
ISRHML – Family Larsson-Rosenquist Foundation

trainee expansion program

Hall of Fame



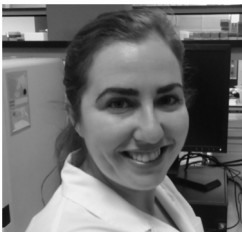
Trainee Expansion Program

AWARDEES 2016



We are pleased to present the awardees of the TEP Bridge Funds and the TEP Travel Funds, who each received up to USD 100,000 or up to USD 10'000 respectively to advance in their academic career.

ALECIA-JANE TWIGGER



Mini mammary gland culture
TBF Awardee 2016

KIMBERLY LACKEY



M. leprae in human milk
TTF Awardee 2016

KLARA STRYDOM



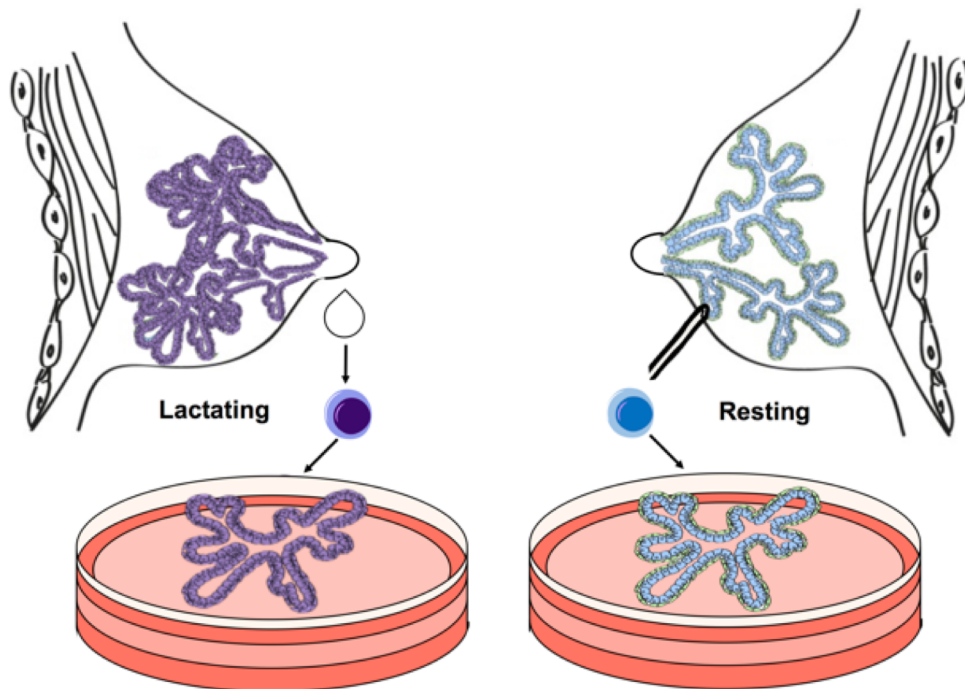
HMO in human milk
of HIV+ mothers
TTF Awardee 2016

MELANIE WANGE LARSSON



Appetite hormones in
human milk
TTF Awardee 2016

ALECIA-JANE TWIGGER

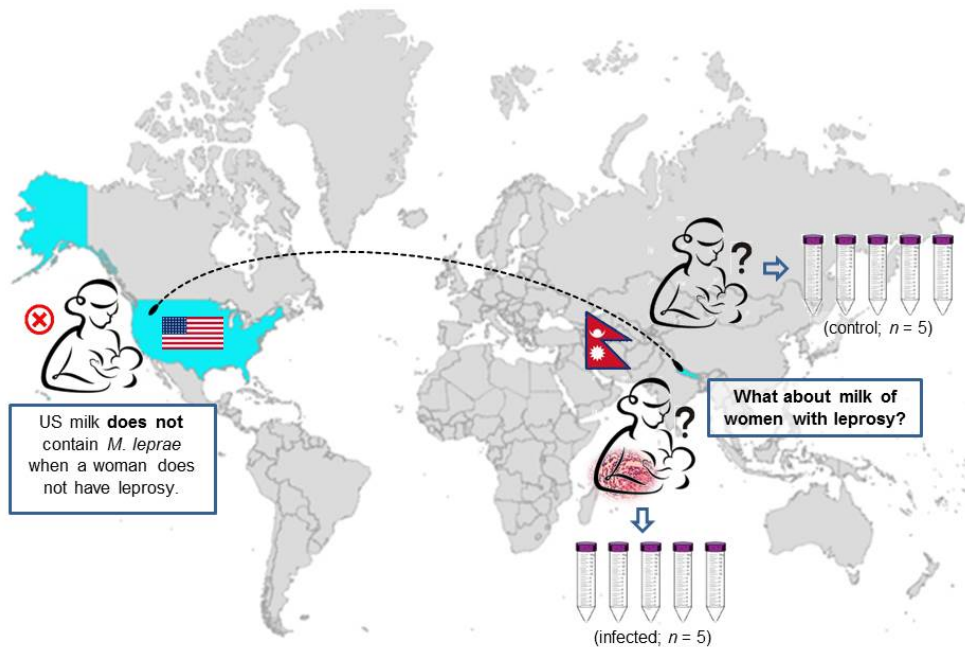


Source A.J. Twigger and J. Linnemann

Extracting cells from milk provides direct access to live viable cells from the lactating mammary gland that can be compared to established characteristics and regenerative capabilities of mammary cells of non-pregnant, non-lactating women. Sorting and comparing gene expression and protein signatures of mammary cells obtained from breast mammoplasties and milk cells will elucidate differences in mammary cell function during the resting and highly plastic periods of normal development. This project brings together expertise in human milk cells and state-of-the-art organoid culturing techniques to develop an *in vitro* model of human lactation that will revolutionise our understanding of the molecular characteristics of mammary cell development and function.

Alecia-Jane Twigger is a biomedical scientist working in the field of human lactation for the past four and a half years as a part of the Human Lactation Research Group at the University of Western Australia. After completing her Bachelor of Science with Honours, she pursued a PhD examining the characteristics of the lactating mammary gland using cells isolated from human milk. Recently, Alecia-Jane has submitted her PhD thesis and plans on moving abroad to enrich her experience in mammary gland biology and develop new techniques to examine the lactating breast.

KIMBERLY LACKEY



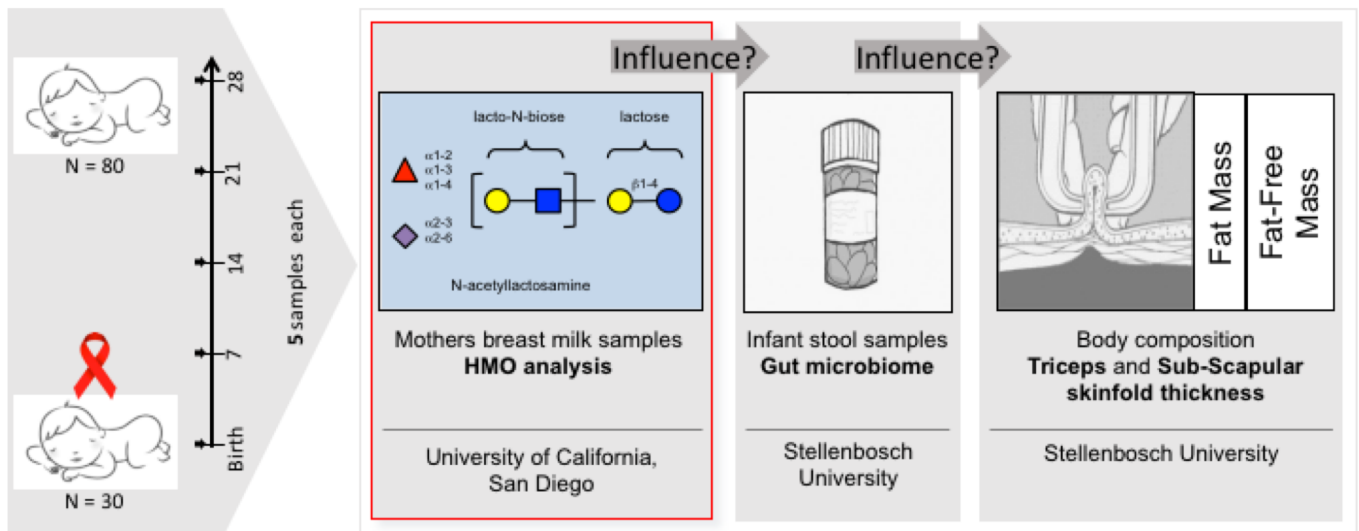
Kimberly Lackey (ISRHML Trainee), Dr. Shelley McGuire, and Dr. Deanna Hagge
 Washington State University (Pullman, WA) and The Anandaban Hospital (Kathmandu, Nepal)



In 2014, 80,544 women were newly diagnosed with leprosy, a bacterial infection caused by *Mycobacterium leprae*. To date, the mechanism(s) of transmission for leprosy is (are) still not understood, but we hypothesize that one potential mechanism could be during infancy via breastmilk. To test this hypothesis, I will travel to Nepal, a leprosy-endemic country, to collect milk samples ($n = 5$) from lactating women with leprosy as well as healthy controls. In Nepal, I will also analyze these samples using an rtPCR assay that I developed for *M. leprae* in breastmilk. This project will serve as proof-of-concept that the leprosy bacterium is or is not present in human milk. We will then use this information as a starting point for more targeted investigations into breastfeeding's potential role in leprosy transmission, or will provide concrete evidence that breastmilk is safe and still best for babies born to leprosy-affected mothers.

Kimberly Lackey is a PhD candidate in Biology at Washington State University under Dr. Shelley McGuire. Originally from Portland, OR, she also completed her BA and BS at Washington State. Her doctoral research focuses on methods to collect and preserve human milk samples collected in rural field conditions, as well as the subsequent analysis of these samples for both the overall microbial community structure and for *Mycobacterium leprae*, the causative agent of leprosy. Her work and PhD will culminate in a proof-of-concept project to determine if *M. leprae* is present in the milk of women with leprosy. Kimberly is especially interested in women's health and infectious disease, and would like to pursue a career in public health after completion of her PhD.

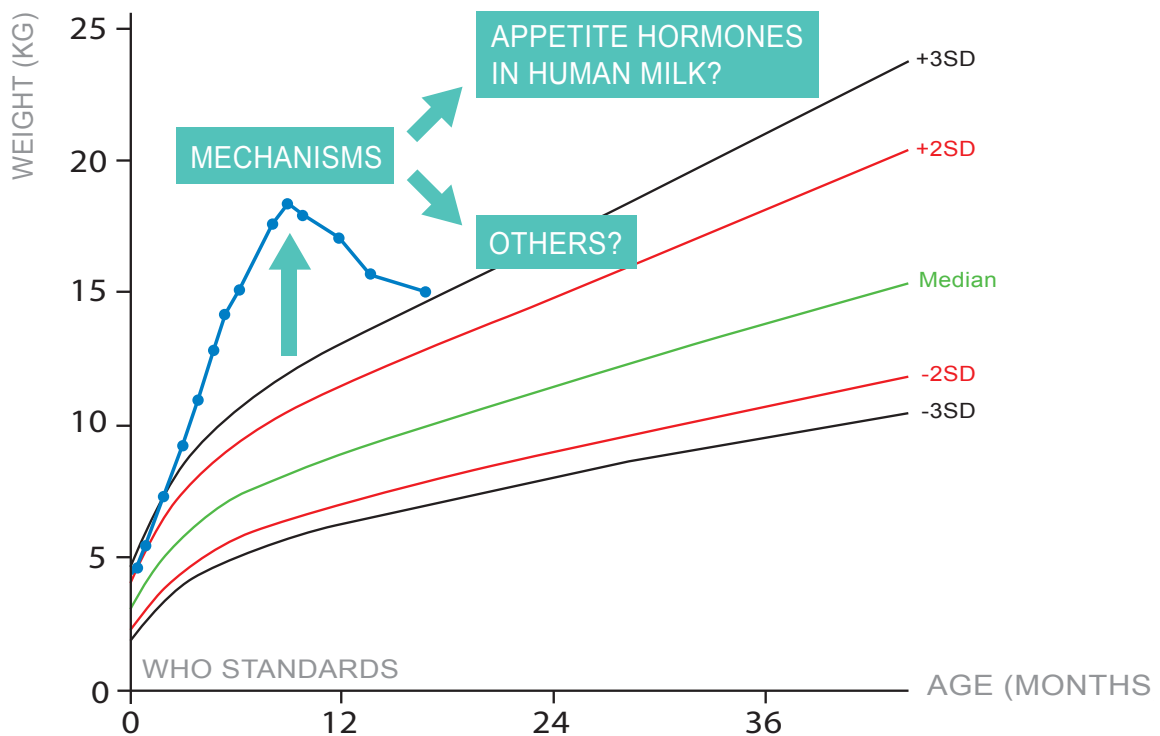
KLARA STRYDOM



HIV-exposed uninfected infants seem to have poorer growth and greater early mortality and morbidity rates than their HIV-unexposed counterparts. Human breast milk composition is very diverse and distinct and there is an array of factors that can have an effect on the concentration of human milk oligosaccharides (HMOs). Once ingested HMOs prevent infections, stimulate beneficial bacterial growth promoting the gut microbiome and they have an anti-inflammatory effect. It has been hypothesized that the differences in breast milk HMO composition are related to the infant's growth and body composition. HMOs have the ability to regulate the gut flora, improve gastrointestinal activities and influence the inflammatory processes, thus being directly proportional to the growth and body composition of the infant. However, there is a distinctive gap in literature whether HMO variety and uniformity are associated with the infant gut microbiome variety and uniformity and whether they are directly proportional to early infant growth and body composition, especially in the context of HIV.

