to-skin contact

stimulates prolactin

ensures nutrition

stimulates oxytocin

ensures protection

stimulates cholecystokinin

ensures wellbeing bonding

The first hours after birth are a

CRITICAL PERIOD

mutual

psycho-neuro-physiological

caregivers

BONDING (Bergman mini-model)

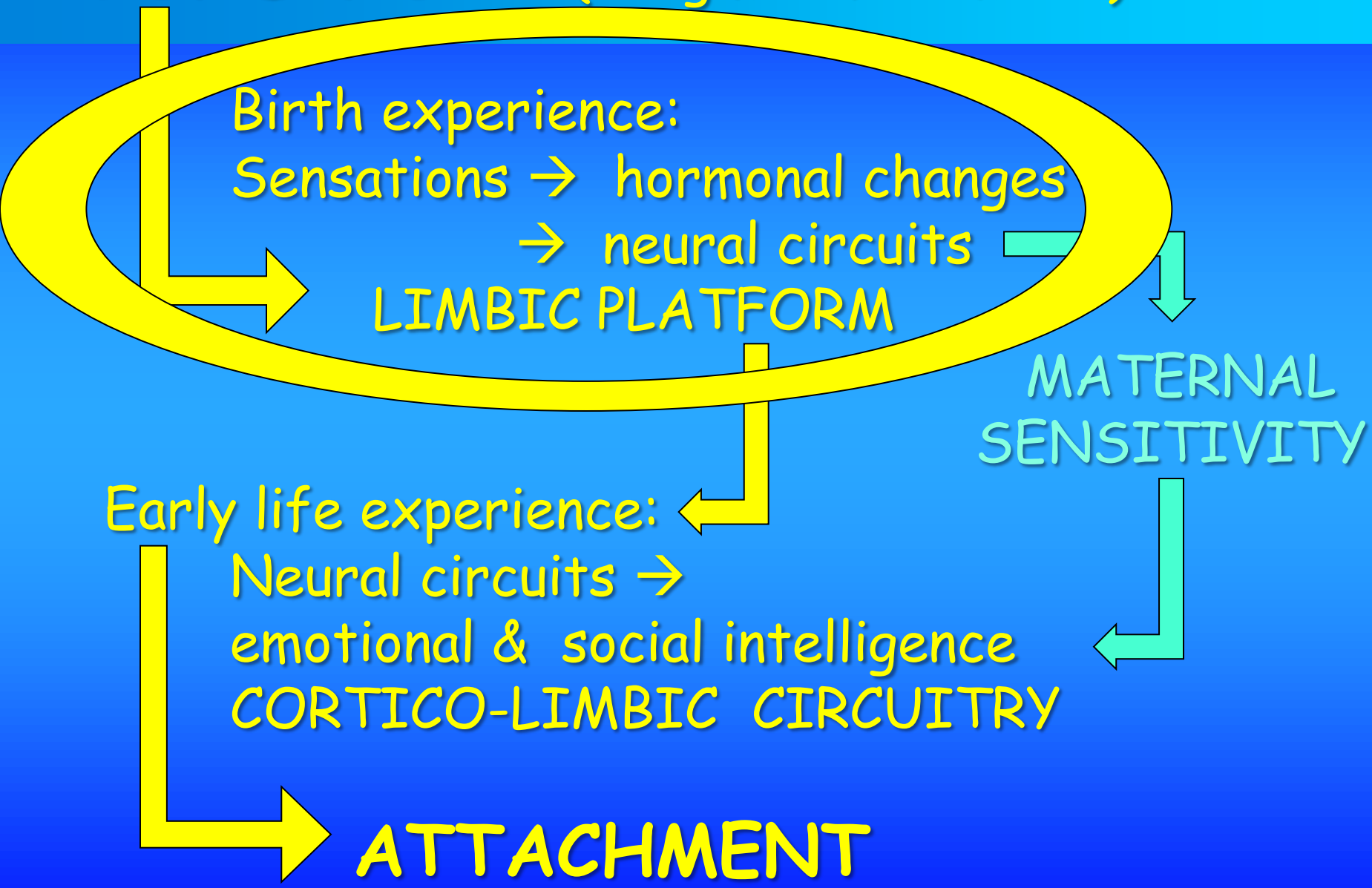
Birth experience:
Sensations → hormonal changes
→ neural circuits
LIMBIC PLATFORM

MATERNAL SENSITIVITY

Early life experience:
Neural circuits →
emotional & social intelligence
CORTICO-LIMBIC CIRCUITRY

ATTACHMENT

BONDING (Bergman mini-model)



