EARLY BRAIN AND CHILDHOOD DEVELOPMENT

WILLIAM M BELLAS, DO, FAAP
SANFORD CHILDREN'S HOSPITAL
DIVISION OF NEONATAL-PERINATAL MEDICINE
CLINICAL ASSOCIATE PROFESSOR OF PEDIATRICS
UND SCHOOL OF MEDICINE & HEALTH SCIENCES

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I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation

OBJECTIVES

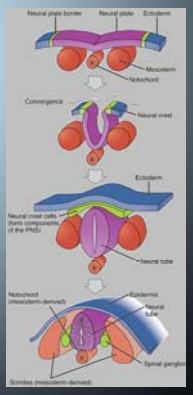
1. Understand the difference between positive and toxic stress in the fetal, premie/term brain
2. Identify some of the lifelong consequences of toxic fetal, premie/term adversity
3. Understand how these early environmental factors and developmental changes may affect epigenetics to result in lifelong consequences

INTRODUCTION

- Brains are built over time through a process that begins prenatally and continues into adulthood
- Its architecture is built in a cumulative, bottom-up manner.
- Simple circuits become more complex and integrated
- A gene-experience interplay (nature/nurture) shapes the architecture of the developing brain
- Based on this interplay, either a sturdy or fragile brain architecture will result

BRAIN: DEVELOPMENT

- Begins 18th to 24th day
- Myelination
- Synaptogenesis
  - At birth 50 trillion synapses
  - At 1 year 1000 trillion
- Pruning
  - "Use-it-or-lose-it"
  - At 20 years 500 trillion



BRAIN: MATURATION

BRAIN: PLASTICITY

- The ability of the brain to reorganize and adapt
- The brain is constantly changing, and plasticity varies across all brain areas
- It is greatest during the 1st years of life and declines with age
- Affords an opportunity to overcome early adversity
- Types include: Synaptic and cellular plasticity

STRESS: OVERVIEW

- Stress is a healthy part of normal development
- The body undergoes physiological changes into high alert to respond to challenges
- When stress is relieved, the stress response ramps down and the body returns to normal or basal state

CHILDHOOD EXPERIENCES & ADULT OUTCOMES

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Childhood Adversity + Toxic Stress = Poor Adult Outcomes

STRESS: PRENATAL

POSITIVE

- Nutritious diet
- Frequent exercise
- Treatment acute/chronic disease
- Avoidance high-risk behaviors

TOXIC

- Placental dysfunction
- Malnutrition
- Maladaptive stress management (i.e. anxiety disorder)
- Maternal drug use
- Untreated chronic disease


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Reproductive Toxicology

journal homepage: www.elsevier.com/locate/reprotox

Prenatal origin of obesity and their complications: Gestational diabetes, maternal overweight and the paradoxical effects of fetal growth restriction and macrosomia

Asher Ornoy*

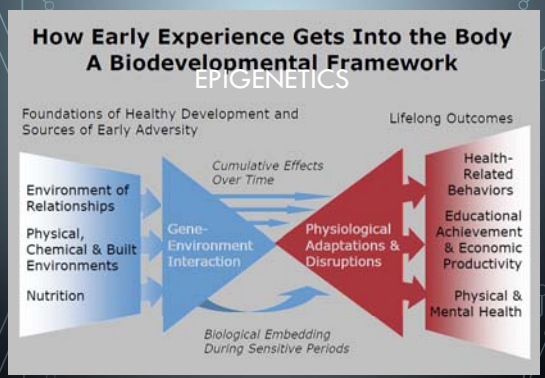
STRESS: MATERNAL DIABETES

- Pre-gestational and Gestational
- Associated
  - Fetal/newborn death
  - Congenital anomalies
  - Neurodevelopmental problems
  - Fetal growth disturbances (SGA vs LGA)
- Controlled maternal serum glucose reduces these changes

STRESS: MATERNAL DIABETES

- Long lasting effects include
  - Overweight and obesity during childhood
  - "Metabolic syndrome" or "Metabolic imprinting"
    - Hypertension
    - Cardiovascular complications
    - Type II diabetes
- Mechanisms are not fully known but…
  - Insulin resistance, Fetal hyperleptinemia, hypothalamic changes, and epigenetic changes
- Preventive measures include dietary control and physical activitty