Klara Strydom is a dynamic dietitian with a high standing academic record. Klara obtained her BSc Dietetics Degree in 2014 whereafter she was involved as a research assistant in a large cohort study. She is currently studying towards a Master's degree in Nutrition at the University of Stellenbosch, South Africa. The title of her thesis is "Body composition, Growth and nutritional intake of HIV exposed preterm, very- and extremely-low birth weight infants in Tygerberg hospital, Western Cape." Her research assesses the effect of HIV-exposure on human milk oligosaccharides in mothers as well as body composition and gut microbiome in preterm infants living in a resource poor setting. Klara is looking forward to working alongside experts in her field of study at the Bode Laboratory during November 2016. Klara enjoys yoga, hiking and traveling and currently resides in the beautiful city of Cape Town, South Africa.

MELANIE WANGE LARSSON



Early high weight gain is a risk factor for later obesity. For the SKOT III study factors such as milk volume, appetite hormones and growth factors in milk and plasma, feeding pattern, eating behavior, and body composition are measured.

The Travel Trainee Award allows Melanie Wange Larsson to visit the Hartmann Human Lactation Research Group (HHLRG) at University of Western Australia and gives her a unique opportunity to gain more experience in the field of research in human milk and lactation. Several of HHLRG's research areas are very relevant for the PhD project of Melanie Wange Larsson. A key area of her PhD study is appetite hormones in human milk, a research area which HHLRG have great experience and expert knowledge in. During the stay at the HHLRG Melanie analyze human milk from Her study in Denmark. In addition, Melanie Wange Larsson will also have the opportunity to observe the ongoing research at the HHLRG and learn about 24 hour milk profiles.

Melanie Wange Larsson holds a Master degree in Human Nutrition from Copenhagen University and is an associate professor at the Institute of Nutrition and Midwifery, Metropolitan University College, Copenhagen, teaching nutrition and physiology including infant and child nutrition, growth and physiology of breastfeeding. Since 2014 Melanie has also been working on her Ph.D. at Copenhagen University.

The overall objective of Melanie's PhD study is to examine exclusively breastfed infants with very high weight gain in the first months of life to have a better understanding of causes for the weight gain and consequences for these infants. The team has established a cohort (SKOT III) of exclusive breastfed infants with excessive weight gain (weight-for-age z-score ≥ 2.00 SD) during the first months of life. Factors as appetite hormones in milk and infant blood, milk volume, feeding pattern, baby eating behavior and body composition will be investigated.

Trainee Expansion Program
AWARDEES SPRING 2017



We are pleased to present the awardees of the TEP Travel Funds, who each received up to USD 10'000 to advance in their academic career.

ADRIANA GAITAN



Endocannabinoid metabolome of breast milk

TFF Awardee 2017

CLARISA MEDINA POELINIZ



Tight junction closure in overweight and obese women

TFF Awardee 2017

KOZETA MILIKU



HMO analysis in the CHILD cohort

TFF Awardee 2017

LARISSA MELO



B-vitamins in human milk

TFF Awardee 2017

SARAH BOOTHMAN



Global breastfeeding promotion and protection policy

TFF Awardee 2017

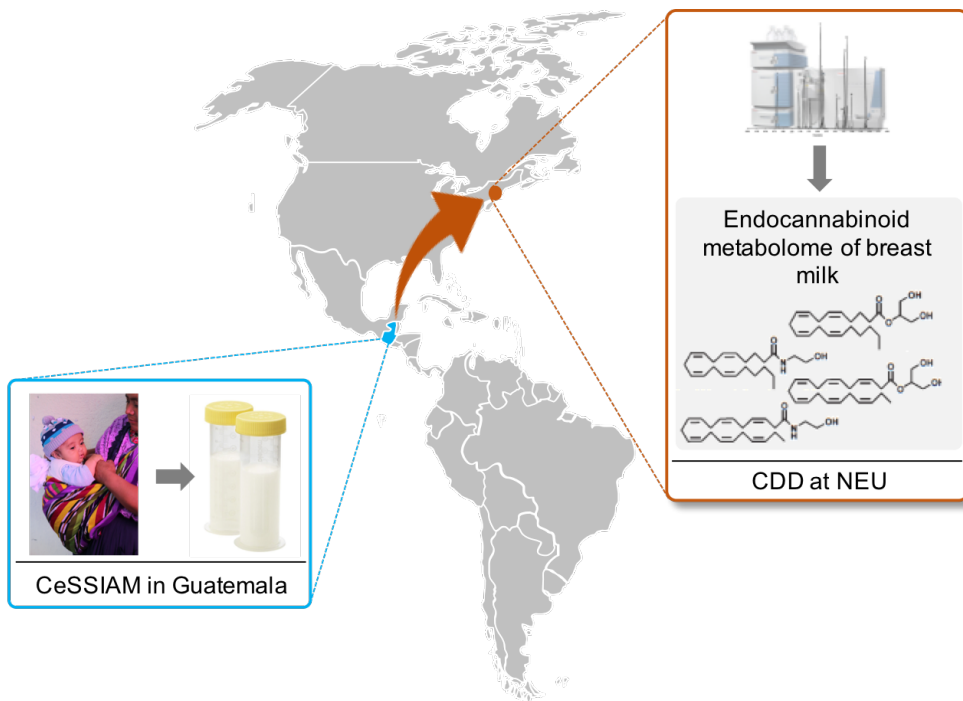
SARAH REYES



Bacterial communities of human milk pumped and stored at home

TFF Awardee 2017

ADRIANA GAITAN



CDD: Center for Drug Discovery, Northeastern University, Boston, MA
 CeSSIAM: Center for Studies of Sensory Impairment, Aging and Metabolism

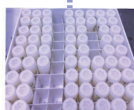
Endocannabinoids, endogenous lipid mediators, play a role in establishing the suckling response of the newborn by activating the cannabinoid receptor type 1 in the infant's brain, in turn activating the oral-motor musculature needed for milk suckling. The established suckling response in turn supports maternal-infant bonding and maintains infant feeding behavior. The mechanism of actions and the role of the endocannabinoid metabolome in breast milk (BM) are not fully understood. Pregnancy complications such as gestational diabetes mellitus can modify the endocannabinoid metabolome of BM; however the resulting effect on infants' development remains to be defined. BM samples were collected from an underserved population in the highlands of Guatemala and will be analyzed for fatty acids, their derived endocannabinoids, and related signaling lipids using state of the art methodology, liquid chromatography-mass spectrometry. This analysis will set the stage for developing hypotheses for future studies that will help to elucidate how this biological system modulates infant health and development. Moving forward, I plan to collect BM samples in Baton Rouge, Louisiana, USA to evaluate the fatty acids and endocannabinoid metabolome in a population that has one of the highest rates of over nutrition among pregnant and breastfeeding women in the United States. In this regard, we will be able to evaluate how maternal nutritional status can affect the fatty acids and endocannabinoid metabolome of BM.

Adriana Gaitán is originally from Guatemala in Central America. She has a bachelor degree in food science from the Zamorano Pan-American Agricultural School, a master in human nutrition, and is working on her PhD in human nutrition at Louisiana State University, USA under the direction of Dr. Carol Lammi-Keefe. Her research has been focused on maternal and infant health, specifically evaluating the benefits of omega-3 fatty acids during pregnancy and infant outcomes. Ms. Gaitán will study the endocannabinoid metabolome in different populations to gain a better understanding of its role in the quality of breast milk for the developing infant. After completing her PhD, she plans to work in a research group (industry or academic) as part of a multidisciplinary group of scientists that generate research in this field.

CLARISA MEDINA POELINIZ



- N=20
- Breast pump-dependent mothers of NICU infants
- Pre-pregnancy BMI \geq 25



- Serial, 12-hourly HM samples (2 mL)
- Collected postpartum days 1-14
- 480 HM samples stored and shipped to UWA



- All pumped HM volume measured postpartum days 1-14
- Weight (nearest 0.1g)



- Analysis of tight junction closure in serial HM samples
- Lactose, protein, sodium, potassium, citrate
- Investigators blind to measured HM volume and maternal perceptions of HM "coming in"



- Timing of maternal perception of HM "coming in" measured



Chicago, IL

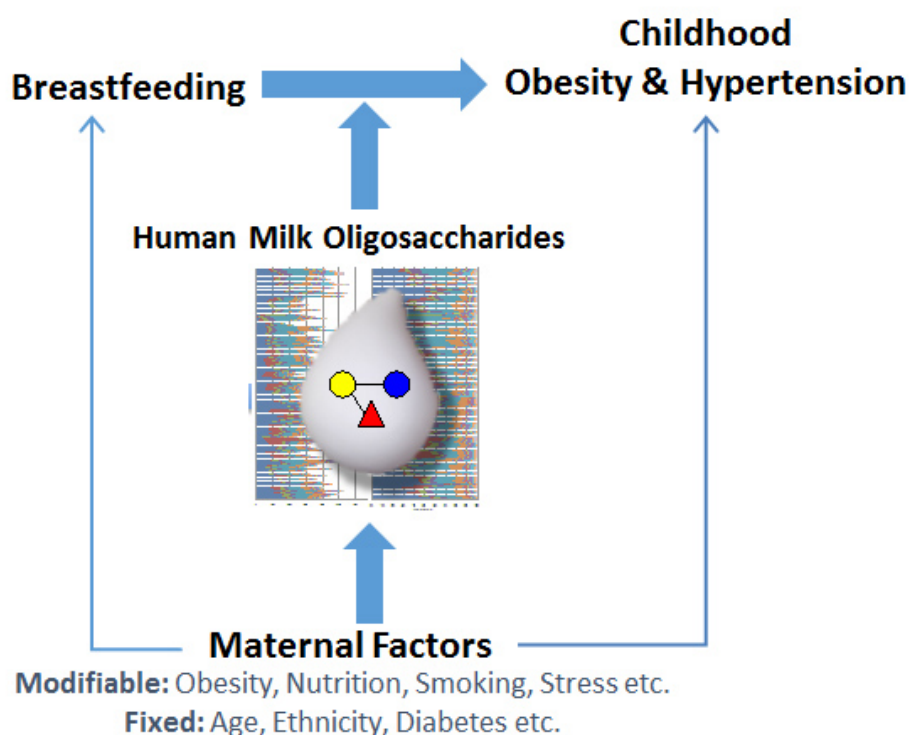


Perth, Australia

Overweight (BMI \geq 25) and obese (BMI \geq 30) mothers are more likely to experience delayed onset of lactation and suboptimal breastfeeding rates than are non-overweight and obese mothers. These clinical findings suggest that the normal process of tight junction (TJ) closure in the mammary gland is impaired. Although patterns of TJ closure have been described for healthy populations, no previous research has examined this patterning for overweight and obese mothers. This research will enroll 20 overweight and obese breast pump dependent mothers of infants hospitalized in the neonatal intensive care unit (NICU), and collect serial 12-hourly human milk (HM) specimens from these women during the first 14 days post-birth. All pumped HM volume will be weighed (nearest 0.1 gram) and mothers will record the timing of their "milk coming in". HM specimens will be analyzed by Ms. Medina Poeliniz under the supervision of basic science colleagues at the University of Western Australia. Statistical analyses will focus on patterning of 5 HM biological markers (lactose, protein, sodium, potassium, citrate) and determining their relationship to standard clinical measures of secretory activation and coming to volume that occur in the early postpartum period.

Clarisa Medina Poeliniz is pediatric nurse practitioner who has been working in maternal-child health for the past 17 years. The overall goal of her research is to understand the biologic mechanisms of maternal overweight and obesity on lactation outcomes and to design diagnostics and/or interventions for this population. She is currently pursuing her PhD in nursing science at Rush University under the direction of Drs. Paula Meier and Aloka Patel. Her research focus is patterning of TJ closure using HM biologic markers for breast-pump dependent mothers of NICU infants with a pre-pregnancy BMI \geq 25. She will examine the relationship between these patterns and measured HM volume and sensations of "milk coming in". Clarisa is excited to travel to the University of Western Australia and work alongside Dr. Donna Geddes and her team.