SENSORY STIMULATION

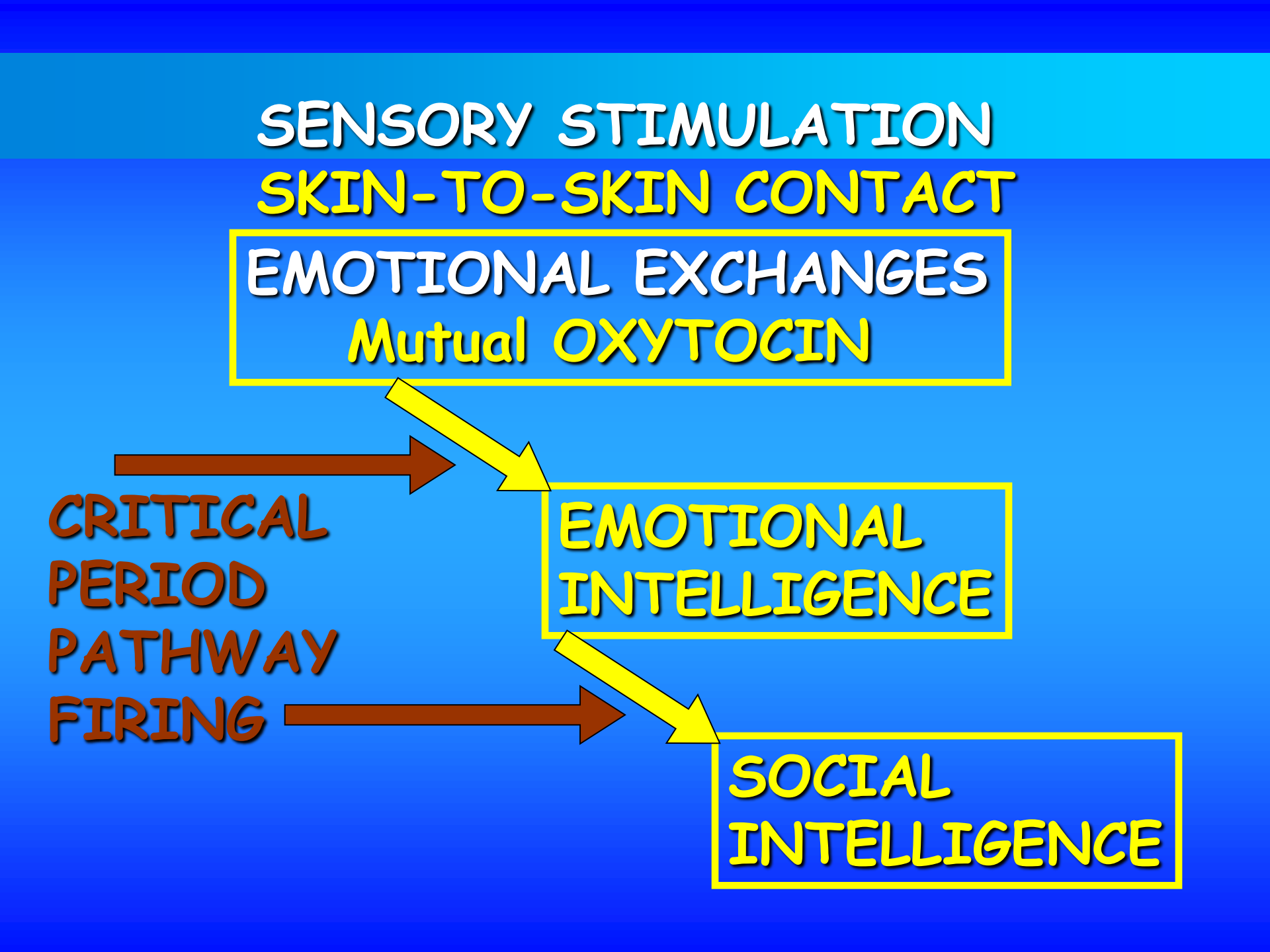
SKIN-TO-SKIN CONTACT

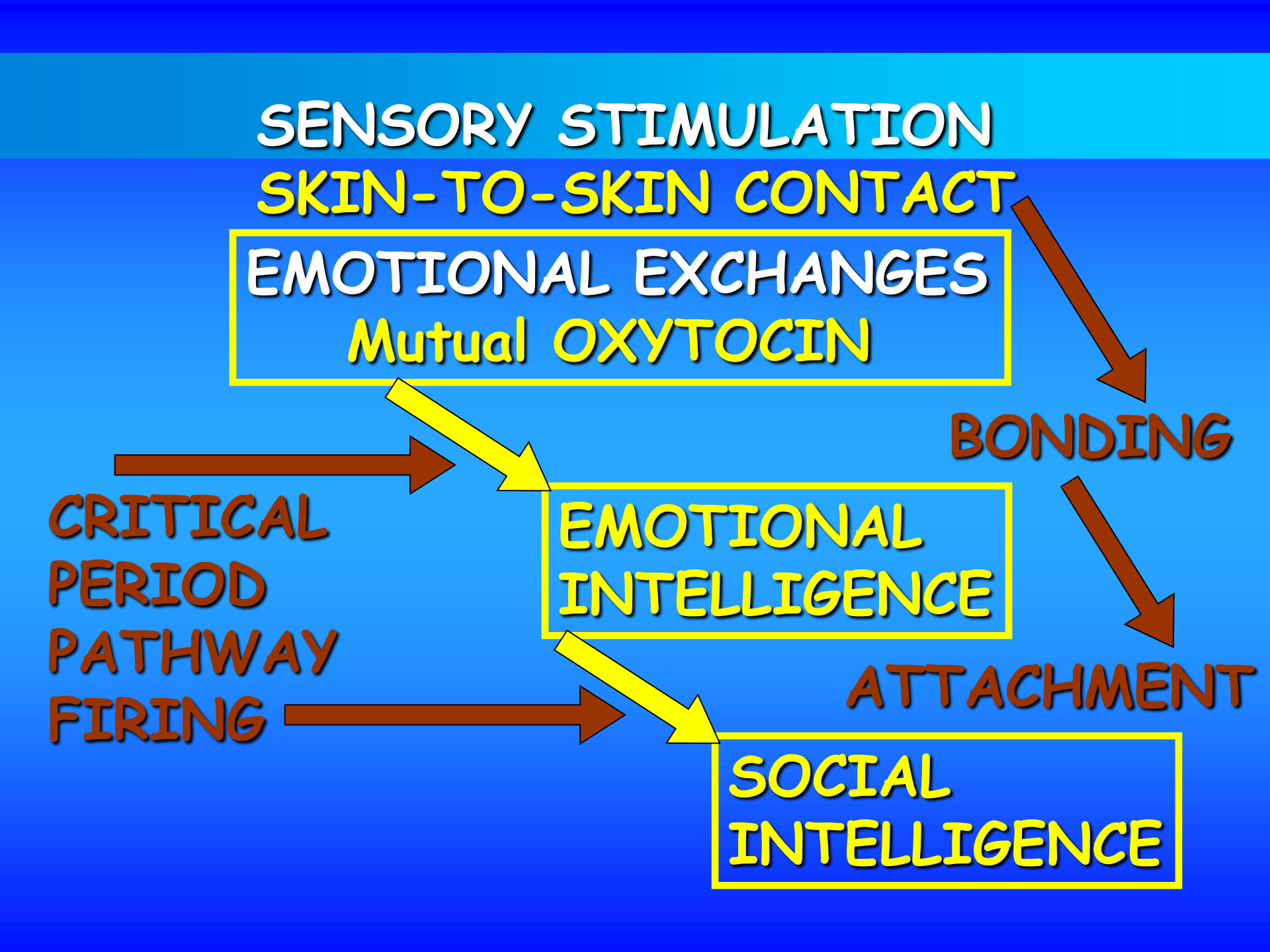
EMOTIONAL EXCHANGES

Mutual OXYTOCIN

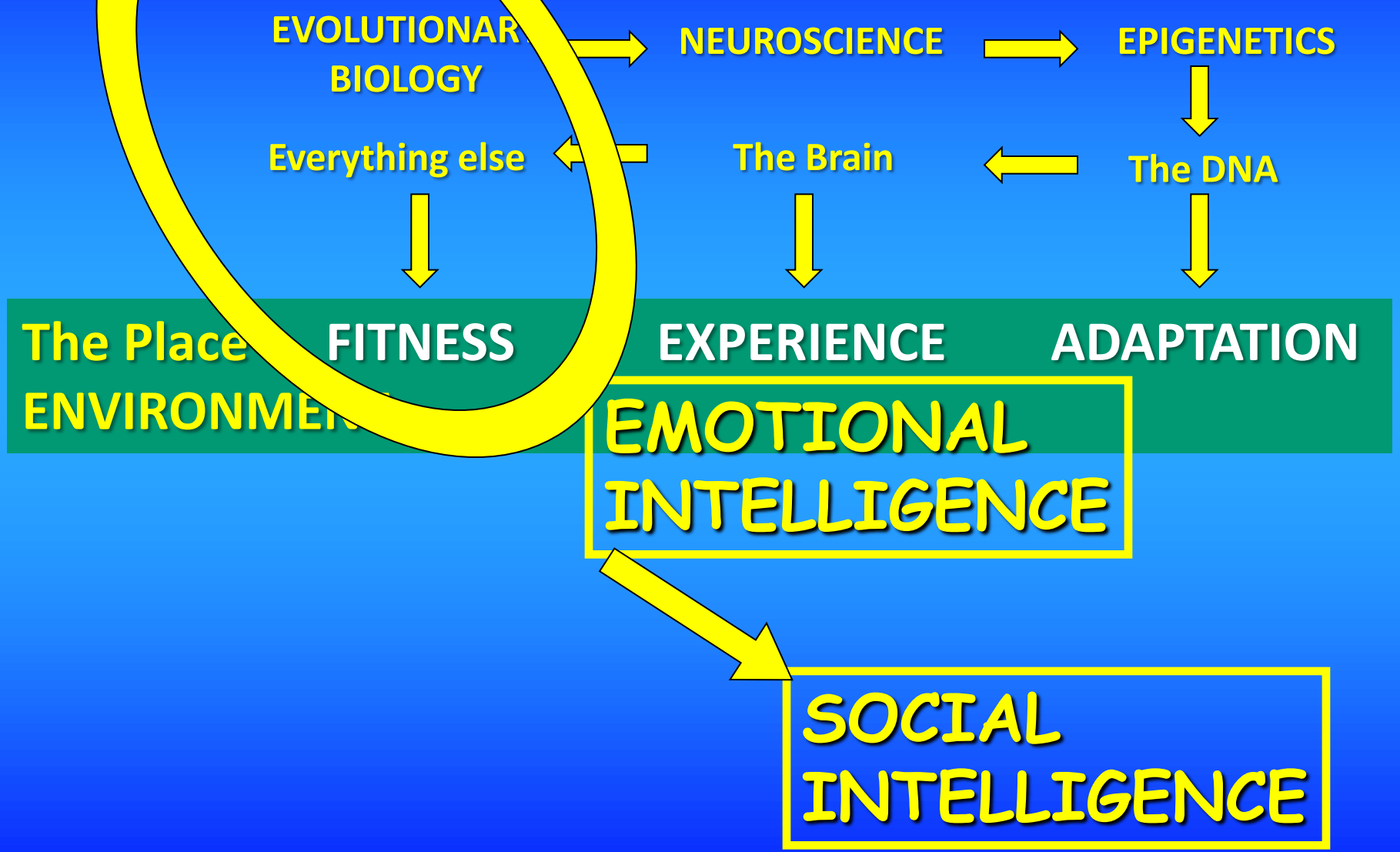
EMOTIONAL INTELLIGENCE

SOCIAL INTELLIGENCE

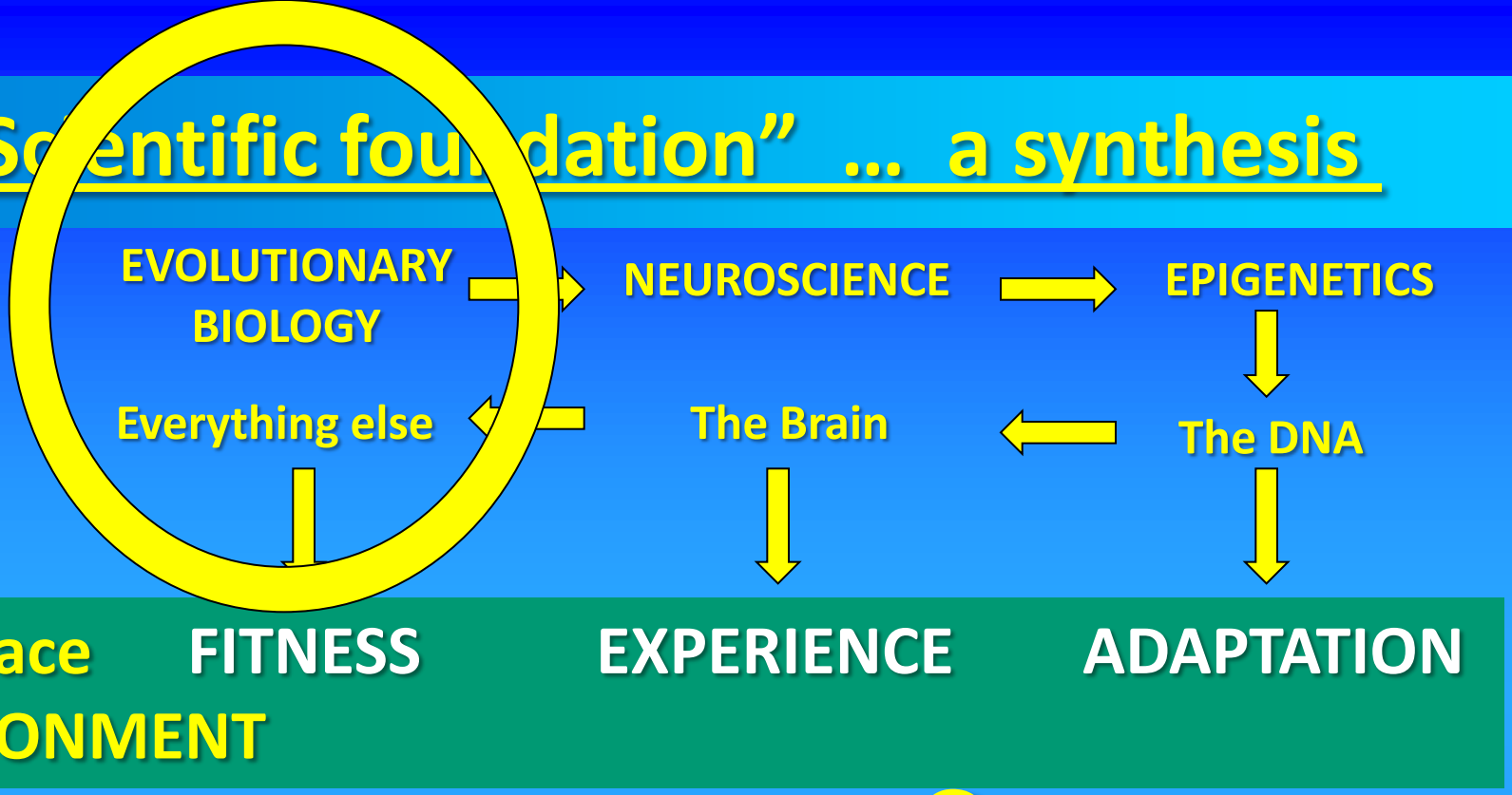

SENSORY STIMULATION
SKIN-TO-SKIN CONTACT
EMOTIONAL EXCHANGES
Mutual OXYTOCIN
CRITICAL PERIOD PATHWAY FIRING
EMOTIONAL INTELLIGENCE
SOCIAL INTELLIGENCE


SENSORY STIMULATION
SKIN-TO-SKIN CONTACT
EMOTIONAL EXCHANGES
Mutual OXYTOCIN
BONDING
CRITICAL
PERIOD
PATHWAY
FIRING
EMOTIONAL
INTELLIGENCE
ATTACHMENT
SOCIAL
INTELLIGENCE

