

Does maternal psychological stress harm the developing fetus?



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ACF meeting
Washington DC
March 13, 2012

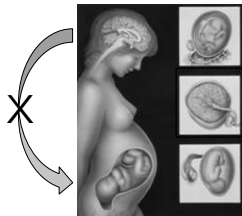


“For behold, the moment that the sound of thy greeting came to my ears, the babe in my womb leapt for joy.” *Luke 1:44*

“When a pregnant woman falls, the baby in the womb answers” *West African Proverb*

“He’s not right. It was grief that caused the boy to be like he is. Wavey was carrying him when Sevenseas Hector went over. Lost her husband”.
The Shipping News (1993), A. Proulx

The maternal-fetal interface



Challenges of linking developmental outcomes to prenatal, biological effects on the developing brain:

Development is difficult to measure

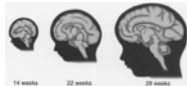
- ▶ Maternal report of child temperament, development, behavior, etc. is not a suitable method in studies on this topic

Psychological stress is difficult to measure

- ▶ Paper and pencils of stress, anxiety, depression, are all highly related and difficult to distinguish from one another and from maternal **personality**

Animal models may provide little insight into human experience and animal models have mixed results

Challenges of linking developmental outcomes to prenatal, biological effects on the developing brain:



Inability to randomly assign

- ▶ Prenatal and postnatal risks covary
- ▶ Shared inheritance

Use of a novel design to disentangle inherited vs exposure effects

Does prenatal maternal stress cause adverse child mental health outcomes?

779 women using IVF:
574 related; 205 genetically unrelated

→ Child anxiety: initial association with maternal prenatal stress in unrelated pairs but disappeared when controlled for maternal postnatal anxiety

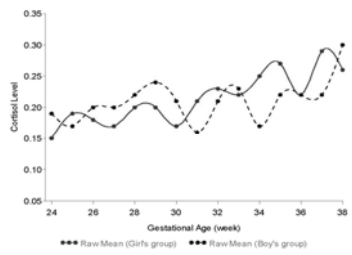
→ Child ADHD symptoms: Significant association with prenatal maternal stress only in genetically related offspring

→ Child behavioral problems: Significance of prenatal stress persisted after appropriate controls

Note: novel design promising but still relies on maternal report

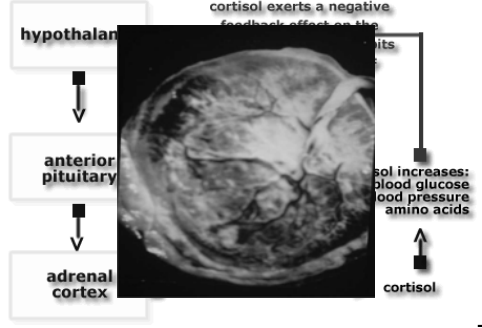
Rice et al, 2010

Pregnancy is a state of natural hypercortisolism



DiPietro et al (2010)
Psychoneuroendocrinology

The Pituitary-Adrenal-Axis



Maternal circulating cortisol is essentially unrelated to how anxious, depressed or stressed pregnant women feel:

e.g., Wadhwa et al., (1996); Petraglia et al., (2001); Buitelaar et al., (2003); Gutteling et al., (2007); Pleuss et al., (2010), Voegtline et al (under review), etc.

When detected, associations are very small:

e.g., Sukar et al (2006); women awaiting amniocentesis.
 $r = .18$ plasma cortisol - anxiety

Johns Hopkins Fetal Neurobehavioral
Development Project (est. 1991)
(DiPietro & Costigan)

- Core hypotheses:
- a. Neurodevelopment during the fetal period indicates patency of the developing nervous system
 - b. Individual differences that are observable during early childhood are established and measurable during the fetal period

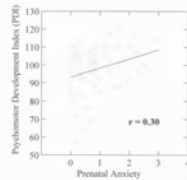
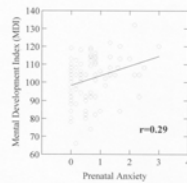
AIMS:

- Document ontogeny in the human fetus
- Evaluate antenatal stability
- Predict child outcomes from fetal measurement
- Examine maternal factors that influence the fetus
- Identify maternal changes during gestation
- Examine fetal factors that influence the mother