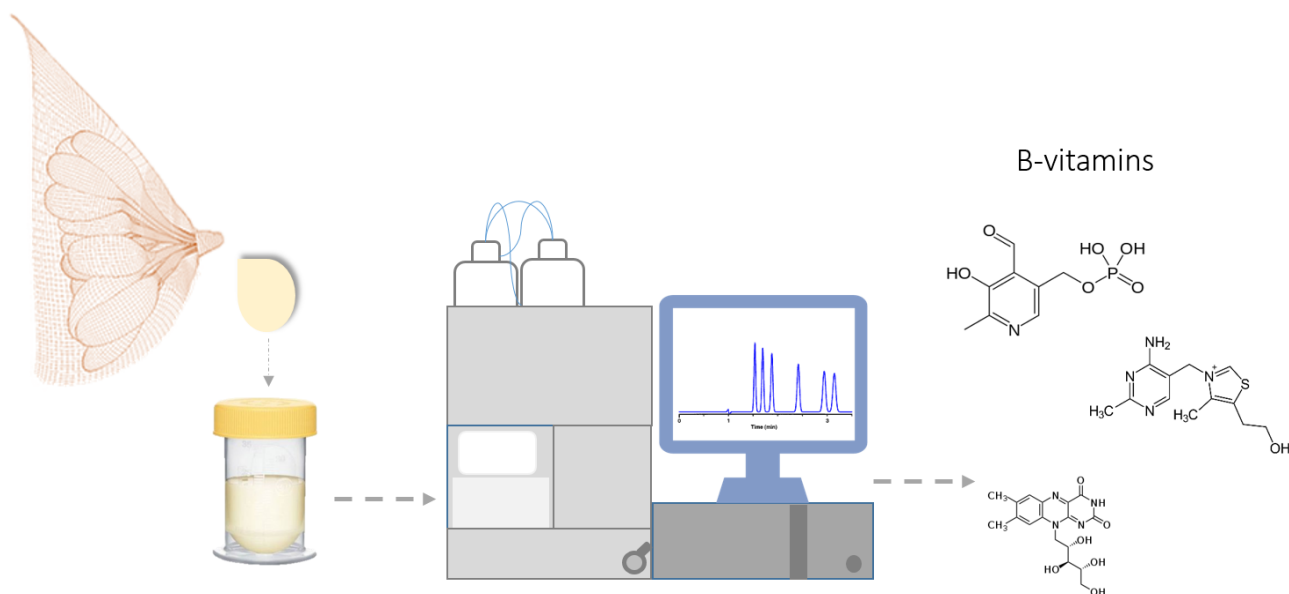
KOZETA MILIKU



Overweight, obesity and cardiovascular disease are major public health problems in both Western and non-Western countries. Breastfeeding can reduce the risk of childhood obesity and high blood pressure, although the evidence is not consistent. A key bioactive component of human milk are human milk oligosaccharides (HMO), however their role in the development of childhood obesity and cardiovascular health is still unexplored. It is suggested that certain HMO are associated with infant body composition, but their effect on childhood obesity and blood pressure has not been studied and the maternal factors that influence HMO production are mostly unknown. The objective of this study is to characterize the integrated roles of maternal factors and HMO in the developmental origins of childhood obesity and cardiovascular health, uniting the unique Canadian Healthy Infant Longitudinal Development (CHILD) cohort with new high-throughput methods for HMO analysis.

Kozeta Miliku is a medical doctor from Albania, currently finishing her PhD at the Generation R Study in the Netherlands. Her doctoral research is focused on identifying early life determinants that affect growth, and development in children, mainly kidney development. Her interest is exploring human milk components, specifically human milk oligosaccharides role on obesity and high blood pressure in children. Kozeta, is defending her doctorate thesis later this spring and plans on moving abroad to enrich her experience in the field of human milk and lactation and developmental origins of health and disease.

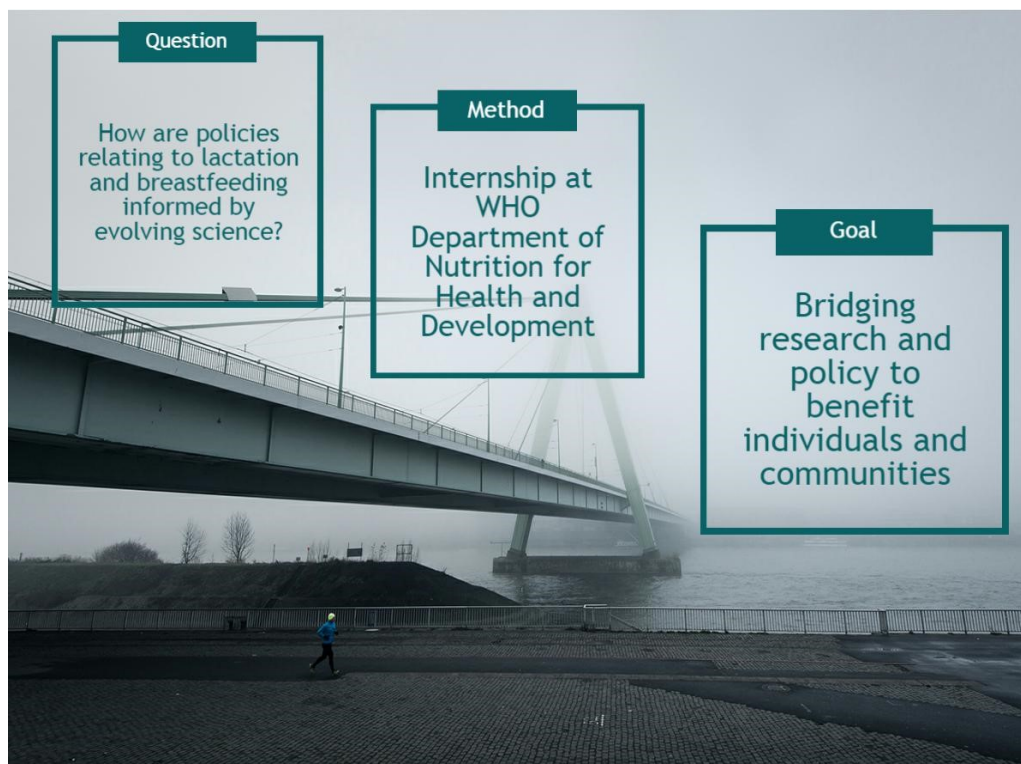
LARISSA MELO



There are several information gaps regarding the nutrient content in human milk, especially concerning vitamins. It should be treated as a research priority since human milk represents the main connection between the mother and child nutritional status. Little is known about the acceptable concentrations of vitamins in breast milk, and much less is known about how to improve it. The USDA Western Human Nutrition Research Center (WHNRC) has worked towards developing and applying methods for the efficient and accurate analysis of nutrients in human milk, aiming to establish global reference values for human milk composition. My background experience is in analyzing fat-soluble vitamins in breast milk, and with this project I aim to expand my knowledge on the methodological approaches involved in the analysis of B-vitamins in human milk.

Larisse Melo graduated from the Federal University of Rio Grande do Norte (Natal, Brazil) with a BSc degree in Human Nutrition. Still in her first undergraduate year, Larisse joined a research group as an Undergraduate Research Assistant, wherein she worked for four years with projects assessing vitamins A and E in breast milk of low-income mothers in Brazil, as well as their dietary intake and the effect of supplementation on milk vitamin concentrations. Larisse has recently started her MSc in Nutrition at the University of British Columbia (Vancouver, Canada), and her main goal is building a career in academic research for contributing to the development of public policies and recommendations associated with the health of pregnant and lactating women.

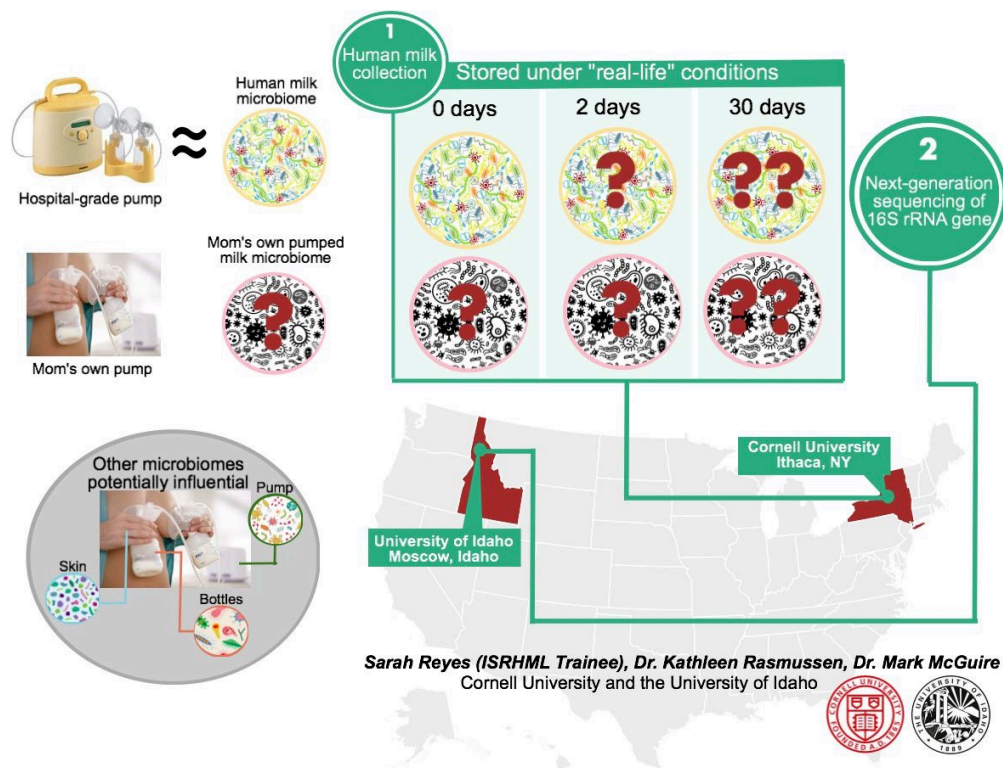
SARAH BOOTHMAN



Navigating the interface between laboratory science and public policy provides a bridge in making changes that will truly benefit maternal, child and infant health. Using scientific results and translating them to inform development of public policy is one thing in which I hope to gain experience during an internship at the World Health Organization. To advance understanding of how our ever-evolving, evidence-based knowledge related to human milk composition and lactation are applied to breastfeeding on a global scale, this project is designed to develop a more thorough understanding of the legal and policy aspects involved in world-wide promotion of breastfeeding and application of research in human milk and lactation. This internship will help equip me to more seamlessly cross disciplinary boundaries. I hope to gain hands-on experience working with programs relating to international breastfeeding promotion and protection, with a focus on national and international policy.

Sarah Boothman is a PhD graduate student in the School of Biological Sciences at Washington State University. Sarah is looking forward to participating in a project that will allow her to combine her interests in human nutrition, law and public health within the context of her current studies in biology, focusing on human milk. Sarah completed her undergraduate degree in human nutrition at Washington State University, and received her Juris Doctor from the University of Idaho College of Law. Prior to her graduate studies, Sarah spent several years as a health educator at a community hospital in a rural, underserved region, where she had the opportunity to get to know many wonderful people and was motivated to continue on to law school and later graduate school to be better equipped with skills and experience to advocate for whatever community she finds herself in.

SARAH REYES



Many women rely on pumping and feeding their milk from a bottle to meet their breastfeeding goals. How storage and handling of human milk (HM) in at-home conditions influence its microbial ecology, which is likely important for colonization of the infant's gastrointestinal tract and risk of infant illness, is poorly studied. Given that the American Academy of Pediatrics recommends HM-feeding without the distinction of *how* HM is fed (breast or bottle), it is important to fill these gaps in knowledge. We will characterize the bacterial community of HM pumped and stored at home. To do this, we will conduct a randomized trial in Ithaca, NY in which women will pump their HM on two consecutive pumping sessions using either their own pump or a hospital-grade pump. Randomization will be used to determine which pump each woman uses first. HM from both pumps will be stored at home and sampled on days 0, 2, and 30 after expression. Samples will be shipped to the University of Idaho where next-generation sequencing of the 16S rRNA gene will be conducted. The results of this research will provide information about the effect of pump type and storage under "real-life" conditions on the bacterial communities of HM, which can be used to inform evidence-based recommendations for handling and storing HM.

Sarah Reyes, MS is a doctoral candidate in the Division of Nutritional Sciences at Cornell University. Ms. Reyes's dissertation, guided by Kathleen Rasmussen, ScD, focuses on the microbial exposures infants receive when they are fed their mothers' milk from a bottle instead of being fed at the breast as well as the relevance of this exposure to the bacterial communities in the infant gastrointestinal tract and infant health outcomes. Ms. Reyes's doctoral research combines training in biological science, epidemiology, and public health nutrition. Ms. Reyes's work is supported by an NIH-sponsored training grant in nutrition, which focuses on training in translational research. Ms. Reyes's long-term career goal is to gain an academic/research position in which she can use her training to advance the science and public health goals of maternal and child nutrition, particularly in the field of human milk and lactation.