Scientific Foundation" … a synthesis

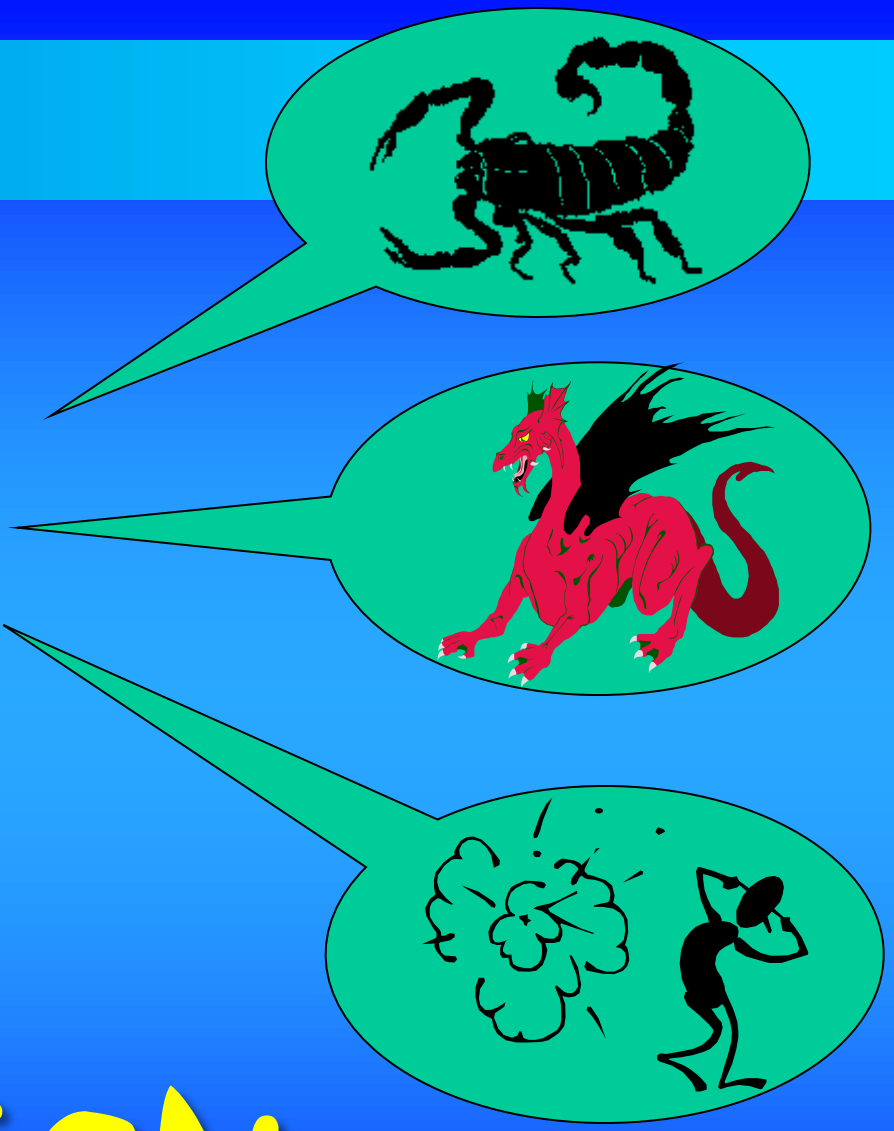


"Scientific foundation" … a synthesis

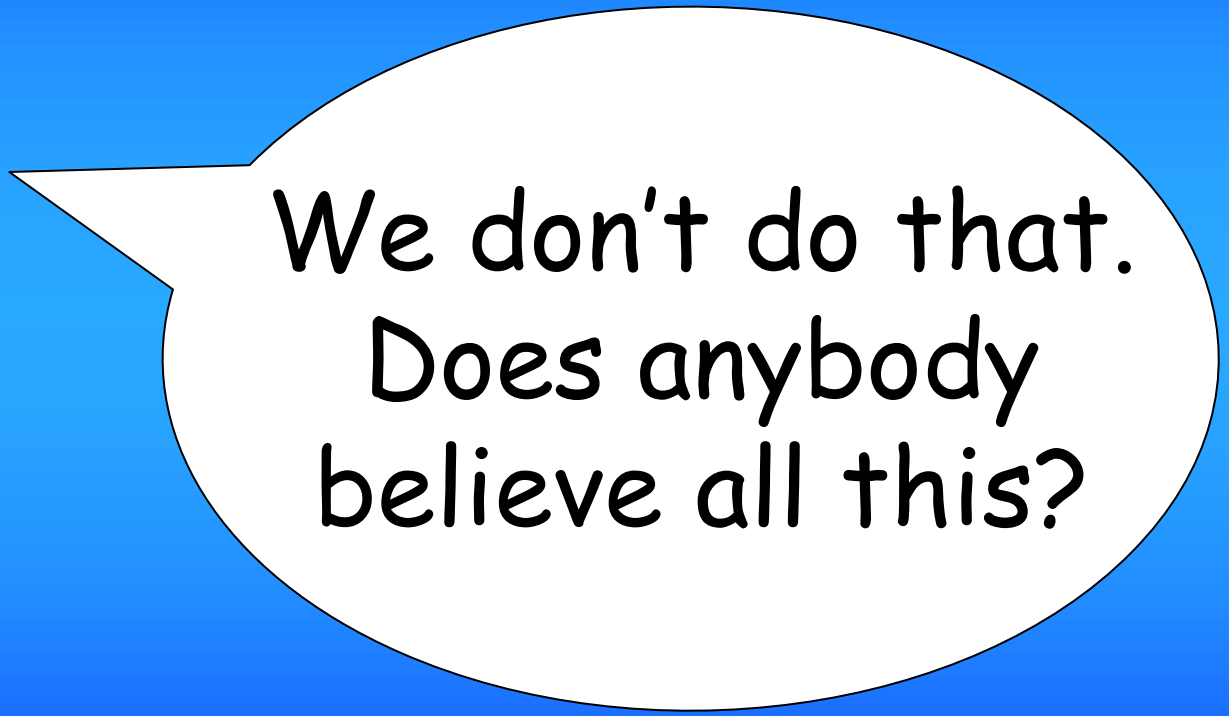


"in the light of mother's body."

ZERO SEPARATION



Grow Your Baby's Brain: the latest neuroscience



NO … BUT →

PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

Pediatrics 2012;129;e224; originally published online December 26, 2011;
DOI: 10.1542/peds.2011-2662

American Academy of Pediatrics

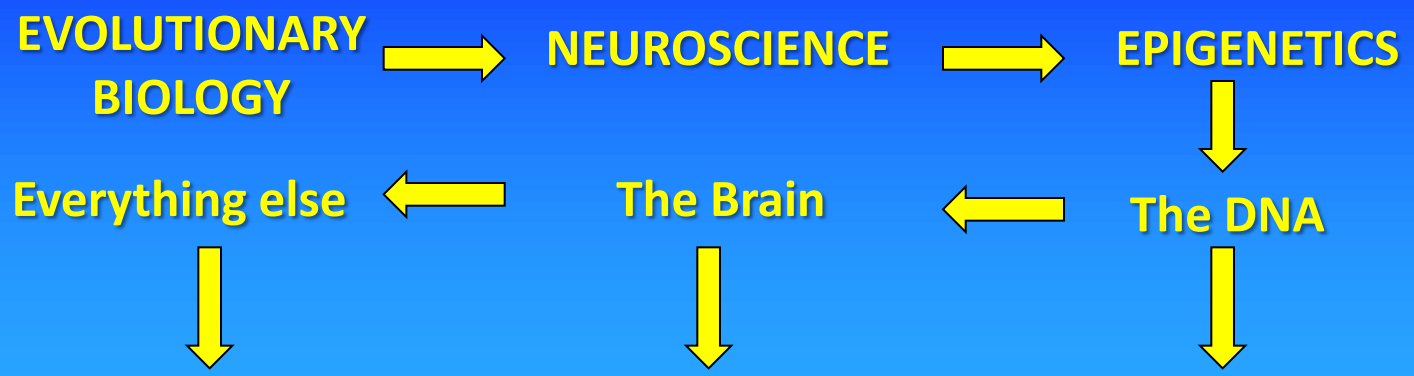
DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child Health Care System and/or Improve the Health of all Children

POLICY STATEMENT

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health

"Scientific foundation" … a synthesis

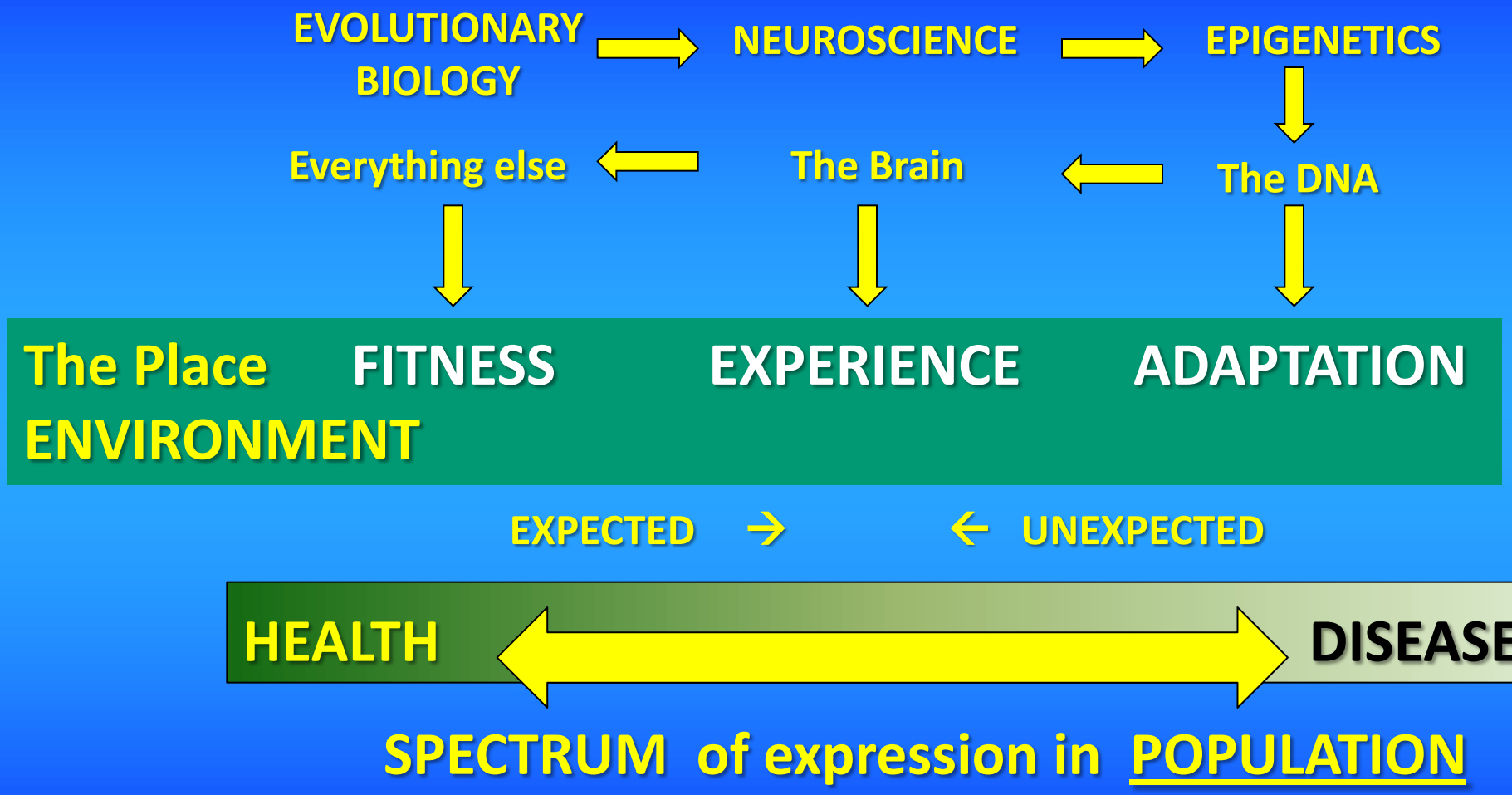


abstract

FREE

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



Platform for better understanding of PUBLIC HEALTH.

