1. **Viewing Breastfeeding Beyond a Single Generation: The Potential Epigenetic Impact of Breastfeeding on Long Term Health**
   By Laurel Wilson, IBCLC, CLE, CCCE, CLD
   Author of The Greatest Pregnancy Ever and The Attachment Pregnancy
2. **Why am I interested in epigenetics?**
3. **It's About History and Herstory**
4. **Traditional Thinking**
5. **How does epigenetics work?**
6. **What is epigenetics?**
7. **Nature and Nurture?**
8. **What is epigenetics?**
9. **Gene Switch**
10. **How does epigenetics work?**
    - ↗DNA Methylation
    - ↗Histone Modification
    - ↗mRNA
11. **Methylation**

    - ↗@30 million CpG Nucleotides that exist in a state of methylation
12. **Histone Modification**
    - ↗50 trillion cells in body
    - ↗6 linear feet of DNA in each one
13. **Histone Modification**
14. **Histone Modification**

    - ↗Deacelylated, condensed genes, difficult to access
    - ↗Acetylated, decompressed, easy access to genes

15. **mRNA**
    - ↗Messenger between DNA and Proteins that express genes through down regulation or translation

16. **Epigenome as Translator**
    - ↗Translator – How do cells differentiate the DNA?

- ↗The Epigenome!

17 **Epigenome as Translator**

Epigenetic Marks

18 **Imprinting**

19 **Imprinting**

20 **Epigenetics and Metabolism**

21 **How does this affect the babies?**

22 **Nutrigenomics**

- ↗Nutrients can directly or via hormonal activity influence the expression of genes
- ↗An entire new field now called nutrigenomics
- ↗What is the most important first food?

23 **Epigenetics at Work**

- ↗Food that goes in changes the enzymes in the gut
- ↗Fermentation of proteins of polysaccharides
- ↗Methyls and Acetyl Groups

24 **Breastmilk and the microbiome**

- ↗Artificial milk fed infants have completely different pH. Changes pH (from an acidic base of 5.1-5.4 to more alkaline of 5.9-7.3 which allows putrefactive bacteria)
- ↗Change the fermentation process and methyl groups available to body

25 **Breastmilk and the microbiome**

- ↗Optimal digestion/immune support the following is required:
  - ↗Amino acids cystein and methionine
  - ↗Uptake of selenium

26 **Breastfeeding and the Phenotype**

27 **Epigenomic Inheritance**

- ↗Memory of the environment experienced is passed down
- ↗Demonstrated in animal research up to 10 generations out
- ↗Human research - influence beyond three generations – HongerWinter winter 1944-spring 1945

28 **How does epigenetics work?**

- ↗Are you what you eat?
- ↗You are what your mother and grandmother ate.

- Diet of grandparents linked to longevity and disease variants in offspring for many generations

- This includes BREASTMILK!!!!!

29 **Why does it work?**
- We are constantly adapting for optimal survival.
- The fetus is preparing for optimal survival outside the womb.
- The newborn is managing its new environment and adjusting to cues.

30 **Breastfeeding and Epigenetics**
- Pregnancy/early postpartum life babies are programmed nutritionally to adapt to their environment.

31 **Epigenetic Animal Studies**
- Mouse studies
  - What we are fed
    - Agouti mice (Jirtle, 2000)

32 **Breastmilk's Epigenetic Influence**

33 **Studies in Review**

34 **1 Duration of Breastfeeding and LEP**

- DNA methylation of LEP
- Responsible for appetite regulation and fat metabolism
- Formula feeding turns OFF Leptin producing gene

35 **1 Duration of Breastfeeding and LEP**

- Obermann-Borst

36 **2 Milk Kinship and Epigenetics**
- Does wet nursing or milk sharing cause consanguinity?

37
- Why is this a possibility?

- Exosomes in breastmilk
  - Tiny endosome-derived membrane vesicles that are released into the extracellular environment
  - Genetic material such as microRNA

38 **2 Milk Kinship and Epigenetics**
- Stem Cells – MaSC (Mammary Stem Cell)
- Active during all stages of mammogenesis
- Ingests thousands to millions with each feeding
- Can turn into many types of cells - bone, fat, liver, insulin
- Stem cells gradually get methylated (turning off parts) until they are very specific – become one type of cell

39 **3 miRNA in Breastmilk**
- High levels of miRNA in breastmilk in first six months of lactation
- Approximately 1.3×10^7 copies/liter/day of miR-181a
- Allow for transfer of genetic material (outside sexual reproduction)

40 **3 miRNA in Breastmilk**

41 **3 miRNA in Breastmilk**
- Influence is Strongest Before age of 2
  - Inadequacy of immune system to reject genetic material
  - Increased plasticity
  - Increased vulnerability of epigenome during developmental period

42 **Not Just the Milk!!!**
- Maternal Licked and Arched Backed Nursing Show More Moderate Stress response
- Changes hippocampus development and release of Glucocorticoid Receptor Expression

43 **Questions to Ponder**
- Nutrition/breastfeeding has epigenetic impact, and is multigenerational.
- What can YOU do to change things in your community?

44 **Thank You!**

- Questions, handouts, resources:
- info@motherjourney.com
- www.motherjourney.com
- www.theattachmentpregnancy.com