Trainee Expansion Program

AWARDEES SUMMER 2017



We are pleased to present the awardees of the TEP Bridge Funds and the TEP Travel Funds, who each received up to USD 100,000 or up to USD 10,000 respectively to advance their academic career.

TEP Bridge Fund Awardees

James Butcher



Characterizing the breastmilk
microbiome with culture-enriched
molecular profiling

TBF Awardee 2017

Kassandra Harding



Evaluation of the first breastfeeding
social media marketing campaign in
Ghana

TBF Awardee 2017

TEP Travel Fund Awardee

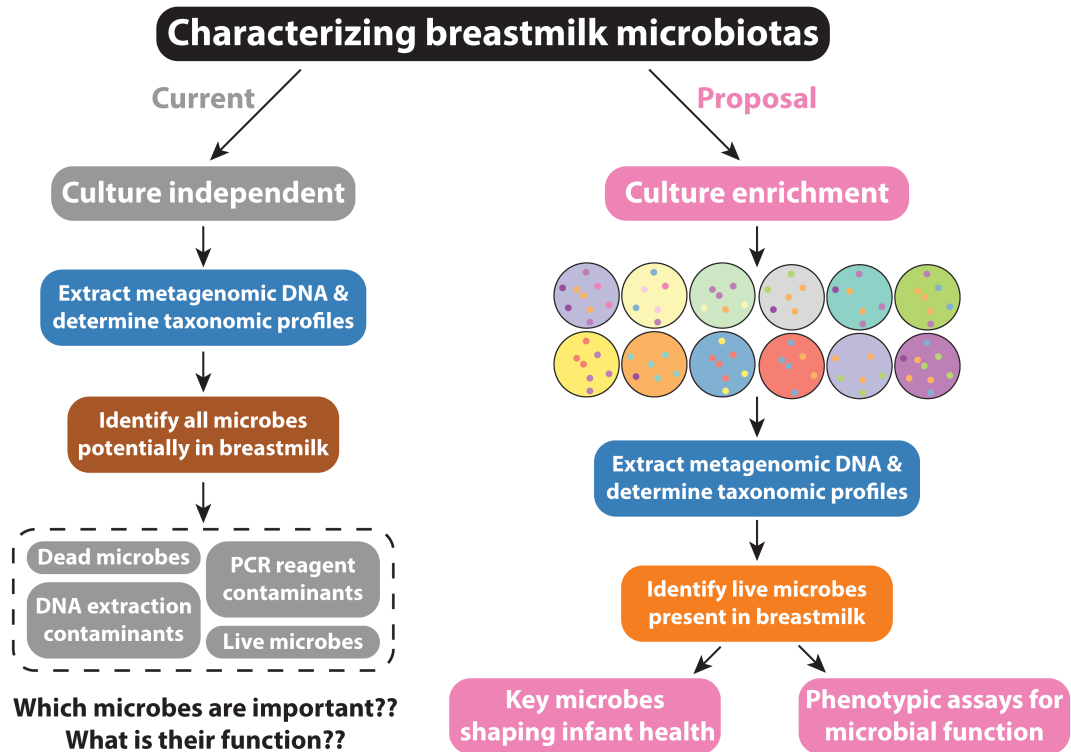
Kyly Whitfield



Responsive feeding

TTF Awardee 2017

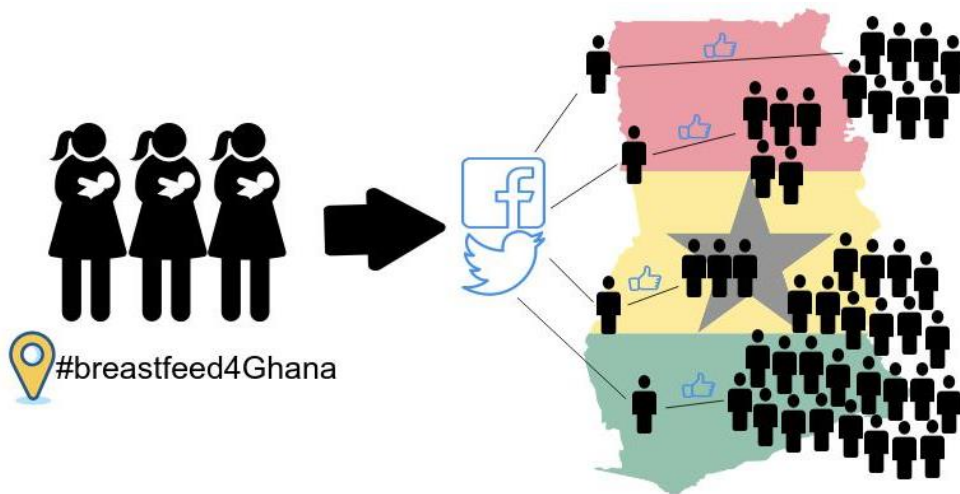
JAMES BUTCHER



Once thought to be sterile, breastmilk is now accepted to contain complex microbial communities and must supply all of the nutrients required by these commensal microbes. Microorganisms in the mother's milk are important to colonize the gut of a new-born infant to help establish a healthy gut flora - all bacteria present in the gut and essential for human digestion and uptake of nutrients. How the breastmilk microbiota adapts, responds and thrives under various conditions is currently unknown and merits investigation. Unfortunately, routine microbiota profiling techniques are ill suited to this task, as they are confounded by breastmilk's inherently low microbial biomass. This project will develop protocols for overcoming these limitations and allow researchers to assess how alterations in the environment and ultimately in breastmilk composition impact microbiota composition and microbial functions.

Dr. **James Butcher** received both his BSc and PhD in Biochemistry from the University of Ottawa, Canada, where he studied iron regulation in the pathogen *Campylobacter jejuni*. Dr. Butcher subsequently completed a Canadian Institutes for Health Research/Canadian Association for Gastroenterology postdoctoral fellowship in Inflammatory Bowel Disease at the Children's Hospital of Eastern Ontario and studied the role of the microbiota in this increasingly prevalent disease. He is currently characterizing gut microbiota development in very low birth weight infants and studying how different feeding regimes influence gut microbiota composition in this vulnerable population. Dr. Butcher will use the funds from the Trainee Bridge Fund to develop protocols for phenotypically characterizing breastmilk microbiotas and study how breastmilk microbiotas respond to alterations in iron bioavailability.

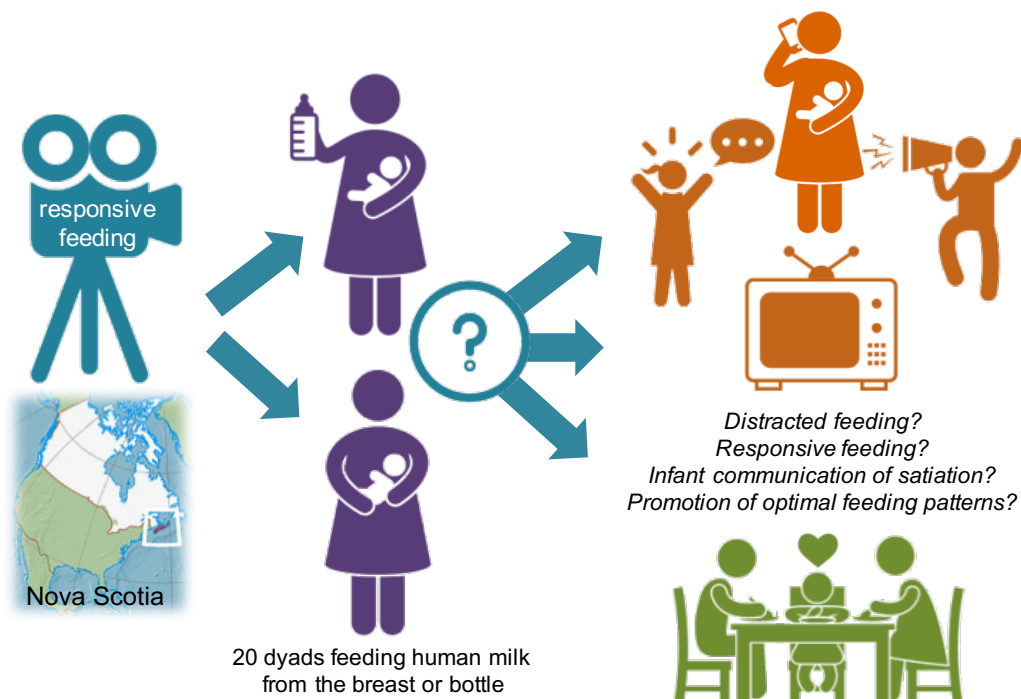
KASSANDRA HARDING



There is a gap in published research regarding dissemination of breastfeeding related information approaches through social media platforms. This approach has the potential to be more cost-effective than traditional campaigns especially when combined with strategies to acquire high exposure and engagement. The utilization of social network analysis could be one approach to optimizing the dissemination of such campaigns given the interrelation between mass media campaigns, social support and breastfeeding practices. This study will implement, monitor and evaluate a breastfeeding social media marketing campaign through Facebook and Twitter and test different paths to disseminate campaign messages incorporating social network targeting methods.

Dr. **Kassandra Harding** is a Postdoctoral Associate at the Yale School of Public Health and a member of the Becoming Breastfeeding Friendly research team. Her research focuses on maternal and child nutrition and health in low-resource settings. Specifically, her interests include: 1) harnessing an understanding of health behavior and beliefs and employing innovative social media marketing methods to develop and improve breastfeeding interventions and promotion of local capacity building; 2) supporting breastfeeding through a focus on women's social networks, empowerment and mental health in low-income settings.

KYLY WHITFIELD



Gan Khoon Lay, Lluisa Iborra, Mello, Ranjit Kumar, Baboon Designs, Madeleine Bennett, Tuk Tuk Design. Map: ©www.maphill.com

Health outcomes are influenced not only by what, but how infants are fed; feeding modality may play a key role in shaping children's eating behaviors and caregivers' feeding practices as children develop. Responsive feeding allows infants to initiate and terminate feedings without caregiver interference, encouraging appropriate energy consumption and development of effective abilities to self-regulate intake in response to hunger and satiation cues. Alternatively, non-responsive feeding patterns, such as encouraging an infant to finish a bottle or feeding while distracted by technology, may lead to overfeeding and decrease the quality of the feeding interaction. To date, there has been no exploration of responsive infant feeding in Nova Scotia, the province with among the lowest breastfeeding rates in Canada. Kyly and Alison will videorecord feeding sessions with 20 mother-infant dyads in Halifax, Canada (10 breastfeeding and 10 feeding human milk from a bottle), for objective responsive feeding analysis in Alison's lab. Kyly hopes that this highly specific training in assessment of responsive feeding and feeding interactions can help to inform the development of infant feeding guidelines for Nova Scotia.

Dr. **Kyly Whitfield** is an Assistant Professor in the Department of Applied Human Nutrition at Mount Saint Vincent University in Halifax, Canada. Kyly is passionate about breastfeeding and global nutrition: the majority of her research aims to identify and combat micronutrient deficiencies during 'the first thousand days' window, from conception through 2 years. Kyly completed her PhD in Human Nutrition at the University of British Columbia under the supervision of Dr. Tim Green, where she studied the efficacy of thiamine-fortified fish sauce to address maternal thiamine deficiency and infantile beriberi in rural Cambodia. Kyly is keen to continue exploring public health-relevant breastfeeding research, this time 'at home' in Canada, focusing on responsive feeding among human milk-fed infants in Halifax. Kyly will be mentored by Dr. Alison Ventura (California Polytechnic State University), a leading expert in the study of mother-infant interactions during feeding and responsive feeding.

Trainee Expansion Program

AWARDEES SPRING 2018



We are pleased to present the awardees of the TEP Travel Funds, who each received up to USD 10,000 to advance their academic career.