… policy and practice that impacts the care of mothers and babies.

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

TECHNICAL REPORT

The Lifelong Effects of Early Childhood Adversity and Toxic Stress

Jack P. Shonkoff, Andrew S. Garner, THE COMMITTEE ON PSYCHOSOCIAL ASPECTS OF CHILD AND FAMILY HEALTH, COMMITTEE ON EARLY CHILDHOOD, ADOPTION, AND DEPENDENT CARE, AND SECTION ON DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS, Benjamin S. Siegel, Mary I. Dobbins, Marian F. Earls, Andrew S. Garner, Laura McGuinn, John Pascoe and David L. Wood

Pediatrics 2012;129;e232; originally published online December 26, 2011;
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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-

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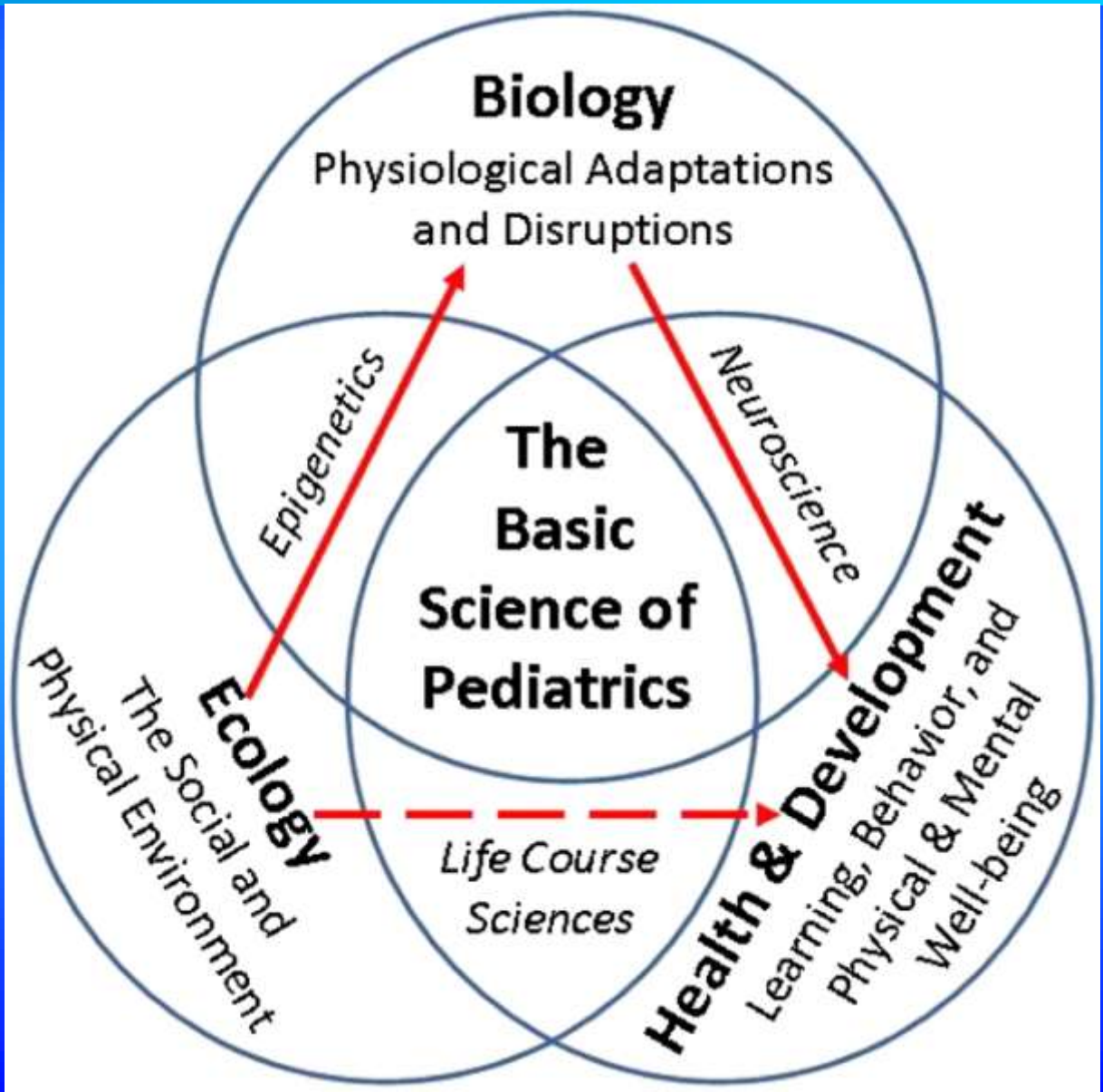
The basic science of pediatrics.

