



Can Breastfeeding Affect a Baby's DNA? A Look at Epigenetics and Breastfeeding

By Nicola Aquino, Professional Liaison Administrator, La Leche League Canada

The question of “Nature versus Nurture” in child development has been a subject of discussion since people had time to discuss it rather than spend every hour of the day ensuring survival. But maybe it isn't one or the other. Recent research has been revealing just how much nature (DNA) and nurture (the environment in which a child is raised) interact to affect life-long health and development. Over the past few years, information from several different sources has come to my attention: Nils Bergman's research on Kangaroo Mother Care (KMC) (1), Jean Liedloff's *The Continuum Concept* (2), Jean Clinton's “Love Builds Brains” webinar (3), Jennifer Tow's many webinars on microbiota and health (4), and an article in *Nature* by Li et al on how “silent” mutations may not be so silent (5). Together these pieces of information build a compelling argument to the importance of providing appropriate stimuli at the right time in an infant's life. Needless to say, breastfeeding is one of those stimuli. What follows is a synthesis of the ideas I have gleaned from these, and other, resources (see reference list) and how they have impacted my understanding of the importance of breastfeeding for lifelong health.

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For many years we have been hearing how critical the first five years of a child's life are to his ♦ wellbeing. Now we have some concrete evidence as to why these early years are so important. For the purposes of this article, I will use a very simple definition of **epigenetics**: a change in phenotype (the characteristic one sees) without a change in the genotype (i.e. no mutation of DNA). That is, the expression of the genes (being turned “on” or “off”) is affected by environmental stimuli. These stimuli can be physical, psychological or physiological.

In the early 1970s, Jean Liedloff identified the importance of seeing life as a continuum; babies cannot be treated as “oblivious beings” for the first couple of years and then suddenly be expected to be a part of society. Although she did not name the process, her observations of how different cultures interact with their babies and how those babies grow up to be a part of their society is instructive. She reported on how *capable* young babies are, and how important following the ‘expected’ path is to future development. The example she gives of child stutterers, who had never crawled, but whose speech impediment was resolved when they “regressed” and spent a few hours per day crawling, is an eye-opener (one among many). (2)

The work of Nils Bergman on the importance of skin-to-skin contact in the hours following birth (and beyond) builds on the observations of Liedloff. “The mother's body is the baby's habitat” and “neurons that fire together, wire together” are two of my favourite statements by Bergman. His research has shown that when babies are separated from their mothers at birth the resulting

♦ Babies are both male and female, but for ease of writing, baby will be male, mother – female.

cortisol spike in the babies results in the “wrong” neurons firing (and wiring together). And here we have the first example of an epigenetic effect: the stimulus applied immediately after birth (either the “expected” habitat or the separation) directly affects the wiring of the brain, with long term consequences. (1)

Jean Clinton, a child psychiatrist and researcher at McMaster University, takes this research one step further, explaining how experiences leave a biological imprint which affects DNA. These effects can be positive or negative and culminate in how a person copes with stressful situations throughout life. She returns to the idea



that a child is a capable/competent being in need of help to thrive, not an empty vessel to stuff with information. In the early years the brain is malleable and sculpted by experience (fire together, wire together); all experience is important, such as being picked up, rocked and carried – special “educational toys” are not required. In her words, “Relationship is the first ‘R’”. By giving babies the ‘expected’ stimuli of love, caring and nurturing, the brain develops buffers which allow the amygdala and hippocampus to respond appropriately to ‘toxic stress’. Her thesis is that relationships are important to the developing brain, building resilience to buffer stress. (6)

The final piece of this ‘puzzle’ is bacteria, specifically the human microbiota. As a Master’s student in microbiology, I regularly taught labs to demonstrate the presence of bacteria on hands and in throats; but until watching Jennifer Tow’s presentations on the “gut-brain axis” and the idea of the co-evolution of humans and their microbiome (4) I had never thought about the symbiosis between the microbes and the human body. Peterson has suggested that the human body should be looked on as a “metaorganism” with multiple ecosystems.(8) The National Institutes of Health are funding a massive, and far reaching, initiative: The Human Microbiome Project (HMP). The aim of the project is to determine the “normal” microbes found in healthy individuals and stimulate research into how deviations from this may play a role in disease.

