

# UNICEF/BabyFriendly Conference 2014

## Epigenetics and Breastfeeding – The Potential Long-term Impact of Breastmilk

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### **Abstract:**

Recent research on epigenetics, literally meaning above the gene, has led medical professionals to query about how the environment impacts the developing baby both in utero and throughout its lifetime. The genome is the genetic information inherited from one's parents, but the epigenome is what deciphers the genome for each cell throughout the body. This deciphering process is impacted by both the internal and external environment of an individual. The external environment can include nutrition, chemicals, toxins, etc. The internal environment would include neuropeptides (emotional molecules) and stress hormones. The environment changes the proteins in the body that help the epigenome translate DNA. This finding has increased awareness of the importance of nutrition on the epigenome. Studies now are finding that the changes in the epigenome can influence not only that individual but can be passed along to future progeny, sometimes four generations out. The first nutrition for a human outside the womb is breastmilk, and thus its epigenetic impact is potentially expansive. New research has expanded the field of epigenetics to include breastmilk and how it potentially changes the epigenome and can affect the lifelong health of a baby. This presentation focuses on some of the latest published research- milksharing/wet nursing and the epigenome, breastmilk, and changes in gene expression and gut flora.

### **Learning Objectives:**

- Define genome and epigenome.
- Identify at least one way breastmilk can potentially influence the epigenome of a baby.
- Identify one way that epigenetics can influence gut flora.

## **Outline:**

- 1.) What is epigenetics?
  - a. Genome=DNA
  - b. Epigenome=Phenotype
- 2.) How does epigenetics work?
  - a. Epigenome
  - b. Translator
  - c. Methylation
  - d. Histones
  - e. mRNA
- 3.) Developmental Origins
  - a. Metabolism
  - b. Hormone Production
  - c. Tissue Sensitivity
  - d. Growth and metabolism
  - e. The Microbiome
  - f. Inheritance based on environment
  - g. Animal research
  - h. Human research
- 4.) Breastfeeding and Epigenetics
  - a. Nutritional programming
  - b. Abundant resources, immune support, healthy food
  - c. Limited resources, immune challenge, poor nutrition
- 5.) Epigenetics and Human Studies Involving Breastmilk
  - a. Leptin Gene
  - b. Milk Kinship
  - c. Micro RNA in breastmilk
  - d. Formula and the epigenome
- 6.) Considerations for Practice

## **References/Bibliography:**

1. Bayol SA & Stickland NC. Maternal “junk food” diet and post-natal development. *Nova Acta Leopoldina*. 2011; 382:21-26.
2. Begum, G. et al., A. Epigenetic changes in fetal hypothalamic energy regulating pathways are associated with maternal