Shonkoff J P et al. Pediatrics 2012; 129:e232-e246

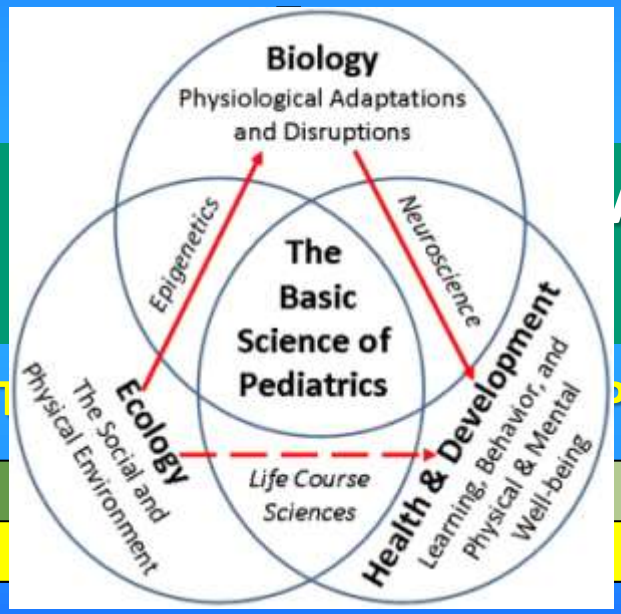


"Scientific foundation" … a synthesis

EVOLUTIONARY BIOLOGY → NEUROSCIENCE → EPIGENETICS

Everything else ← The Brain ← The DNA

The Place ENVIRONMENT — FITNESS — ADAPTATION



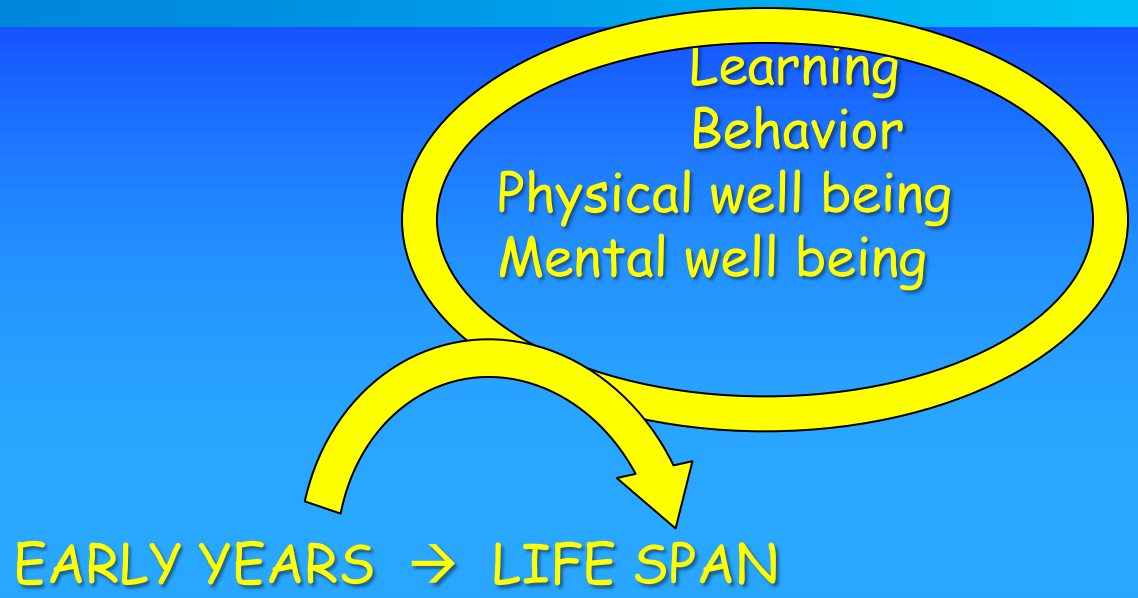
EXPECT … PECTED

HEALTH ← → DISEASE

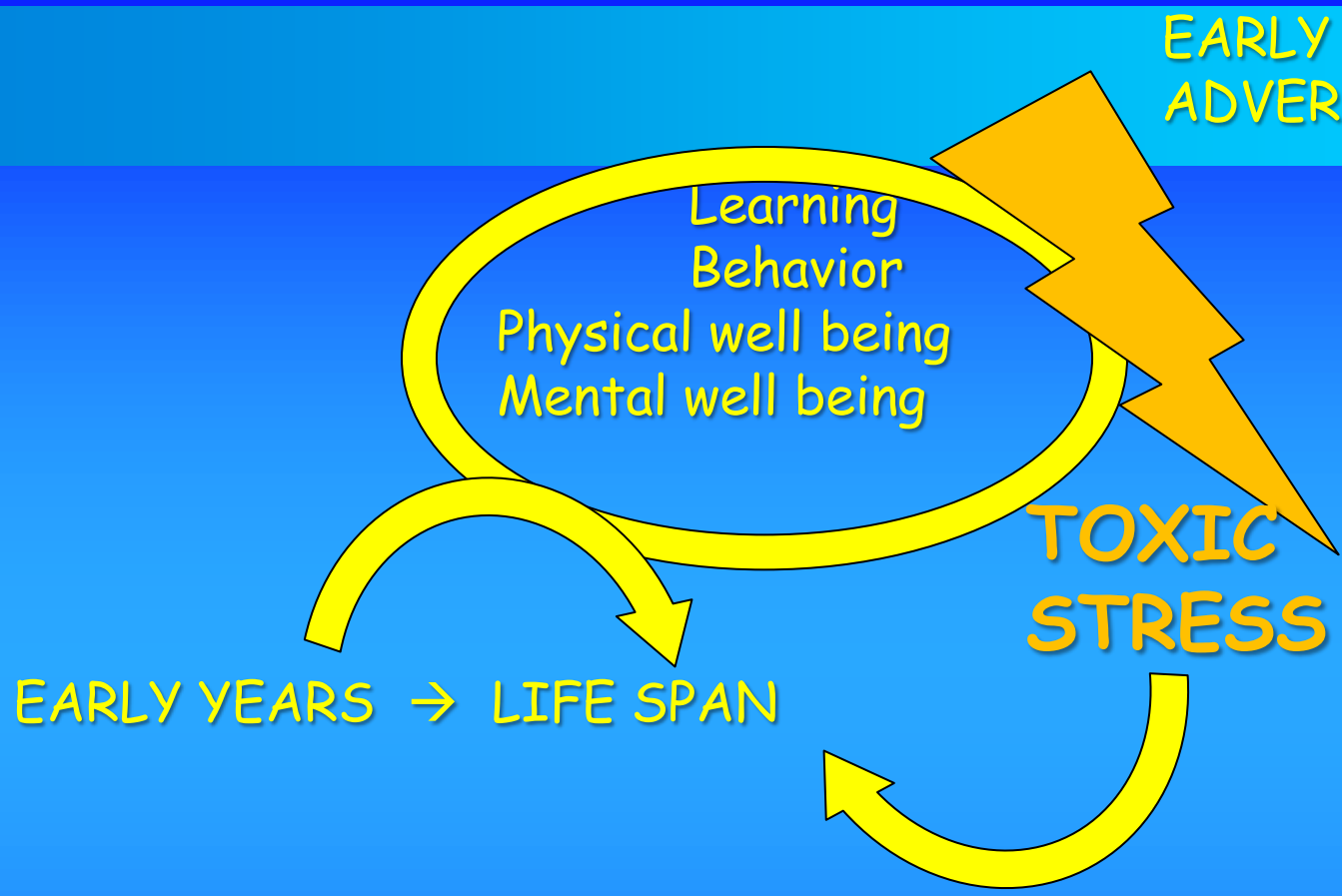
SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.

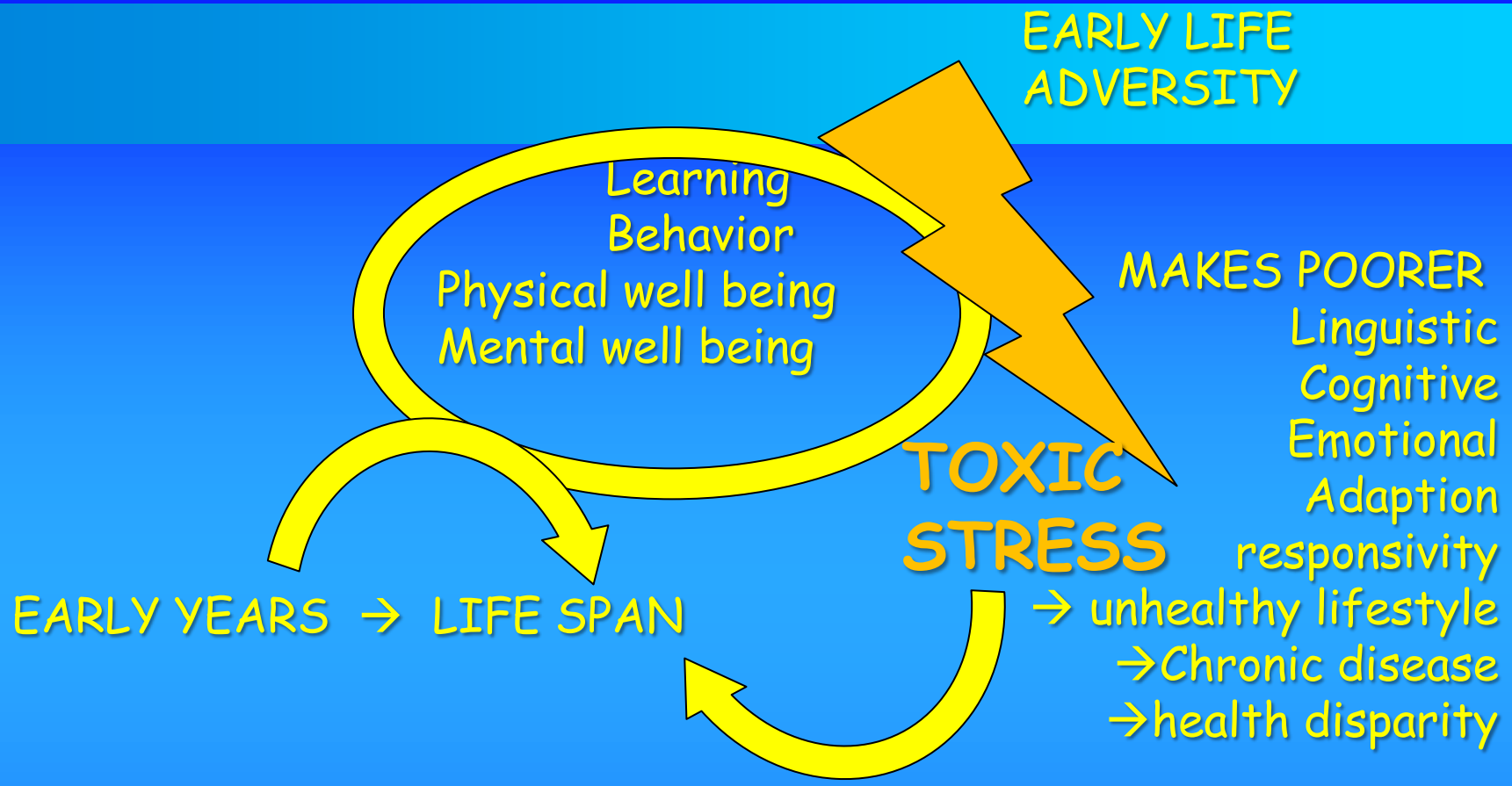
… policy and practice that impacts the care of mothers and babies.



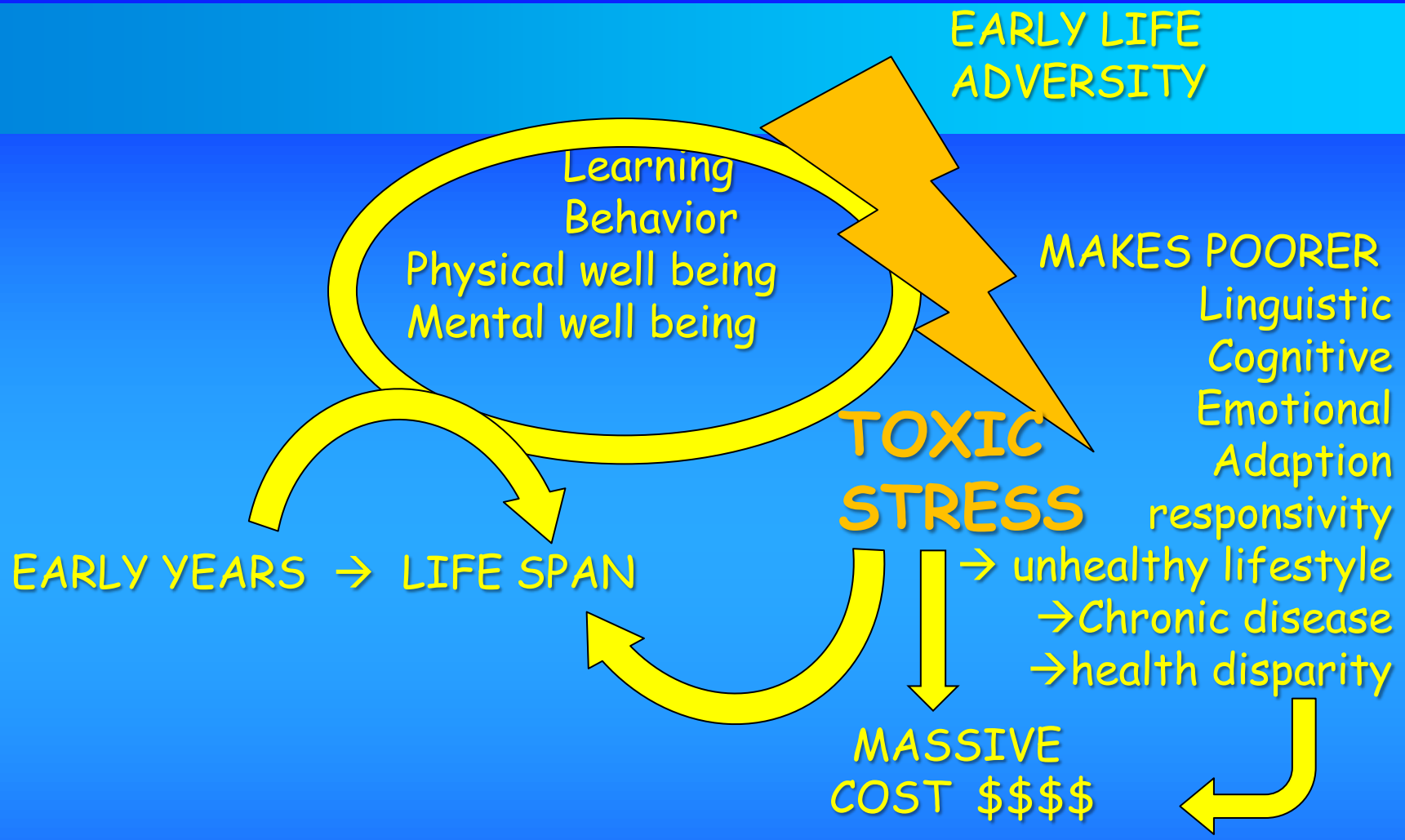
2 … advances in the biological sciences underscore the foundational importance of the early years and support an EBD framework for understanding the evolution of human health and disease across the life span.