HMP researchers also reported that this plethora of microbes contribute more genes responsible for human survival than humans contribute. Where the human genome carries some 22,000 protein-coding genes, researchers estimate that the human microbiome contributes some 8 million unique protein-coding genes or 360 times more bacterial genes than human genes. (7)

There are many implications from this research, from nonalcoholic fatty liver disease to arthritis (8), but I will focus on the information relevant for breastfeeding. It has long been known that the gut flora of formula fed babies is different from that of breastfed babies. As far back as the 1920s studies demonstrated that even a single bottle of non-human milk could affect a baby’s flora (9) (10) (11). Marsha Walker’s seminal article “Just One Bottle” (12) identifies the issue – these differences are a deviation from normal, and therefore should be considered abnormal – but that is just the tip of the iceberg. In an essay from last year, Funkhouser and Bordenstein suggest that transmission of maternal bacteria is an important piece of the puzzle, and that it may even begin in utero, although not all scientists agree with this conclusion. (13) Everyone does agree that babies born vaginally are exposed to a unique ‘cocktail’ of maternal microbes and that, along with breastmilk, these bacteria are important to the development of the neonatal gut. New research is suggesting that the gut microbiome may impact brain development; that is, the ‘gut-brain axis’ is actually a two-way street, with the gut microbiome affecting mood and behaviour, possibly through epigenetic control. These effects may be effected through methylation of DNA, resulting in genes being turned off and altering the way in which we react to biological stresses. (4)

I had just got my head wrapped around all of that when somebody sent me an article about how information from archeological specimens is showing that the flora of the human mouth went through significant (negative) changes as we moved from a hunter-gatherer society to an agrarian one, and then again with the introduction of processed foods during the Industrial Revolution (14) (15). What implications does that have for the “normal” microbiome being identified by HMP? Tow points out that the rampant use of antibiotics, combined with the lack of exclusive breastfeeding, already make it very difficult to know what is “normal”. (4) Then there is very new research showing that chimerism and mosaicism (having more than one genome represented in a single organism) are much more common than had previously been thought (16). Could that have implications for how individuals and their symbiotic microbes interact? Before that there was Li’s article, referred to in the introduction; he showed that mutations to the genetic code that do not change the protein the gene codes for can still affect expression of the gene.



But what does all this mean for breastfeeding? The field of epigenetics is very new, and is fueled by ever more powerful research techniques. Some of these approaches were unimaginable just a few years ago, and as scientists build on them we are likely to peel back even more layers to understand how breastfeeding fits into the puzzle. But, we already know enough to say: breastfeeding affects gut health directly and gut health impacts brain development, immune system maturation and possibly behaviour; the act of breastfeeding meets many of the infant human’s biological ‘expectations’: to be held skin-to-skin, to interact with mother, to receive love and care. It is undeniable that breastfeeding (nature’s way) has positive epigenetic influences on human DNA.

There was no intention for this article to be an academic review of the literature; rather it was to share information to pique the reader’s interest and provide resources for further exploration of the subject.

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Developing Brains: Why do children do the things they do? At:

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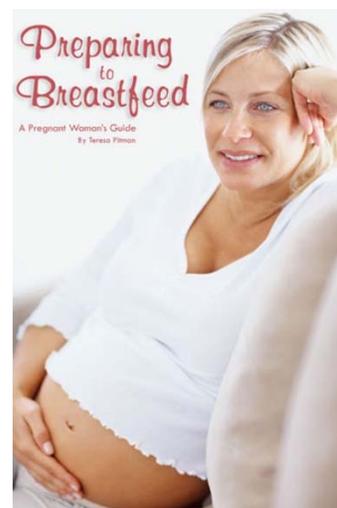
The Impact of Birth on Lifelong Wellbeing. GOLD Perinatal keynote lecture, November 2013 Dr. Sarah Buckley, author of *Gentle Birth, Gentle Mothering: A Doctor's Guide to Natural Childbirth and Gentle Early Parenting Choices* (Celestial Arts 2009) www.sarahbuckley.com