How Early Experience Gets Into the Body
A Biodevelopmental Framework
EPIGENETICS

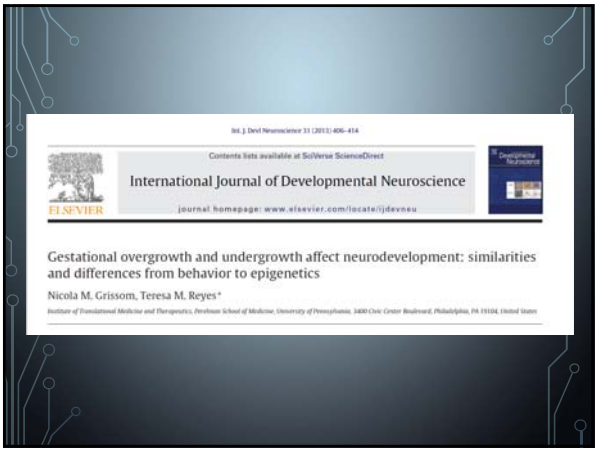


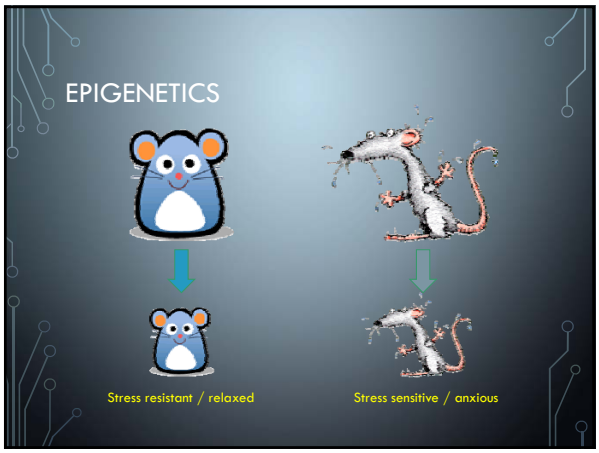
EPIGENETICS

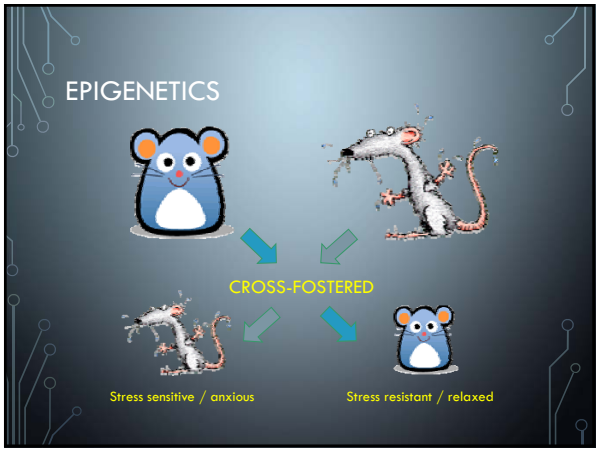
- Ecology influences how the genetic blueprint is read and utilized
- Which genes, when, and where
- Ecology effects "Molecul-ology" at the genetic level
- Stress-induced changes in gene expression

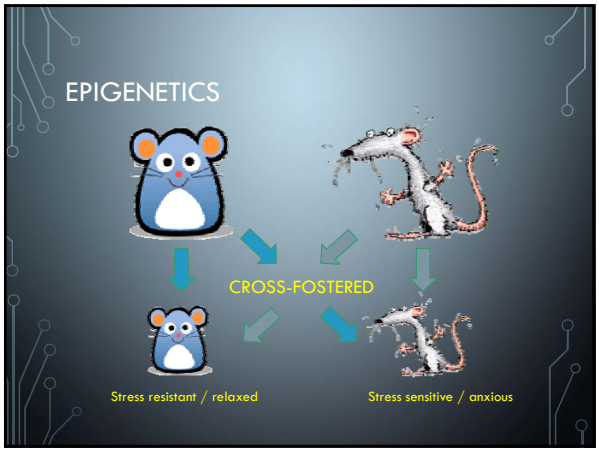
EPIGENETICS

- "Above the genome"
- Represent the way in which the environment causes long-lasting changes in a cell or organism and its progeny without altering the DNA sequence
- The major processes: histone modification, DNA methylation and microRNAs in the development of the nervous system and the formation of behavior




EPIGENETICS
Stress resistant / relaxed
Stress sensitive / anxious


EPIGENETICS
CROSS-FOSTERED
Stress sensitive / anxious
Stress resistant / relaxed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CHALLENGES

- The critical challenge now is to translate advances in developmental science into effective policies and practices for families with children

QUESTIONS

- Is child abuse a positive or toxic stress?
- On a cellular level, how does toxic stress affect your baby?
- Does toxic stress in fetal/newborn period increase your risk for diabetes as an adult?

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