ALBA BOIX AMORÓS



Breast milk biomarkers for mastitis

TTF Awardee 2018

ANITA ESQUERRA-ZWIERS



Human milk biomarkers for
perceived insufficient milk supply

TTF Awardee 2018

CAMILLE DUGAS



GDM, breastfeeding and the risk for
obesity and T2DM in children

TTF Awardee 2018

KRISTEN MEYER



Maternal IgA and the infant
microbiome

TTF Awardee 2018

RUKSHAN MEHTA



Mycotoxin contamination of human
breast milk

TTF Awardee 2018

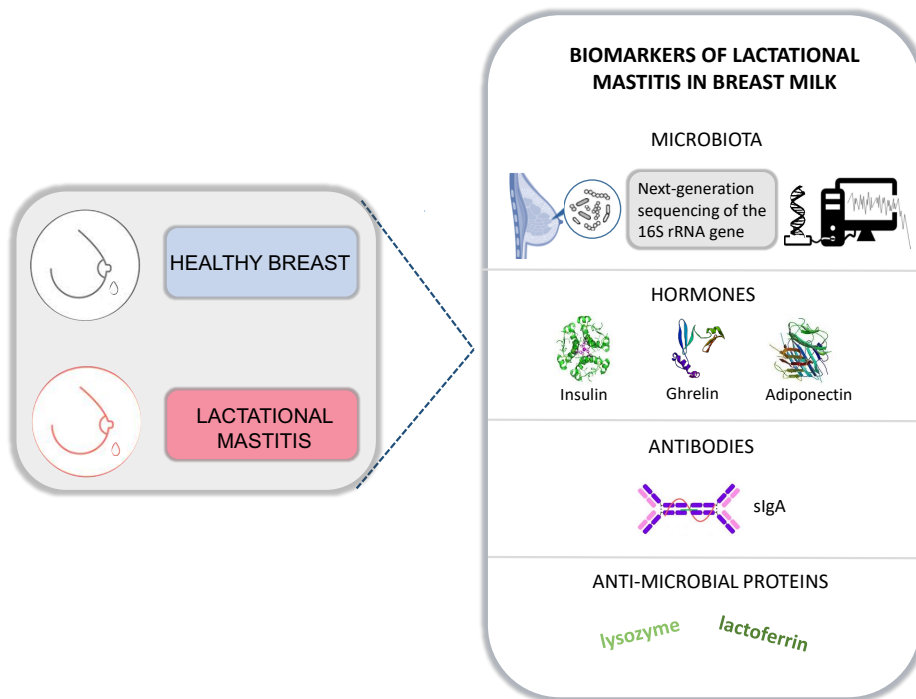
SHIRIN MOSSAVI



Breast milk bacteria strain diversity

TTF Awardee 2018

ALBA BOIX AMORÓS



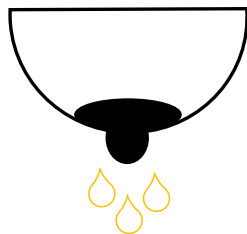
Breast milk (BM) hosts commensal bacteria under normal conditions. However, an imbalance in the bacterial ecosystem can lead to an overgrowth of opportunistic pathogens that may drive to mammary infections, such as mastitis, which is one of the main causes of early weaning. *Staphylococcus aureus* infections are responsible of acute mastitis, causing inflammation and systemic flu-like symptoms. Other commensal bacteria normally present in BM can overgrow and lead to sub-acute mastitis, which is a less acute state of the disease, but fastidious and with difficult diagnose. Little is known about changes in milk components, such as proteins and antibodies, associated to lactational mastitis. In addition, hormonal content during the disease has not been assessed before. Potential differences in BM composition between the healthy status and mastitis could be used as biomarkers of the disease, and novel bacterial next-generation sequencing approaches could help to better understand its etiology.

Alba Boix Amorós graduated from the Polytechnic University of Valencia (Valencia, Spain) with a BSc degree in biotechnology, after which she completed a MSc in biomedical research. During her master thesis, she developed a flow cytometry protocol to accurately quantify bacterial loads in different human samples, including breast milk. Alba is currently finishing her PhD, under the direction of Dr. Maria Collado and Dr. Alex Mira, in Valencia (Spain). Her work focuses on studying the human breast milk microbiota in healthy conditions and during lactational mastitis. She is excited to work at Dr. Donna Geddes's lab, where they will compare several breast milk components in samples from healthy and mastitis-suffering women, in order to examine potential biomarkers of the disease.

ANITA ESQUERRA-ZWIERS

PERCEIVED MILK SUPPLY

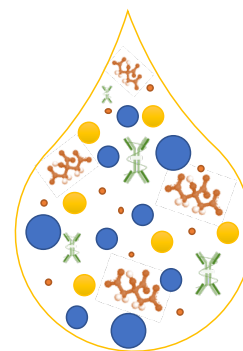
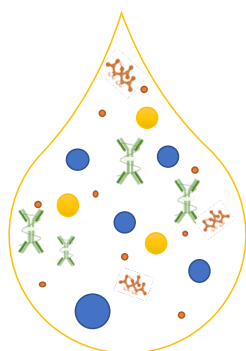
Insufficient



Sufficient



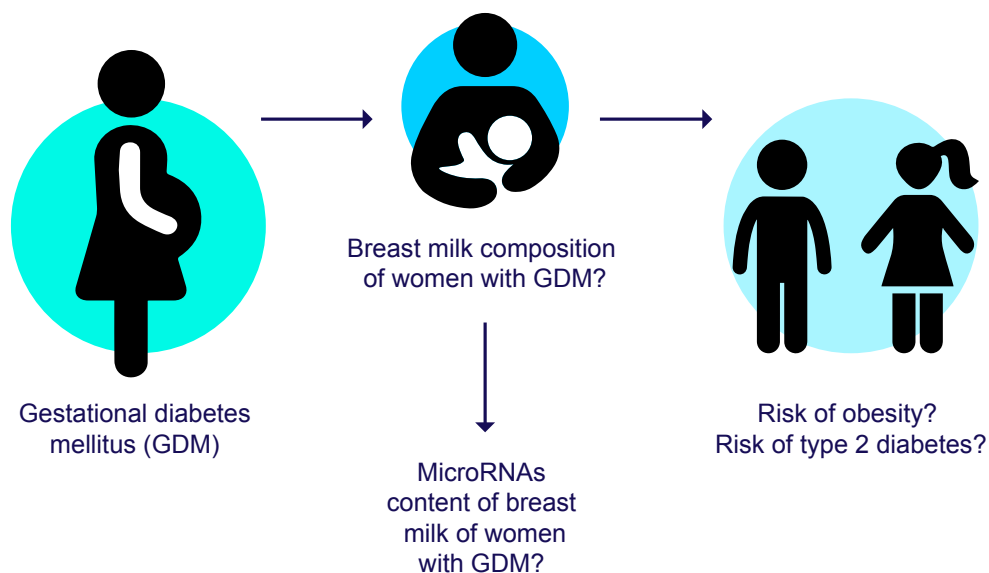
HUMAN MILK BIOMARKERS



Maternal perceived milk insufficiency is one of the main reasons cited for discontinuation of lactation. This barrier prevents infants from receiving optimal nutrition in their first year of life. Much research has been done on social, attitudinal, and behavioral determinants of breastfeeding but research is limited on the role of biological determinants. A better understanding of the biological determinants may offer practitioners a means of targeting early breastfeeding interventions to mitigate complications associated with a mother's perceived insufficient milk supply. This study will provide Anita with the tools to identify human milk biomarkers and evaluate any associations with perceived insufficient milk supply in term mothers controlling for attitudinal, social, and behavioral factors. Anita will obtain 100 term milk samples and measure perceived insufficient milk supply. These samples will then be sent to the School of Molecular Sciences at the University of Western Australia, Perth Australia where Anita will travel and collaborate with their research team to learn how to conduct human milk analysis, discuss, and disseminate these results.

Dr. **Anita Esquerra-Zwiers**, RN is an Assistant Professor in Nursing at Hope College, Holland, MI. Anita's dissertation research focused on mothers of preterm infants and the impact of donor human milk on mother's own milk feedings. During her time working with mothers of preterm infants she learned that some mothers were unable to provide exclusive human milk feedings regardless of their behavioral and motivational factors to provide for their infants. Since the completion of her dissertation she has been establishing her research group focusing on social, attitudinal, behavioral, physiological, and biological determinants of breastfeeding with term mothers.

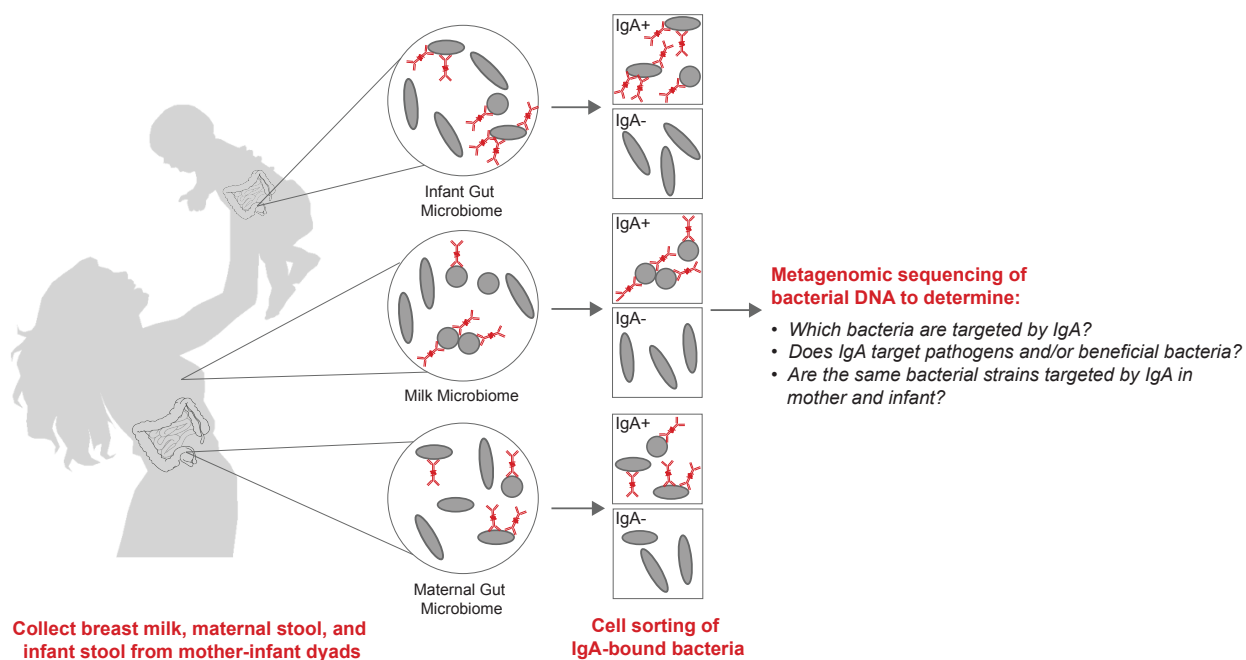
CAMILLE DUGAS



Previous works showed that breastfeeding is associated with a reduced risk of obesity among children exposed to gestational diabetes mellitus (GDM) in utero, but a longer breastfeeding duration seems necessary to achieve this protective effect when compared to children unexposed to GDM. This may be due to the breast milk composition of women with prior GDM that would be altered. However, no study compared microRNAs content of breast milk of women with and without a history of GDM. MicroRNAs are small RNAs particles involved in biological phenomena. They are present in human milk and are transferred to the breastfed infant. As they may be involved in health programming by epigenetic mechanisms, the study of microRNAs content in breast milk of women with prior GDM could allow us to better understand the association between breastfeeding and children's later health among a population at high-risk of developing obesity and type 2 diabetes.

Camille Dugas received both her B.Sc. and M.Sc. in nutrition from Laval University (Quebec City, Canada). During her master degree, she studied the impact of infant feeding practices on glycemic and anthropometric profiles of children exposed to gestational diabetes mellitus (GDM) in utero. To further investigate the association between breastfeeding and subsequent health of children exposed to GDM, an objective of her current Ph.D. thesis is to compare breast milk composition of women with and without a recent history of GDM. Camille will use funds of the Trainee Travel Fund to do a two months internship in Dr Bertrand Kaeffer's laboratory, at Nantes University, in France, to learn a technic developed by Dr Kaeffer's team to evaluate microRNAs content of breastmilk.