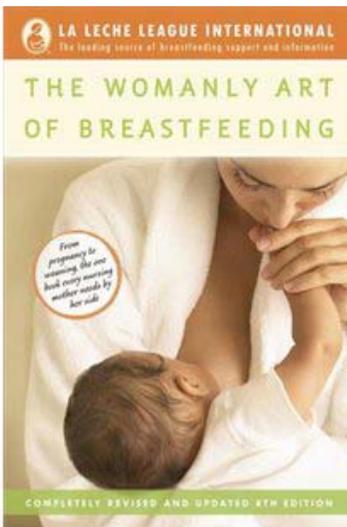
A Quiz About Breastfeeding Resources

Prepared by Cassie Kent and Linda Wieser, Area Professional Leaders, Atlantic Canada
(Answers can be found starting on page 8)

- Which would be the **BEST** resources to share with a mother experiencing milk supply issues related to breast surgery? (Choose all that apply.)
 - The Breastfeeding Mother's Guide to Making More Milk*
 - Breastfeeding: A Guide for the Medical Profession*
 - Defining Your Own Success: Breastfeeding After Breast Reduction*
 - Medications and Mothers' Milk*
 - www.bfar.org or www.lowmilksupply.org websites
- Are you familiar with The Academy of Breastfeeding Medicine, an international physician association? What will you **NOT** find on their web site (www.bfmed.org)?
 - A list of breastfeeding-friendly physicians
 - Twenty-five (25) protocols including "Hypoglycemia," "Co-sleeping and Breastfeeding," "Analgesia and Anesthesia for the Breastfeeding Mother," and "Galactogogues"
 - The brochure for the International Annual Meeting and 2-day conference for health professionals
 - Information about their journal *Breastfeeding Medicine*
- Which of the following would be **LEAST** helpful in finding information and treatment for tongue-ties?
 - Anterior and Posterior Tongue-Tie: A Comprehensive Guide* - DVD by Dr. Evelyn Jain.
 - Articles by dentist Dr. Lawrence Kotlow at <http://www.kiddsteeth.com/articles.html>
 - You Tube video showing Dr. Kotlow examining an infant for posterior tongue-tie <http://www.youtube.com/watch?v=5opSbXvL7yQ>
 - Supporting Sucking Skills* by Catherine Watson Genna
 - Tongue-Tie; Morphogenesis, Impact, Assessment and Treatment* by Alison Hazelbaker
- If you go to: <http://d-mer.org>, you will learn:
 - D-MER means dysphoric milk ejection reflex
 - What D-MER is and what it is not
 - About handouts for mothers and health professionals
 - Ways to manage this breastfeeding challenge
 - All of the above.
- Which mobile app would be **MOST** helpful to a mother with possible thrush?
 - Breastfeeding Management 2
 - LactMed@NIH
 - Breastfeeding Solutions



6. Suzanne Colson's web site Biological Nurturing <http://www.biologicalnurturing.com/> is **MOST** helpful to mothers because:
- There is information on becoming a BN Certified Laid-Back Breastfeeding Consultant.
 - It has a video demonstrating laid-back breastfeeding.
 - The book *An Introduction to Biological Nurturing* is available in the BN Shop.
 - Dr. Colson has information about her webinars and conferences.
7. Which of the following resources would you be **LEAST** likely to recommend to a woman pregnant with her first child?
- Mothering Your Nursing Toddler*
 - Preparing to Breastfeed*
 - The Womanly Art of Breastfeeding*, 8th edition (2010)
 - Breastfeeding Made Simple: Seven Natural Laws for Nursing Mothers*
 - Adventures in Tandem Nursing*
8. The **BEST** way to find a La Leche League Group in your area is to:
- Download the free "LLLC" app
 - Go to the La Leche League of Canada (LLLC) web site www.lllc.ca and click on "Get Help"
 - Look in the Yellow Pages
 - a & b



9. What is Breastfeeding Gateway?
- A new breastfeeding game app for the iPhone.
 - An international web site with links to reliable and up-to-date information about breastfeeding advocacy, research and awareness.
 - A one-stop shop for information on breastfeeding and HIV, environmental contaminants and human milk, breastfeeding legislation, protecting infants during emergencies.
 - A breastfeeding sculpture in Toronto.
 - b & c

10. Which of the following found on the La Leche League of Canada website www.lllc.ca would be **MOST** useful for health care professionals? (Choose all that apply.)
- Quizzes from past years

- How to become a La Leche League Leader
- Health Professional Seminar information
- Patient Information Sheets on such topics as: "How Fathers Help Breastfeeding Happen," "Storing Human Milk," "Breastfeeding Tips."
- Information about LLLC's annual fundraiser Breastfeeding Benefits

Bonus Question:

There is a fairly new website with information about cleft lip and palate, for both parents and health professionals. Can you name it?