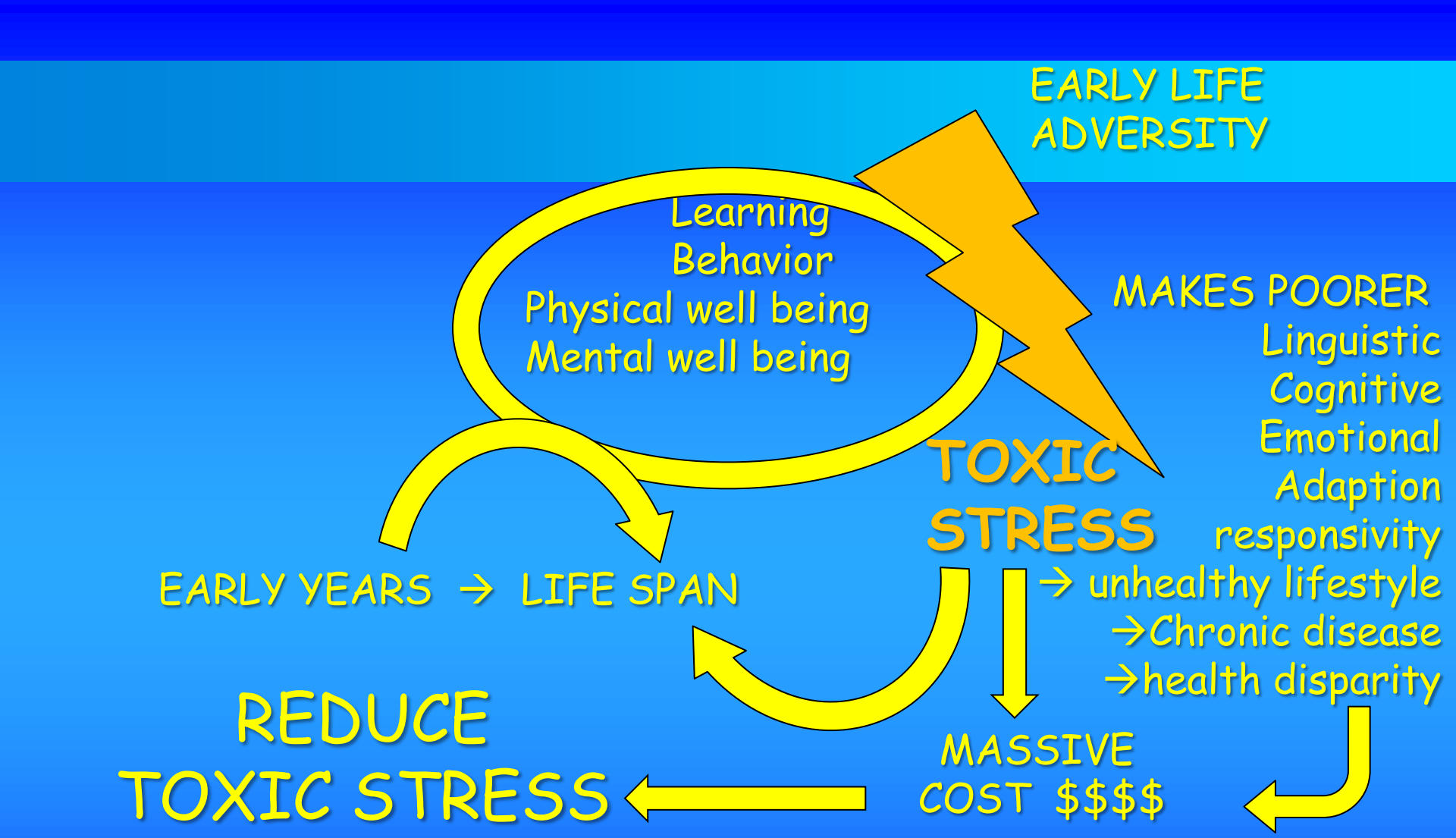
3. The biology of early childhood adversity reveals the important role of toxic stress in disrupting developing brain architecture and adversely affecting the concurrent development of other organ systems and regulatory functions.



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.

POLICY STATEMENT

Early Childhood Adversity, Toxic Stress, and the Role of the Pediatrician: Translating Developmental Science Into Lifelong Health

American Academy of Pediatrics
DEDICATED TO THE HEALTH OF ALL CHILDREN™

APPLICABILITY TO NEONATOLOGY ???

Question: do PRETERMS experience TOXIC STRESS ??

(Modi & Glover 1998, Mooncey 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):

	Cortisol	Endorphin
Massage	slightly lower	no change
Soft music	no change	no change
Skin-to-skin	**66% lower**	**74% lower**

SSC - PROTECTION

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Stress hormones at such levels are **neurotoxic**.

SEPARATION RAISES STRESS HORMONES

	Cortisol	Endorphin
Massage	slightly lower	no change
Soft music	no change	no change
Skin-to-skin	**66% lower**	**74% lower**

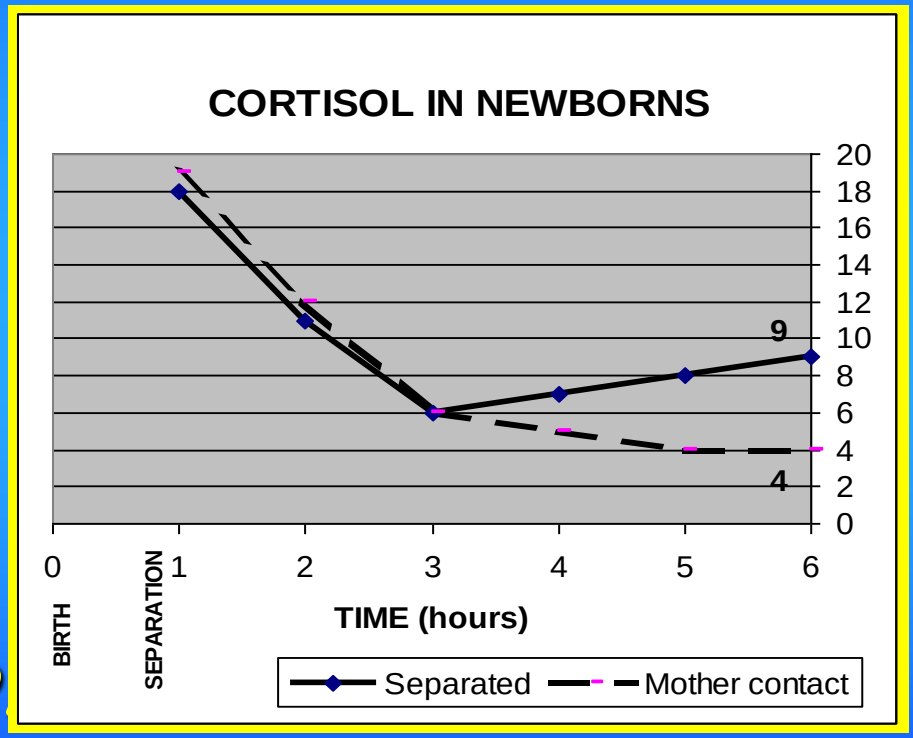
SSC - RESEARCH protection

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

SEP



PEDIATRICS®
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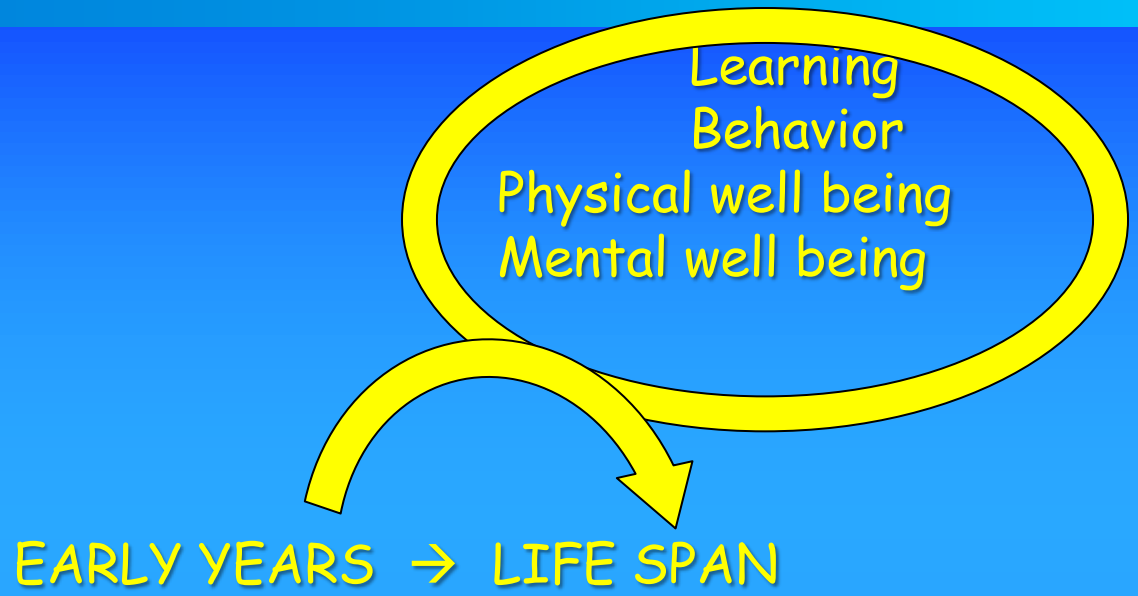
Preterm infants have
LESS RESILIENCE →
Need "ideal" EEA

TOXIC STRESS
concerns the NEONATOLOGIST
more than the PEDIATRICIAN

BERGMAN COMMENTARY - NEWBORN

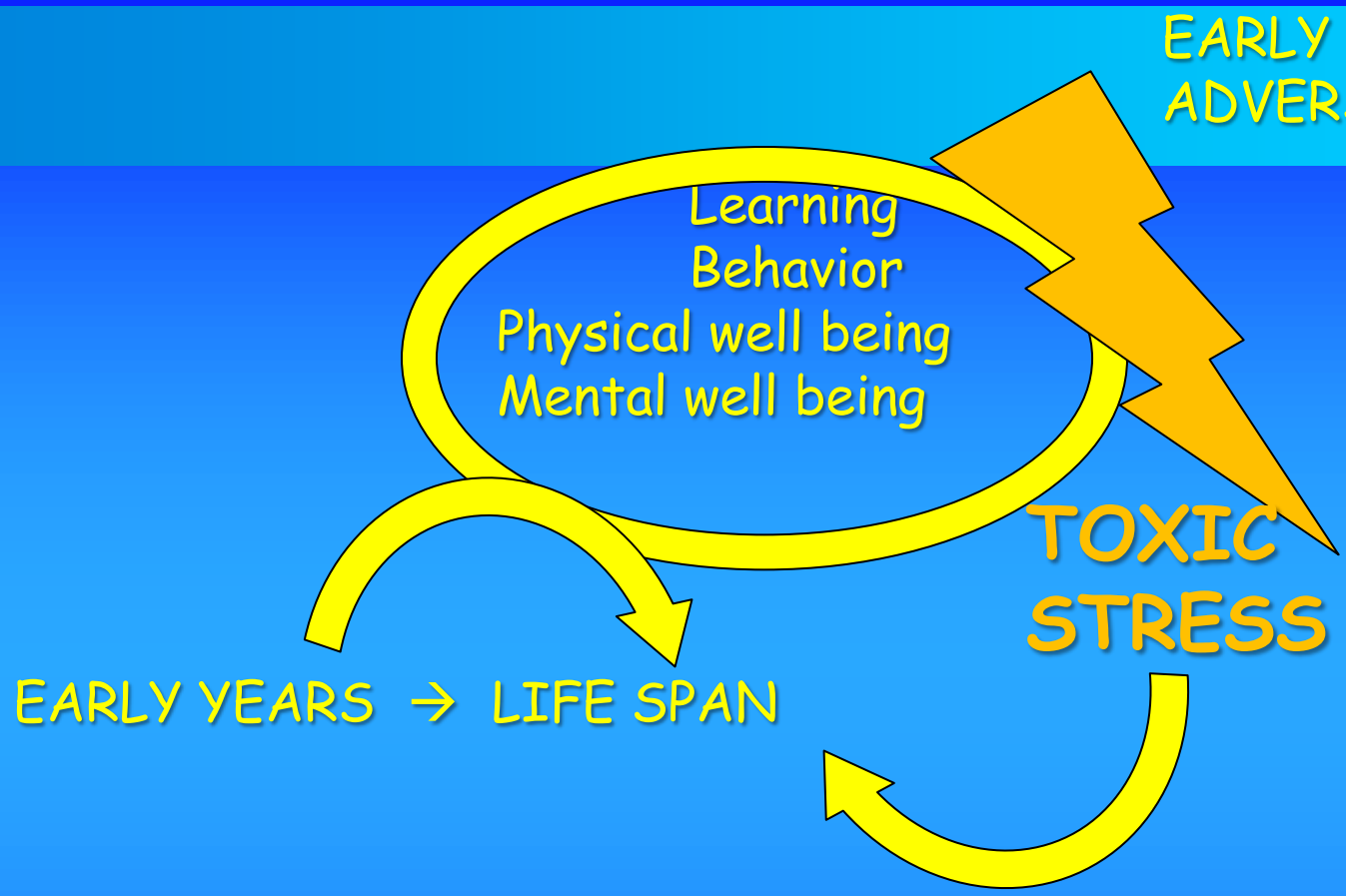
The basic science of pediatrics.