KRISTEN MEYER

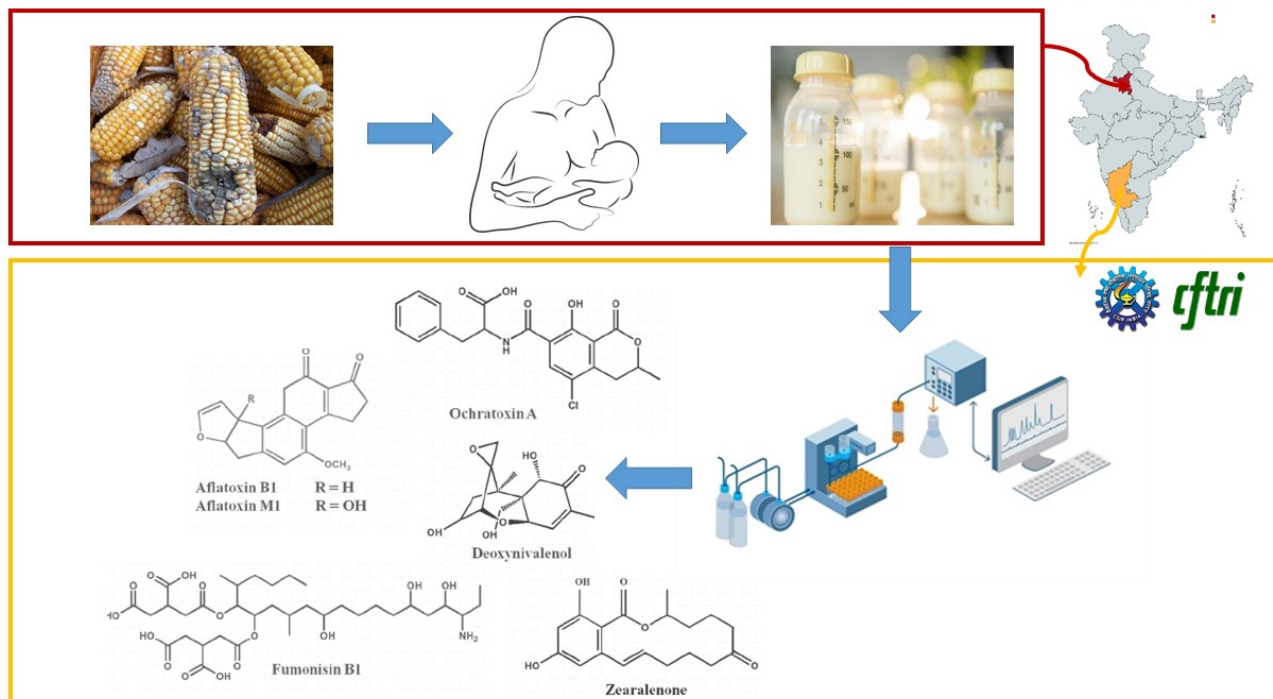


Breastfeeding significantly impacts the development of the infant gut microbiome as breast milk contains many bioactive components that serve to interact with and influence the microbiota in the infant gut. We aim to evaluate the impact of IgA, a highly abundant immunoglobulin in human milk that provides passive immunity to the infant in early life. Using maternal stool, breast milk, and infant stool samples collected from mother-infant pairs coupled with metagenomics sequencing of bacterial DNA, we aim to 1. identify which bacteria are targeted by maternal IgA in each body site, 2. determine if IgA targets exclusively pathogens, or if beneficial microbes are targeted as well, and 3. determine if identical bacterial strains are targeted in both breast milk and the infant gut, suggesting vertical transmission of IgA-coated bacteria. This will inform our understanding of how maternal IgA influences the infant microbiome and will help us understand if the role of IgA in breast milk may extend beyond providing passive immunity to the infant.

Kristen Meyer received her BSc in Chemistry from Washington State University and is now in the Medical Scientist Training (MD/PhD) Program at Baylor College of Medicine in Houston, Texas. Training in the lab of Dr. Kjersti Aagaard, Kristen's thesis research focuses on bioactive components of breast milk and understanding how the milk microbiome, human milk oligosaccharides, and maternal immunoglobulins interact to influence the trajectory of infant microbial development. Kristen will use the funds from the Trainee Travel Fund to study in the lab of Dr. Nicola Segata in Trento, Italy to learn computational tools for metagenomic analysis, which she will use to perform strain-level mapping of IgA-coated bacteria in breast milk and stool samples from mother-infant pairs.

RUKSHAN MEHTA

<http://www.differencebetween.net/science/difference-between-sc-ms-and-lc-ms/>
Appl Biochem Biotechnol (2014) 174:880–896, DOI 10.1007/s12010-014-0993-0



Food safety concerns and environmental exposures are gaining increasing visibility as issues of importance in global health. Mycotoxins are fungal agents found in 25% of the world's food supply chains. We are interested in characterizing contamination of human breastmilk with mycotoxins in Haryana, India among breastfeeding mothers with children 2-4 months of age. To date, there is no data looking at breastmilk mycotoxins among women in Haryana, the last mile link in the bioamplification pathways for these contaminants along the food chain. As part of a larger NIH funded study aimed at understanding the role of maternal malnutrition on lactation performance, this add-on will help us examine the levels of exposures in breastmilk of mothers using high-throughput liquid chromatography/mass spectrometry (LC/MS). We further hope to understand the role of the contaminants on human health, including inflammatory markers in the mother and subsequent impacts on gut integrity in the breastfeeding infant. Mehta in collaboration with Drs. Young and Kannan will work with CFTRI in India to learn extraction and quantification protocols for breastmilk mycotoxins, as part of this TEP.

Rukshan Mehta is a PhD student in the Doctoral program in Nutrition and Health Sciences at Emory University. Rukshan's dissertation will focus on the role of environmental exposures including mycotoxins and pesticides in breastmilk and their impact on child health. Rukshan is particularly interested in the intersecting roles of environmental health and nutrition with a focus on mothers and children in low and middle-income countries. She has worked on several international development projects employing implementation science modalities and is very interested in sustainable global health interventions such as breastfeeding. Rukshan completed her undergraduate degree at the University of Toronto and has a Master's degree in Social Work from the same. She began her PhD after spending 5 years working in international development both in Canada and overseas, last on a randomized control trial evaluating the effectiveness of multiple micronutrient powders to reduce anemia in children.

Trainee Expansion Program

AWARDEES SUMMER 2018



We are pleased to present the awardees of the TEP Bridge Funds and the TEP Travel Funds, who each received up to USD 100,000 or up to USD 10,000 respectively to advance their academic career.

TEP Bridge Fund Awardees

Eva Naninck



Mum don't stop bugging me – does stress affect breastmilk composition and the neonatal gut microbiome?

TBF Awardee 2018

Stephanie L. Martin



Acceptability and feasibility of interventions to improve exclusive breastfeeding among informal working mothers in urban Tanzania

TBF Awardee 2018

TEP Travel Fund Awardee

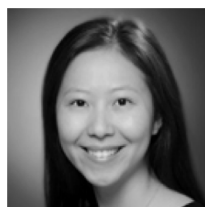
Grace Carroll



Costing a maternity leave cash-transfer to support breastfeeding among women employed in the informal economy

TTF Awardee 2018

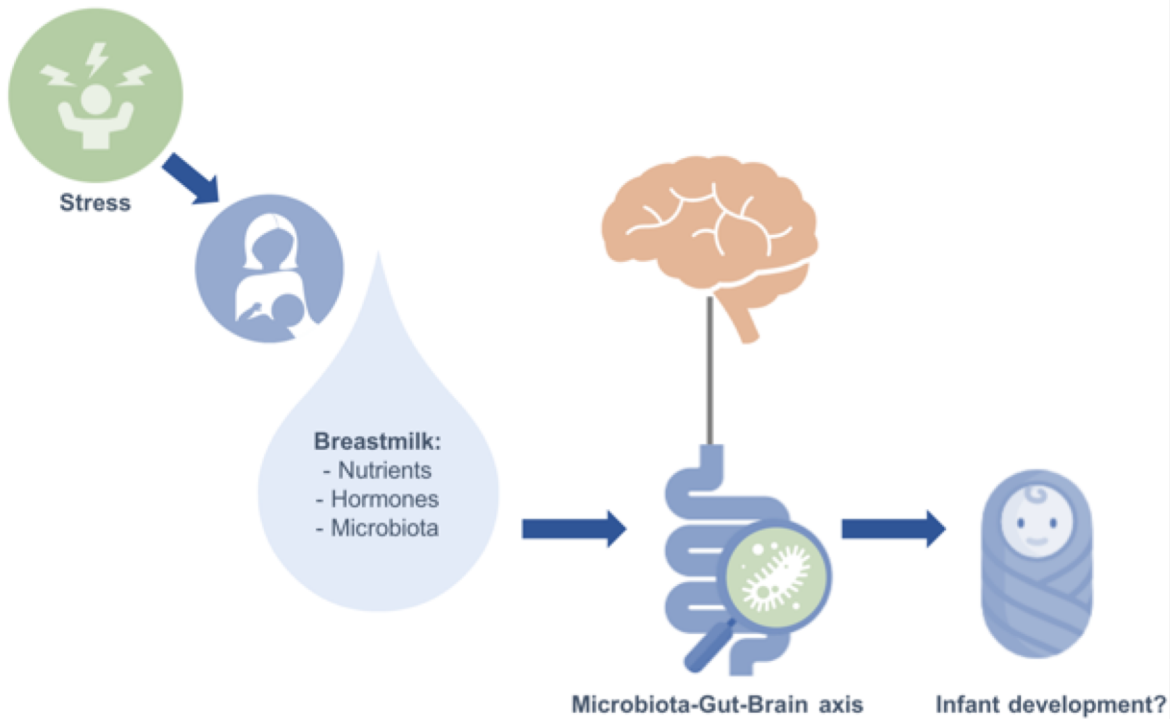
Yimin Chen



Bioactive peptides in digested human milk

TTF Awardee 2018

EVA NANINCK

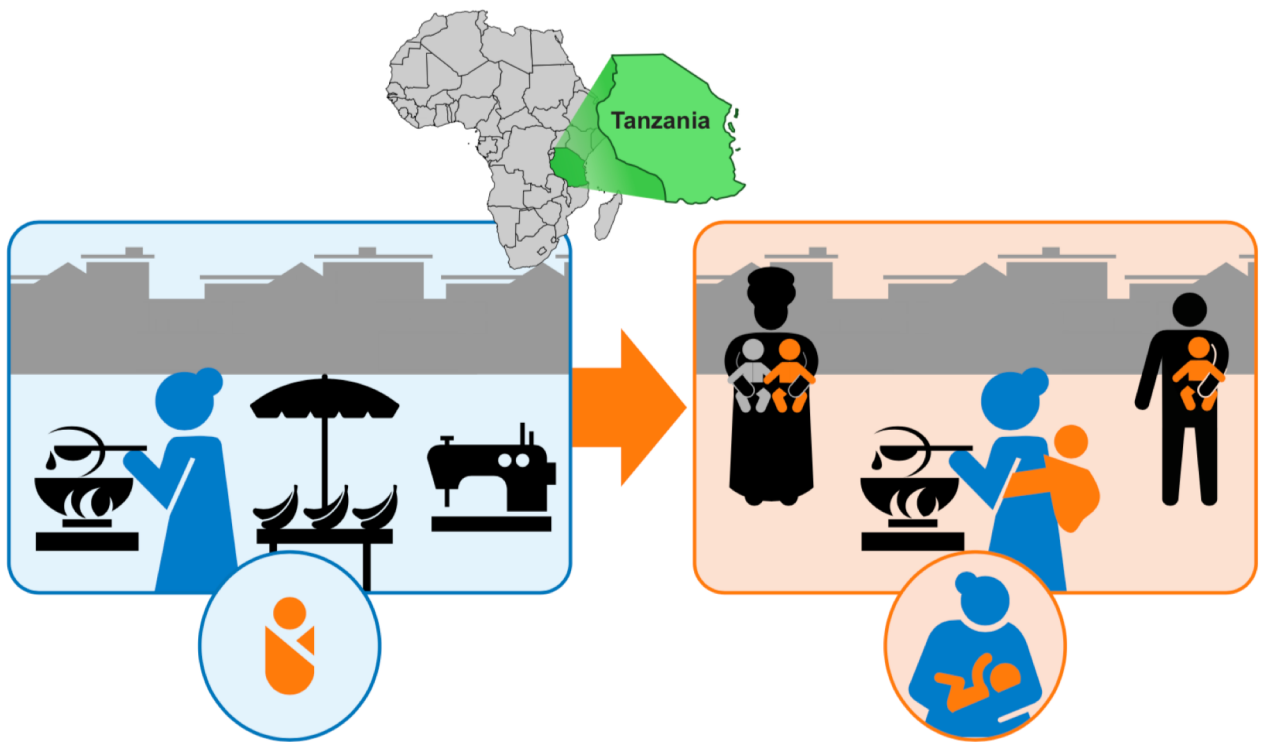


Stress is a very common, unavoidable factor in the lives of many mothers and their infants, known to have a lasting impact on infant development and later health. Human milk conveys biological messages from mother to infant via numerous bioactive compounds, including microbiota, an important emerging factor in neonatal health and programming. However, currently we know remarkably little about how stress affects human milk composition. This project aims to fill this gap.

Specifically, the goal of this project is to investigate the microbial content of breastmilk from stressed and control mothers and study how this relates to gut microbiome establishment and emotional development of their infants. For this, the Amsterdam-Mother's-Milk-Study cohort will be used, a collaborative initiative of stress researchers (Dr. Korosi) and experts in neonatal care (Prof. van Goudoever) and nutritional scientists in the Netherlands. The use of this cohort will allow for the integration of microbial analyses of breast milk and infant fecal samples with ancillary information on maternal stress levels, nutritional and hormonal human milk composition and measures of child development. The findings of this project hopefully lead to recommendations for nursing mothers in inevitably stressful situations.

Eva Naninck, PhD, is a postdoctoral researcher at the University of Amsterdam (the Netherlands) where she manages the Amsterdam Mother's Milk Study. Eva received her B.Sc. in psychobiology and her M.Sc. in Neuroscience (with honors) from the University of Amsterdam. During her PhD at the SILS center for Neuroscience under the supervision of Dr. Korosi and Prof. Lucassen, she studied how stress impacts brain development, with a focus on the role of early nutrition. Her preclinical research showed that nutritional supplementation of the lactating dam can protect her offspring from the negative effects of stress exposure in early life. After obtaining her PhD, Eva started translating her findings 'from bench to bedside'. She set up the Amsterdam Mother's Milk Study to investigate how stress modulates human milk composition. Her research is aimed to provide a new, integrated understanding on how various key components of human milk essentially contribute to infant health and development and how this is affected by stress.