Join us for the 2014 Health Professional Seminar Series this Spring

Title: Addressing Breastfeeding Barriers to Improve Lactation Outcomes

Speaker: Diana West

Dates and Locations:

Fri, May 23	Moncton, NB
Mon, May 26	St. Catharines, ON
Wed, May 28	Calgary, AB
Fri, May 30	Saskatoon, SK
Mon, June 2	Brandon, MB
Wed, June 4	Halifax, NS
Fri, June 6	Kingston, ON

Topics: Breastfeeding After Cosmetic Breast Surgery
Knipple Knowledge
Making More Milk
Overcoming Breastfeeding Ambivalence

Cost: Early Bird (until April 25th) **\$160**
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For more information: <http://www.llc.ca/health-professional-seminars>

Purchasing a LLLC [Health Professional membership](#) BEFORE you register for a HP Seminar entitles you to a 10% discount on your seminar registration fee.

Stay Tuned for more information about La Leche League Canada's Fall Family Conference in the Greater Toronto Area, October 4, 2014.

ANSWERS to Resource Quiz

1. Answer a) c) & e). Ruth Lawrence's book *Breastfeeding: A Guide for the Medical Profession* was written primarily for physicians. Tom Hale's *Medications and Mothers' Milk* is a resource for health care providers seeking information on the compatibility of a specific medication, test or treatment with breastfeeding. All the other answers are resources for mothers. In *Making More Milk*, authors Diana West and Lisa Marasco discuss reasons for a low milk supply and ways to increase milk production. *Defining Your Own Success* by Diana West is written specifically for women with a history of breast reduction surgery. These authors also have the two websites: <www.bfar.org> and <www.lowmilksupply.org> with discussion forums for members.
2. Answer a). The Academy of Breastfeeding Medicine, formed in 1994, is a worldwide organization of physicians dedicated to the promotion, protection and support of breastfeeding and human lactation. They have over 500 members from more than 50 countries. They do not have a list of their members. Most of their protocols have been translated into at least two other languages besides English. These translations include: Spanish, Japanese, German, Polish, Korean, and Chinese. Their two-day conference after the Annual Meeting is one of the few conferences organized to facilitate networking among physicians, midwives, IBCLCs, nurses and other health care professionals.
3. Answer d). *Supporting Sucking Skills* briefly mentions tongue-tie as it relates to sucking problems, but it does not go into depth on the topic. Dr. Jain's DVD released in 2012 has detailed information and demonstrations showing how to diagnose and treat both anterior and posterior tongue ties. Dr. Kotlow's website has extensive information on tongue-tie and breastfeeding with patient handouts and many photos. His YouTube demonstration of assessing for a posterior tongue-tie is particularly helpful since this can often be missed by health care practitioners unfamiliar with its presentation. Dr. Hazelbaker's book discusses tongue tie in depth including assessment from a breastfeeding perspective.
4. Answer e). Alia Macrina Heise, IBCLC and mother of three who experienced D-MER herself, created this web site to share information about this phenomenon with mothers and health professionals. In her research, she found that D-MER can be linked to an inappropriate drop in dopamine that occurs when milk is released. This causes a dysphoria with the breastfeeding mother experiencing negative feelings. It is a physiological, not psychological, reflex. The specific symptoms and intensity vary from woman to woman; but it can be treated with lifestyle changes, natural treatments and/or medications. Sometimes just knowing that it *is* physiological is enough 'treatment' for the mother. The website lists many resources including handouts, FAQ's, a 6-minute YouTube video, quotes from mothers and a Facebook group.
5. Answer c). Nancy Mohrbacher's app *Breastfeeding Solutions*, based on her new book by the same name, is specifically designed to help mothers find solutions to common breastfeeding problems. Most breastfeeding apps available for parents focus on documenting early feedings. *Breastfeeding Management 2* was created by the Massachusetts Breastfeeding Coalition for use by health care professionals. It has guidelines and core knowledge that are important in the early days of breastfeeding. The weight loss and feeding calculators for different ages are particularly helpful. LactMed@NIH is an excellent resource for information about drugs and breastfeeding.
6. Answer b). The video demonstrating laid-back breastfeeding is particularly helpful for mothers in the early weeks, especially those having difficulty latching their babies or experiencing sore nipples. It is often commented that how we have taught mothers to breastfeed in the past is a left brain approach with many steps to remember. Laid-back breastfeeding is a



right-brain approach that new mothers find easier. The three other items mentioned are resources for health professionals. The book *An Introduction to Biological Nurturing* discusses in detail Dr. Colson's research that resulted in her coining the term "biological nurturing."