For newborn:
it is MOTHER
that is
ecology,
biology,
development

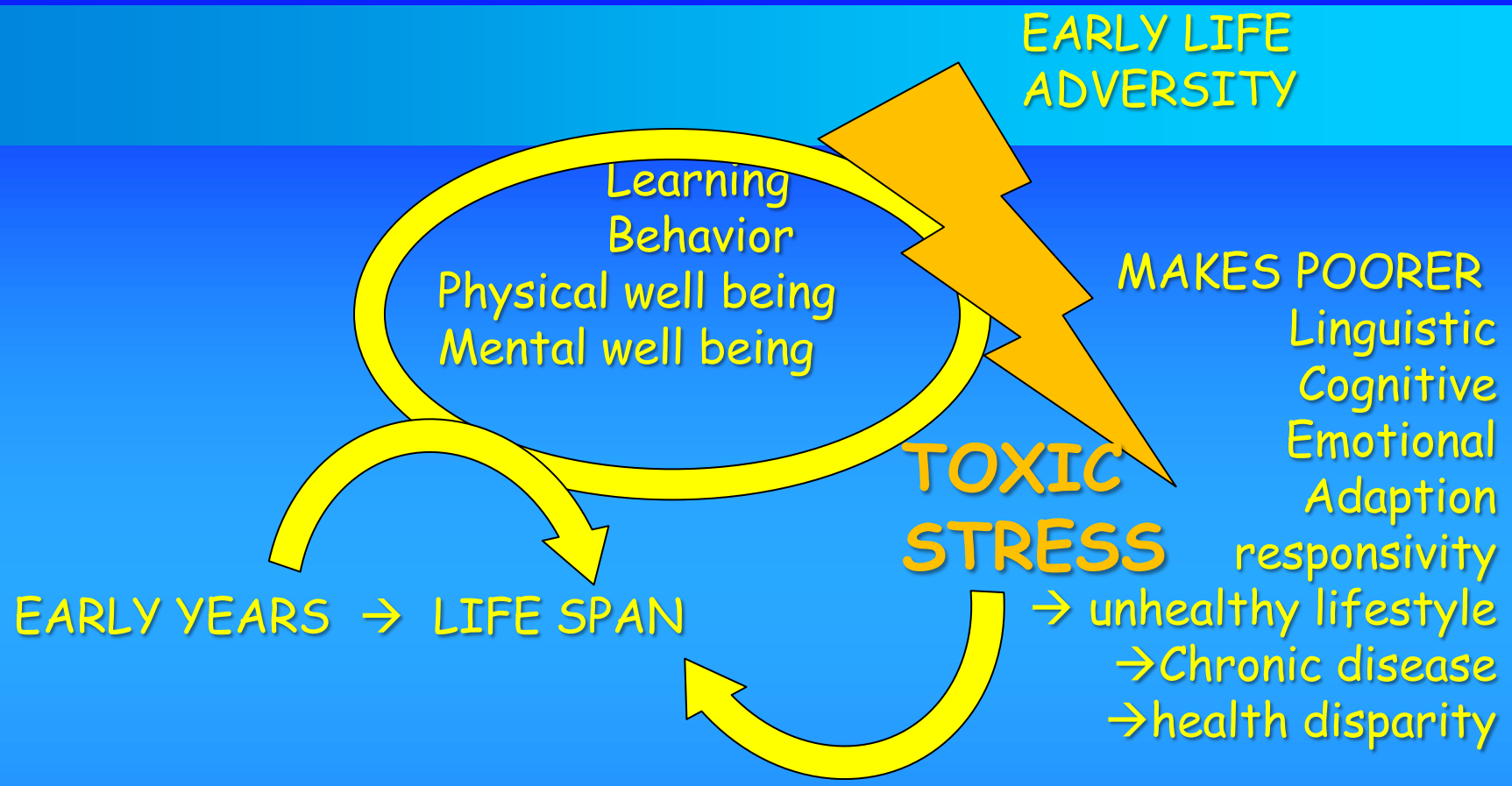


BERGMAN COMMENTARY - NEWBORN

Early years = early hours & days



BERGMAN COMMENTARY - NEWBORN
Maternal absence is TOXIC STRESS

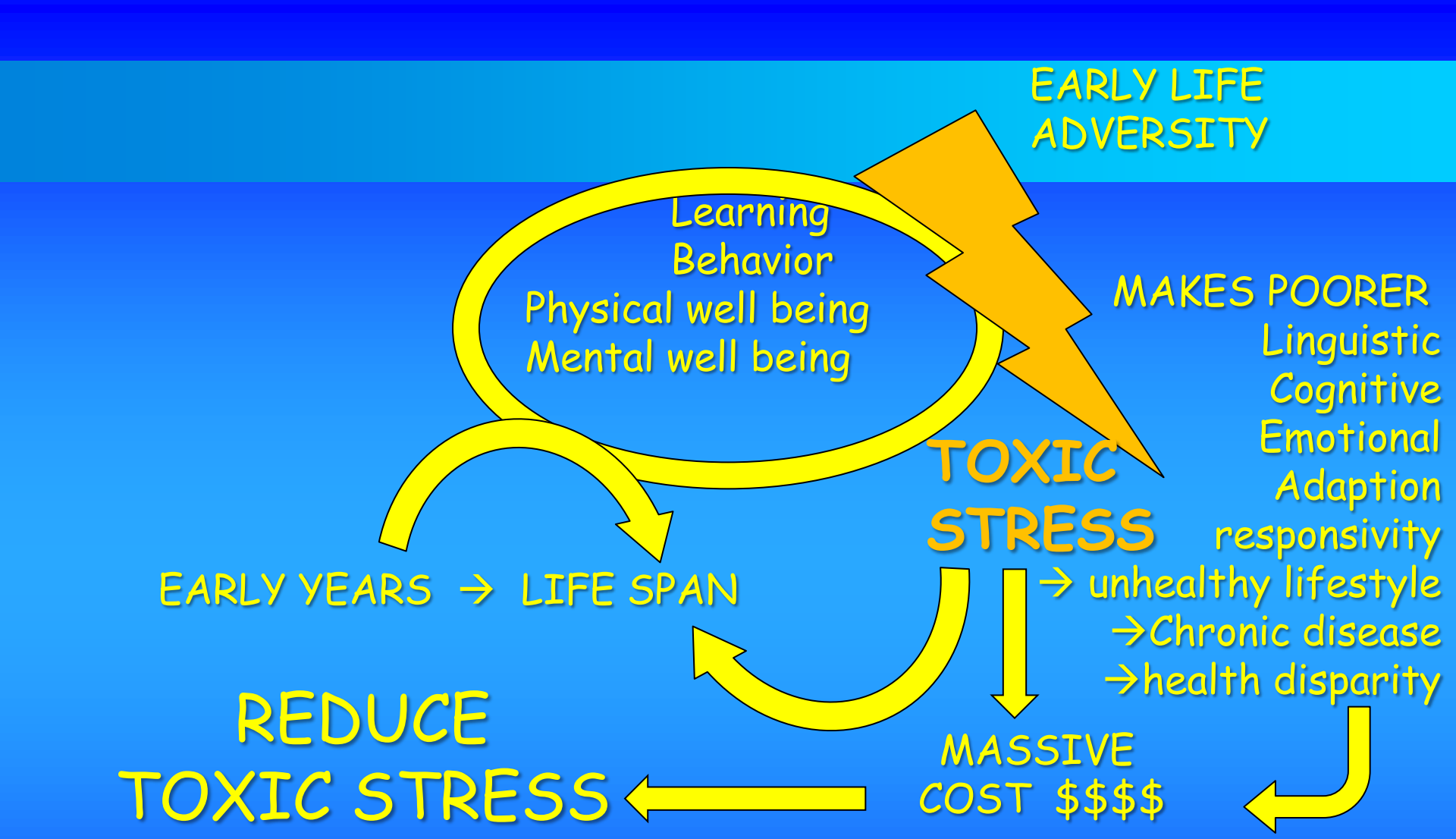


BERGMAN COMMENTARY - NEWBORN

For separated preterm newborns, we have decades of evidence for this.

BERGMAN COMMENTARY – NEWBORN

even more massive ??