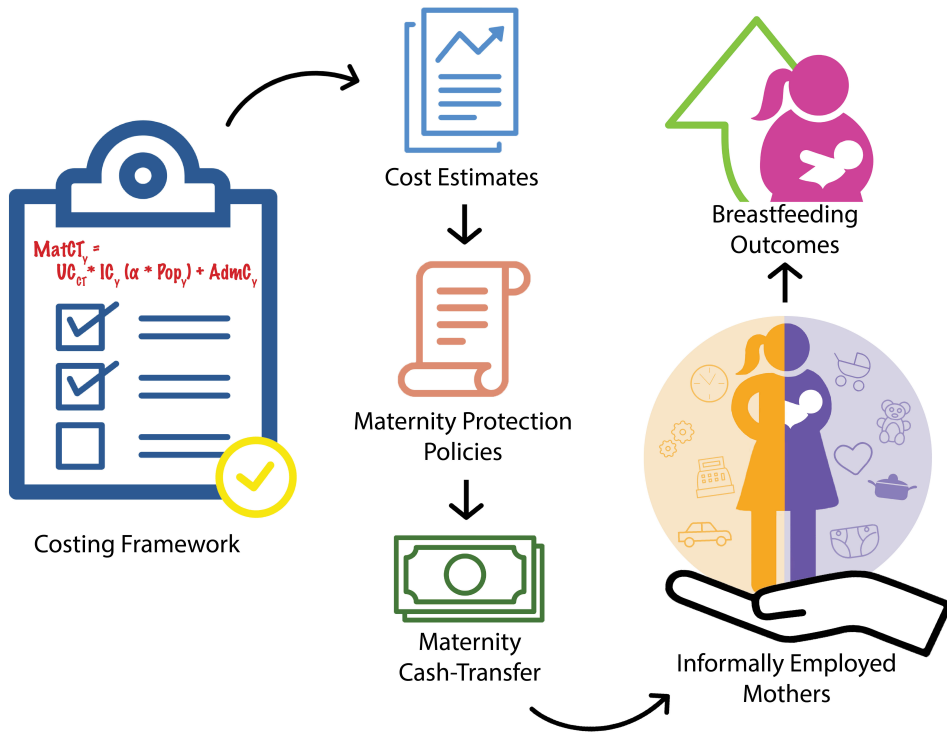
STEPHANIE L. MARTIN



Tanzania, like many countries in Sub-Saharan Africa, is experiencing rapid urban growth. While urbanization can contribute to health improvements and economic advances, current infant feeding practices and child health outcomes in urban areas of Tanzania fall below those of their rural counterparts. Maternal employment is a barrier to optimal breastfeeding practices worldwide, and for women in urban areas working informally (without legal or social protection) exclusive breastfeeding for 6 months is particularly challenging. As the urban population grows, context-specific interventions to support optimal infant feeding practices are needed. This project will use qualitative methods to examine barriers and facilitators to exclusive breastfeeding and assess the acceptability and feasibility of potential interventions to support exclusive breastfeeding among women working informally in Moshi Urban District, Tanzania.

Stephanie Martin, PhD, is an assistant professor in the Department of Nutrition at the Gillings School of Global Public Health at the University of North Carolina at Chapel Hill. She is also a fellow of the University's Carolina Population Center and a Certified Lactation Counselor. Dr. Martin's research focuses on the design and evaluation of behavioral interventions to improve infant feeding practices and maternal and child nutrition in resource limited settings. She is currently examining family members' experiences supporting infant feeding practices in East Africa. Dr. Martin completed her PhD in nutrition at Cornell University in 2016. Prior to pursuing her PhD, she worked as a global health practitioner, and implemented policy-, health facility-, and community-level programs to promote exclusive breastfeeding and maternal and child nutrition.

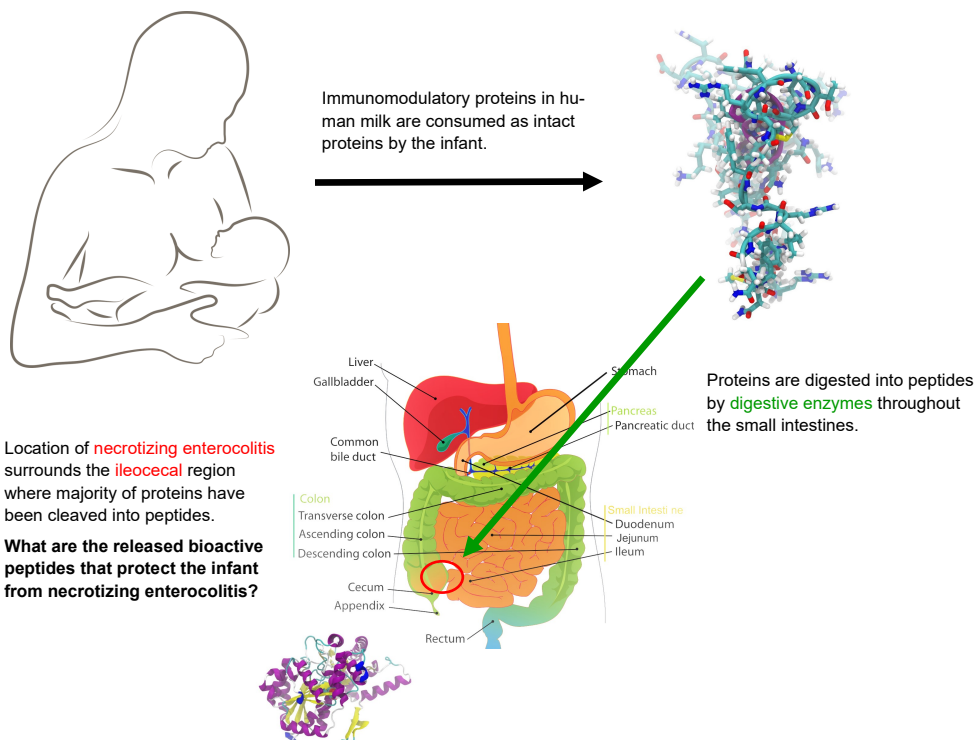
GRACE CARROLL



Many women living in low- and middle-income countries lack maternity leave benefits as they are more likely to be engaged in unprotected jobs in the informal economy. This absence of social protection is one of the structural and societal barriers that interfere with women's ability to breastfeed optimally. Investing in maternity protection for working women in the informal economy is an important social equity mechanism that can also improve breastfeeding outcomes. Currently, there is a lack of country-level guidance for estimating costs to support governments assess the financial feasibility for scaling up breastfeeding programs, such as maternity leave benefits. With mentorship from Dr. Mireya Vilar-Compte, Grace will standardize a costing framework and estimate the costs for a maternity cash-transfer for informally employed women in three low- and middle-income countries.

Grace Carroll is a Research Associate at the Yale School of Public Health and a member of the Becoming Breastfeeding Friendly research team. Grace's research interests are focused on improving breastfeeding outcomes and preventing chronic diseases among vulnerable populations by effectively translating research into policy. Grace holds a Bachelor of Science in Biology from Union College, a Masters of Arts in Education from Oakland University, and a Masters of Public Health in Social and Behavioral Sciences from the Yale School of Public Health. Grace anticipates this project funded by the TEP Travel Fund will help prepare her for a doctoral program and career in the field of maternal and child nutrition and health. Grace will be mentored by Dr. Mireya Vilar-Compte, a distinguished mentor and professor in health economics at the Universidad Iberoamericana in Mexico City.

YIMIN CHEN



Human milk (HM) is the single intervention that has consistently been shown to protect premature infants from developing necrotizing enterocolitis, which is characterized by severe inflammation and tissue necrosis. The most common location of disease occurs at the ileocecal region – the most distal portion of the small intestine and most proximal portion of the large intestine. HM consumed by the infant is fully digested when it reaches this region of the gastrointestinal tract, thus it is most clinically relevant to ascertain bioactive peptides released from digestion and determine the peptides most responsible for suppressing inflammation and cytotoxicity. Once these bioactive peptides are identified, it is Dr. Chen's long-term goal to determine specific maternal characteristics that influence the presence and quantity of these bioactive peptides, and subsequently translating this information to maternal interventions that will positively modify the peptide profile in the HM produced.

Dr. **Yimin Chen** is a postdoctoral research associate at the University of Illinois at Chicago. She completed her PhD with a 15-year background as a nutrition support dietitian with specialization in the gastroenterology, critical care, and neonatology. Dr. Chen's dissertation research showed that in vitro digested colostrum/transitional human milk (tHM) from different mothers suppressed inflammation and cytotoxicity in varying degrees. She will extend this research by profiling the bioactive peptides released in digested colostrum/tHM to determine the peptides responsible for inflammation and cytotoxicity suppression with the support of the Trainee Travel Fund. She will be mentored by Dr. Dallas at Oregon State University, and gain mass spectrometry-based peptidomics expertise.

Trainee Expansion Program

AWARDEES SUMMER 2019



We are pleased to present the most recent TEP Bridge Fund and TEP Travel Fund awardees. Each talented individual received a scholarship of up to USD 100,000 or up to USD 10,000 to help advance their career.

TEP Trainee Bridge Fund Awardee

Yarden Golan Maor



Genomic characterization of regulatory elements that effect human breast milk production

TBF Awardee 2019

TEP Trainee Travel Fund Awardees

Kozeta Miliku



Genome-wide association studies (GWAS) of human milk fatty acids

TTF Awardee 2019

Ashley Nelson



Effect of human milk on the intestinal epithelium and its associated immune compartment

TTF Awardee 2019

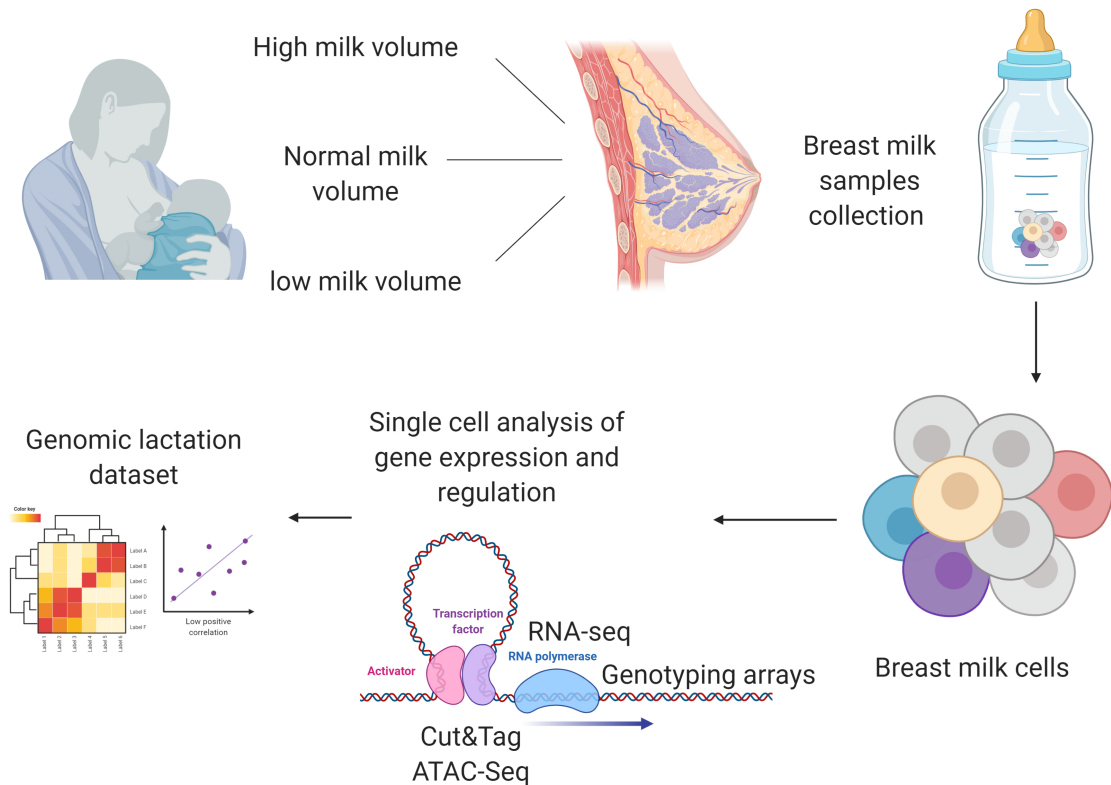
Tonny Jimmy Owalla



Secretion of malaria vaccine antigens in breastmilk during asymptomatic/active malaria infection