7. Answer a) & e). *Mothering Your Nursing Toddler* is an excellent resource for mothers nursing older babies and *Adventures in Tandem Nursing* would be appropriate for a mother still breastfeeding when she becomes pregnant again. (Written by Hilary Flower, this LLL International publication contains mothers' stories and well referenced information for mothers considering breastfeeding during a pregnancy and/or breastfeeding an infant and older baby at the same time.) However, for a first time mother-to-be, any of the other three books would be a good choice. *Preparing to Breastfeeding* is a new publication by Teresa Pitman, co-author of the *Womanly Art of Breastfeeding, Pregnancy and Birth*, and *Dr. Jack Newman's Guide to Breastfeeding*. It is an inexpensive, short, book targeted at the mother-to-be with all the basic information about getting breastfeeding off to a good start. The 8th edition of La Leche League's manual, *The Womanly Art of Breastfeeding*, was completely revised in 2010 resulting in a valuable evidenced-based reference book for the entire span of the breastfeeding relationship. Mothers find the "Tear-Sheet Toolkit" in the back particularly helpful. *Breastfeeding Made Simple* by Nancy Mohrbacher and Kathleen Kendall-Tackett gives mothers seven general principles about how breastfeeding works rather than a lot of rules.
8. Answer d). Both LLLC app and website have information about free Group Meetings and both have an FAQ section with the most common questions mothers ask. Staff at local hospitals and public health often have information about LLLC Meetings. Meeting information is rarely found in the Yellow Pages.
9. Answer e). Created in 2010 by WABA (World Alliance for Breastfeeding Action), Breastfeeding Gateway <<http://www.bfgateway.org>>, brings together in one location all key breastfeeding resources, making an initial search for information easier. As you start perusing this website, you'll be surprised what you'll find. There are links to current breastfeeding campaigns, upcoming conferences, breastfeeding art, resources for evidence-based practices, peer reviewed breastfeeding journals, related UN documents, breastfeeding teaching aids and so much more.
10. Answer a), c) & d). Most health professionals find the quizzes included in each issue of *Keeping in the LLLoop (KITL)* helpful to test their breastfeeding knowledge. Those who are able to attend yearly Health Professional Seminars have heard international speakers Nancy Mohrbacher (2013), Linda Smith (2012) and Suzanne Colson (2011). The speaker for 2014 will be Diana West; see information elsewhere in this issue for details of dates and locations. Health providers, childbirth instructors and IBCLCs use many of the seven evidenced-based Information Sheets as handouts for their patients. Information on becoming a La Leche League Leader would be helpful to any mother thinking about volunteering with La Leche League Canada. Breastfeeding Benefits is an annual fundraiser done primarily at the Group level.

Bonus: Cleft Lip And Palate Breastfeeding: Because you can! at <http://cleftlipandpalatebreastfeeding.com/>
This website is hosted by Alice Farrow, a La Leche League Leader in Italy, who experienced difficulty finding information about clefts when her son was born with one. It contains information specific to breastfeeding babies born with cleft lip and/or cleft palate.

You are encouraged to use this quiz for training purposes without further permissions, so long as it is not used in settings that contravene the WHO Code on the Marketing of Breastmilk Substitutes.

Useful Information

La Leche League Canada is a national charity supported by memberships and donations

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- breastfeeding Information Sheets to download for use with your clients
- past issues of *Keeping In The LLLoop*
- breastfeeding quiz compilations from past issues of *Keeping In The LLLoop* - excellent tools for breastfeeding education
- 10% discount on your Health Professional Seminar registration fee
- access to all the features of the general Member Access area of this website.

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Sustaining LLLC Health Professional Membership - \$70.00 Canadian

Purchase of a Sustaining LLLC Health Professional membership helps LLLC increase our ability to reach out to new mothers and health professionals with breastfeeding information and support. As an alternative, you may wish to make a donation

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