- undernutrition and twinning. *The FASEB Journal*, 2012; 26 (4): 1694 DOI: 10.1096/fj.11-198762
3. Black RE, Allen LH, Bhutta ZA, et al. Maternal and child undernutrition: global and regional exposures and health consequences. *Lancet*. 2008;371(9608):243-260.
  4. Canani, R et al. Epigenetic mechanisms elicited by nutrition in early life. *Nutrition research reviews*, 2011. 24; 198-205.
  5. DOHaD. International Society for the Developmental Origins of Health and Disease. Available at <http://www.mrc.soton.ac.uk/dohad/index.asp>. Accessed 14 January 2013.
  6. Doneray H, Orbak Z, Yildiz L: The relationship between breast milk leptin and neonatal weight gain. *Acta Paediatr*. 98(4), 643–647 (2009).
  7. Einstein, Francine. Challenges of Linking Early-Life Conditions and Disease Susceptibility. *Diabetes May* 2012 61:981-982; doi:10.2337/db12-0087
  8. Gluckman PD, Hanson MA. Living with the past: evolution, development and patterns of disease. *Science* 2004;305:1733–6.
  9. Ilcol YO, Hizli ZB, Ozkan T: Leptin concentration in breast milk and its relationship to duration of lactation and hormonal status. *Int. Breastfeed J*. 1, 21(2006).
  10. Kosaka et al.: microRNA as a new immune-regulatory agent in breast milk. *Silence*, 2010,1:7.
  11. Kuzawa, C. W. and Sweet, E. (2009), Epigenetics and the embodiment of race: Developmental origins of US racial disparities in cardiovascular health. *Am. J. Hum. Biol.*, 21: 2–15. doi: 10.1002/ajhb.20822
  12. Kuwaza, C. et al. Timescale of human adaptation: the role of epigenetic processes. *Epigenomics*, 3(2), 221-234, 2011.
  13. Kuzawa CW: Fetal origins of developmental plasticity: are fetal cues reliable predictors of future nutritional environments? *Am. J. Human Biol*. 17(1), 5–21 (2005).
  14. Langley-Evans, SC. Nutrition in early life and the programming of adult disease: a review. [J Hum Nutr Diet](#). 2014 Jan 31. doi: 10.1111/jhn.12212.
  15. Miralles O, Sanchez J, Palou A, Pico C: A physiological role of breast milk leptin in body weight control in developing infants. *Obesity (Silver Spring)* 14(8), 1371–1377 (2006).

16. National Institutes of Health. National Human Genome Research Institute. All About the Human Genome Project. Accessed Jan 2014. <http://www.genome.gov/10001772>
17. Nilsson, E et al. Environmentally Induces Transgenerational Inheritance of Ovarian Disease. PLOS One. May 03, 2012 DOI: 10.1371/journal.pone.0036129
18. Obermann-Borst, S et al. Duration of breastfeeding and gender are associated with methylation of the Leptin gene in very young children. *Pediatr Res* 74: 344-349; advance online publication, July 24, 2013; doi:10.1038/pr.2013.95
19. Ozkan et al.: Milk kinship hypothesis in light of epigenetic knowledge. *Clinical Epigenetics* 2012, 4-14.
20. Park, Chung. Role of compensatory mammary growth in epigenetic control of gene expression. *FASEB Journal*, 2005. Vol 19, no. 12.
21. Rasmussen KM, Habicht J-P: Maternal supplementation differentially affects the mother and newborn. *J. Nutr.* 140(2), 402-406 (2010).
22. Savino F, Liguori SA, Fissore MF, Oggero R: Breast milk hormones and their protective effect on obesity. *Int. J. Pediatr. Endocrinol.* 2009, 327505 (2009).
23. Savino F, Liguori SA, Oggero R, Silvestro L, Miniero R: Maternal BMI and serum leptin concentration of infants in the first year of life. *Acta Paediatr.* 95(4), 414-418 (2006).
24. Simmons, R. Epigenetics and maternal nutrition: nature v. nurture. *Proc Nutr Soc.* Nov 29:1-9, 2010.
25. Thayer, Z et al. Biological memories of past environments. *Epigenetics* 6:7, 798-803: July 2011.
26. T.H.-T. Tan, et al. The Role of Genetics and Environment in the Rise of Childhood Food Allergy. *Clinical and Experimental Allergy.* 2012 (42) 20-29.
27. Valles, Y. et al. Metagenomics and the development of the gut microbiota in infants. [http://www.lcg.unam.mx/frontiers/files/frontiers/Valle%60s\\_etal\\_final.pdf](http://www.lcg.unam.mx/frontiers/files/frontiers/Valle%60s_etal_final.pdf)
28. Waly, M. et al. Prenatal and Postnatal Epigenetic Programming: Implications for GI, Immune, and Neuronal Function in Autism. *Autism Research and Treatment.* Volume 2012. <http://dx.doi.org/10.1155/2012/190930>

29. Waterland, Robert and Jirtle, Randy. Early Nutrition, Epigenetic Changes at Transposons and Imprinted Genes, and 20:63-68. 2004.