Associations between MDI/PDI
at age 2 and prenatal maternal
anxiety ($n = 94$)

*Significant positive associations
persist after controlling for
postnatal anxiety, stress, &
depression at 6 weeks postnatal
and 24 months

DiPietro, Novak et al.
(2006). *Child Dev*

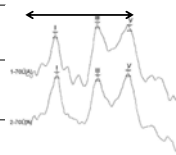


Brainstem auditory evoked potential



Associations between prenatal stress and newborn BAEP ($n = 47$)

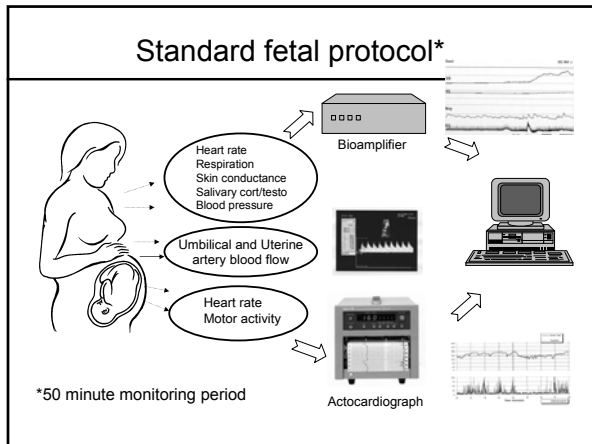
	Pregnancy stress*	Cortisol >33 wks
Wave V latency	-.35*	-.39**
I-V Interpeak interval	-.27 ⁺	-.29*
III-V Interpeak Interval	-.30*	-.35*
Irritability ($n = 97$)	.28**	.05

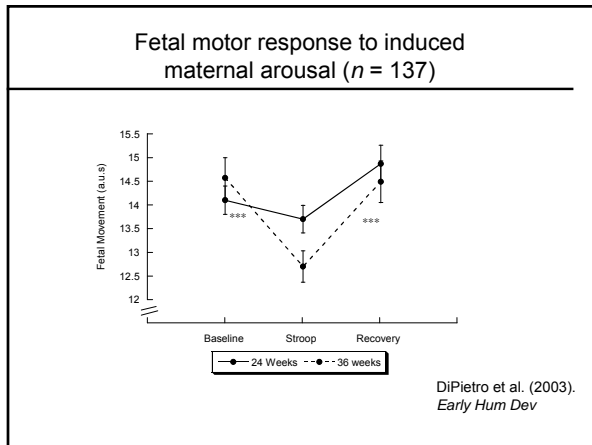


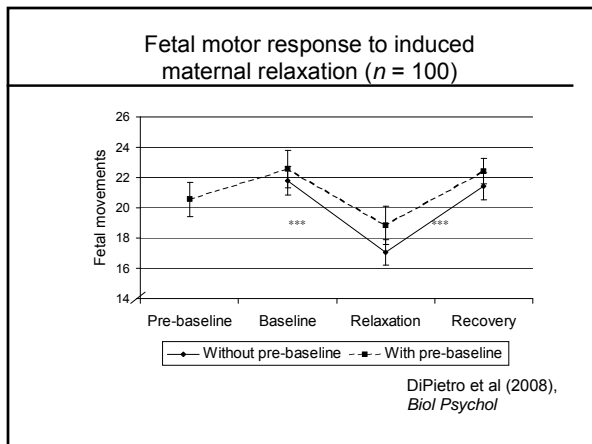
*DiPietro et al (2010), *Child Dev*

Based on the totality of the **existing** literature, the current evidence that maternal stress during pregnancy **harms** the developing human fetal brain, as reflected by disordered child development, is not compelling.

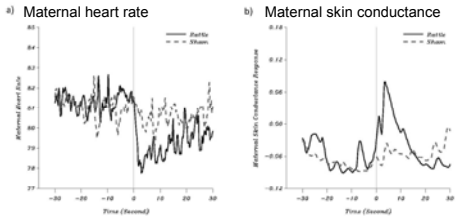
However, because maternal psychological distress adversely affects early parenting, and prenatal maternal distress predicts postnatal maternal distress, pregnancy provides a key opportunity for maternal mental health interventions, particularly given the number of provider contacts that occur in routine prenatal care.







Maternal response to evoked fetal response



Yerkes-Dodson Law of arousal (1908)