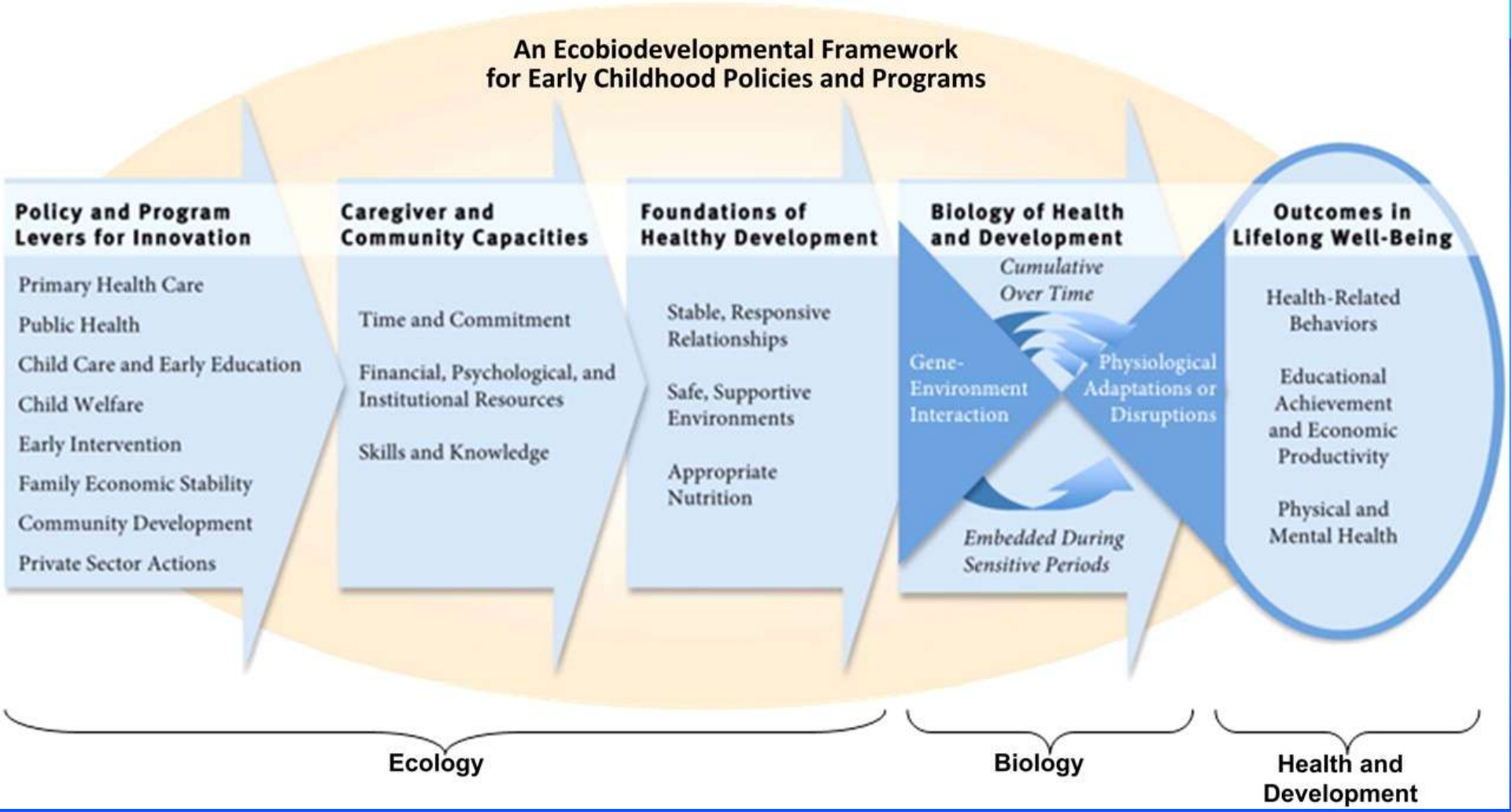


BERGMAN COMMENTARY - NEWBORN

Reducing toxic stress IS VERY EASY !!

KEEP
US
TOGETHER

An ecobiodevelopmental framework for early childhood policies and programs.



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PEDIATRICS®

Innovative strategies …

… reduce toxic stress

Creative new strategies

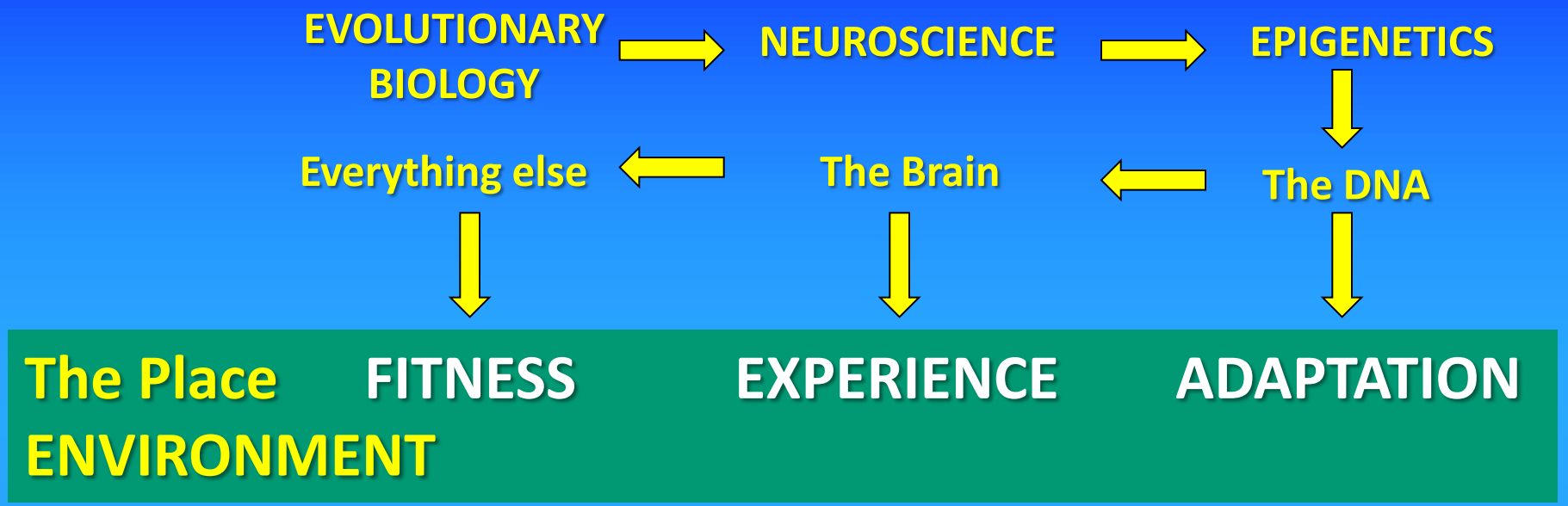
"compelling need for bold new strategies"

"compelling need for bold new strategies"
NOT → Kangaroo Care !!!

BUT …
Developmental science
(ecobiodevelopmental)

APPLYING PRIMATE EVOLUTIONARY BIOLOGY

"Scientific foundation" … a synthesis



SPECTRUM of expression in POPULATION

Platform for better understanding of PUBLIC HEALTH.

… policy and practice that impacts the care of mothers and babies.

Jack SHONKOFF - *CHALLENGE !*

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,

Child Development, Jan/Feb 2010 Volume 81 Number 1 Pages 357 - 367

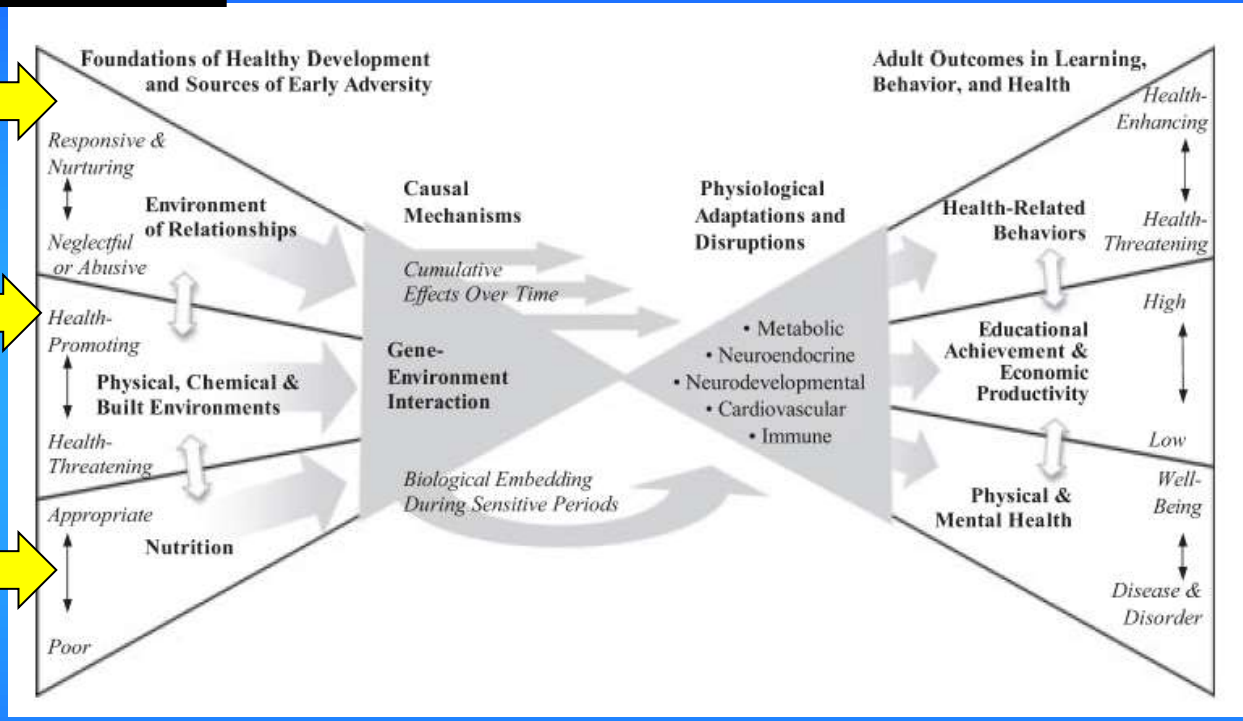
Attachment

Bonding

Skin-to-Skin Contact

Breast-feeding

Regulation



Attachment

Bonding

Skin-to-Skin Contact

Breast-feeding

Regulation

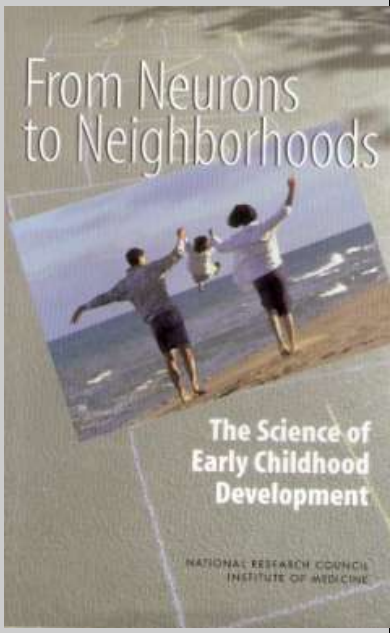
Relationships

Safe places

Nutrition

Emotional & social IQ

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)

www.skintoskincontact.com

The right start
to life makes
parenting so
much easier !
Parenting is more
enjoyable and fulfulling,
an actively engaging baby is
just much more fun!

Personally I feel that one of the biggest discoveries in the field of pediatrics in my time is the concept that the newborn child is a small human being, with all its senses developed, open and receptive."

(John Lind, 1979)

... 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,
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