TTF Awardee 2019

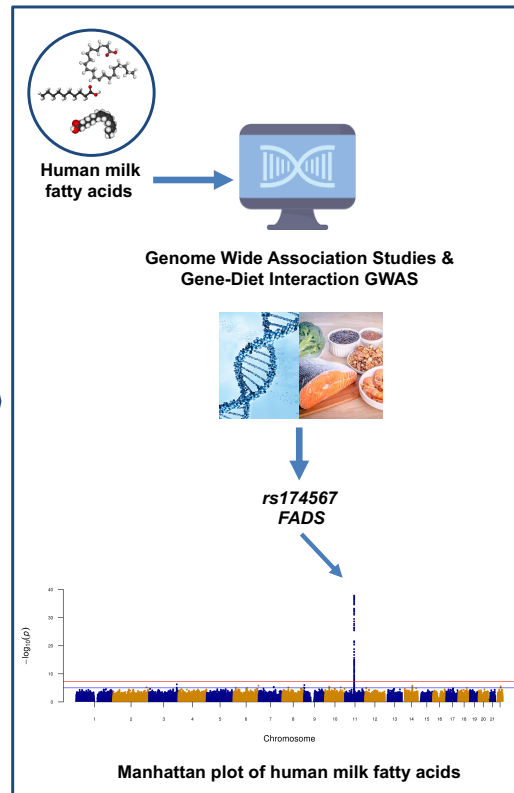
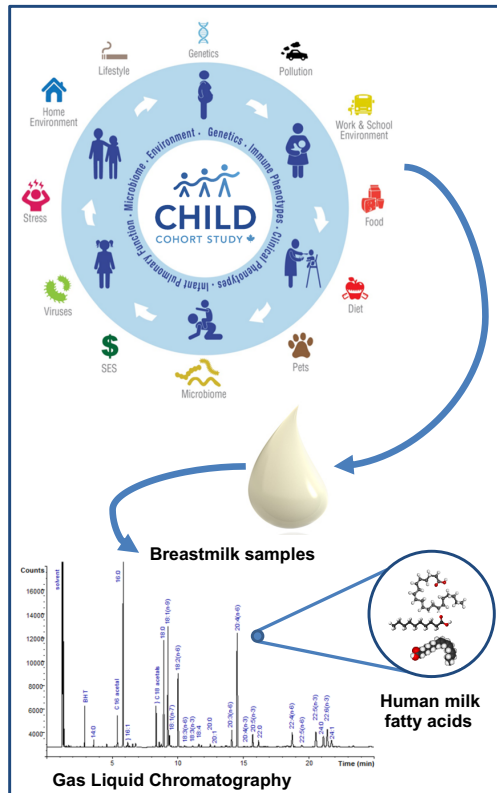
YARDEN GOLAN MAOR



Breastmilk is the optimal dietary source for infants, as it supplies all the nutritional requirements for the first six months of life. It contains macro- and micronutrients as well as numerous bioactive compounds and several different cell types, including epithelial, myoepithelial, stem cells and leukocytes. Genetic variation in the mom may have various effects on breastmilk components and supply and subsequently affect child health and even lead to disease. However, not much is known about the genetic factors affecting breastmilk composition and production. This study will characterize the breastmilk cell transcriptome (single-cell RNA-seq), regulome (ATAC-seq and Cut&Tag), and variome (genotyping arrays) and link them to create a novel and important genomic lactation dataset. Samples will be collected under both physiological (e.g., colostrum, mature milk and involution) and pathological (e.g., low milk production) conditions, to study the mechanisms underlying different lactation pathologies and to characterize how genetic variation influences lactation outcomes and infant growth. Collectively, the results of this study will significantly impact mother and infant health worldwide and expand our toolbox to improve breastfeeding and help mothers dealing with breastfeeding issues and related diseases.

Yarden Golan Maor, PhD, is a molecular nutrition scientist. After completing her Bachelor of Nutrition Science with Honour she started to study for a PhD degree under the supervision of Prof. Assaraf at the Technion (Israel Institute of Technology, Haifa, Israel). Her PhD research focused on studying the transport mechanism of zinc into human breast milk and how mutations in the Zinc transporter 2 (ZnT2) may lead to Transient neonatal zinc deficiency (TNZD) in exclusively breastfed infants. During her PhD Yarden also developed a genomic test for early diagnosis of TNZD using cells that are present in the mother's breastmilk. Yarden recently started her post-doc research under the mentorship of Prof. Nadav Ahituv from the University of California San Francisco where she will continue to discover the effect of genetic variations on human breastmilk production and components.

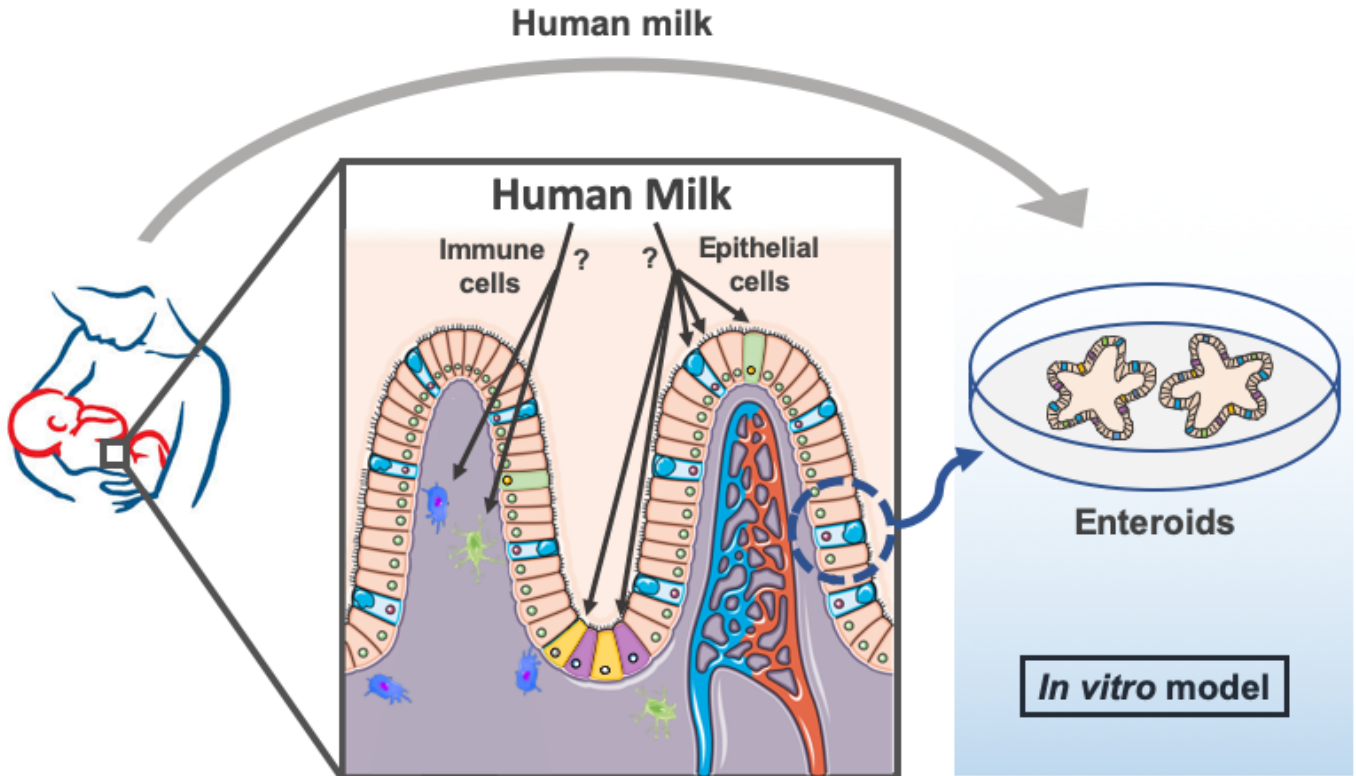
KOZETA MILIKU



Fatty acids are a vital component of human milk. They influence infant growth, neurodevelopment and immune function, and they provide ~50% of milk's energy content. In the CHILD Cohort Study Dr. Miliku and authors have recently shown that mothers' diets (fish oil supplements and dietary fish intake) are associated with omega-3 milk fatty acids levels and *FADS* gene variants determine the concentrations of milk omega-6 fatty acids. Yet, not much is known on other genetic determinants of human milk fatty acids levels, and the combined interactions of gene and diet in human milk fatty acids are not widely explored.

Kozeta Miliku, MD, PhD, is a post-doctoral fellow at Children's Hospital Research Institute of Manitoba, University of Manitoba in Winnipeg, Canada. Her research interest are the fields of human milk and lactation and the developmental origins of health and disease. Dr. Miliku's current work in the Azad lab is focused in determining the role of human milk composition on infant health outcomes and identifying the mechanisms. She will visit Dr. Duan's lab at Queen's University to advance her genetic/genomic research skills and study the genetic determinants of human milk fatty acids.

ASHLEY NELSON





Human milk (HM) is known to promote infant health and many of its effects occur in the gastrointestinal tract. However, our current understanding of the specific effects of HM on the gut epithelium and its associated immune compartment is limited. This project aims to expand our knowledge of the effects of HM on different cell subsets of the intestinal epithelium through use of human intestinal enteroids. Enteroids, aka “mini-guts”, are generated from primary biopsies of the human intestinal epithelium and form structures in vitro that maintain their cellularity and closely resemble the intact gut epithelium. Thus, enteroids are an optimal tool to elucidate the specific effects of HM on the human intestinal epithelium. Under the mentorship of Dr. Sasirekha Ramani at Baylor College of Medicine, Ashley will learn the nuances of enteroid culture, enabling her to establish this cutting edge model in her research on the mechanisms whereby HM promotes health.


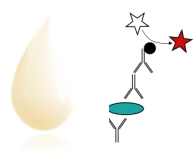
Ashley Nelson is a second year PhD candidate in the Immunology program at the University of Rochester School of Medicine and Dentistry in New York. She received her BSc with high honors in Biotechnology and Molecular Bioscience at the Rochester Institute of Technology. Ashley is interested in studying the effects of human milk on gut epithelial function, with a focus on epithelial cell subsets as well as immune cell populations. She is also the president of a graduate student organization at the University of Rochester called Graduate Students Raising Families which helps support and advocate for student parents.

TONNY JIMMY OWALLA

88 breastmilk samples of asymptomatic *Plasmodium falciparum*-infected breastfeeding mothers in Uganda





High sensitivity ELISA for detection of *Plasmodium falciparum* antigen pLDH and pHRP2 in breastmilk







Plasmodium falciparum HRP2 & pLDH antigens are shed in 15% of breastmilk samples of *Plasmodium falciparum* infected mothers (Van den Elsen, Verhasselt and Egwang, in press)

Is Circumsporozoite protein (CSP) antigen, an immune component of the leading malaria vaccine (RTS,S), present in breastmilk ?




- Develop highly sensitive and specific techniques for detection of *P. falciparum* CSP vaccine antigen in breastmilk
- Determine if CSP is found free or bound to Antibody
- Analyse levels of CSP in 88 breastmilk samples






ELISA Western Blot Mass Spectrometry

Public health significance of malaria CSP antigen shedding in breastmilk in Ugandan infants



- Influence on immune reactivity and susceptibility to *Plasmodium falciparum* infection?
- Influence on malaria vaccine efficacy?



According to the World Health Organization, more than 200 million cases of malaria occur yearly worldwide with the majority in infants aged under 5 years. This highlights the need for a successful strategy of prevention of malaria infection especially in early life. Breastfeeding is the most efficient way to prevent child morbidity and mortality related to respiratory and gastro-intestinal infectious disease. In contrast, there is conflicting evidence on malaria prevention by breastfeeding. We propose the original hypothesis that the presence of malaria antigen in breastmilk may stimulate antimalarial immune defences and reduce malaria risk in breastfed infants. Our preliminary data confirms the shedding of *Plasmodium falciparum* histidine-rich protein 2 (pHRP-2) and lactate dehydrogenase (pLDH) in breastmilk of 15% of breastfeeding mothers with asymptomatic-malaria in Uganda. The goal of this project is to investigate whether (i) the malaria vaccine antigen CSP is secreted in breastmilk since this may influence specific antimalarial immune responses and malaria risk in vaccinated infants; (ii) CSP is free or complexed with maternal antibodies in breastmilk. These questions are significant because CSP is the major component of the new leading RTS,S vaccine. Therefore, we expect that shedding of CSP antigens in breastmilk may be particularly efficient for infant immunisation and prevention of malaria in breastfed

infants. To address these questions, I will set up ELISA, Western blotting and Mass Spectrometry analysis, for detection of CSP in breastmilk samples from Ugandan mothers under the supervision of Professor Valerie Verhasselt during my visit to the University of Western Australia.

Tonny Jimmy Owalla is a Research Associate at Med Biotech Laboratories, Kampala-Uganda with a strong background in malaria. He holds a BSc in Biomedical Laboratory Technology from Makerere University, Kampala-Uganda and expects to attain the MSc in Molecular Biology and Biotechnology from the same university in January 2020. During his undergraduate research, Tonny studied natural immune responses to blood stage malaria vaccine candidates in pregnant women and children in Uganda under Professor Thomas Egwang. This cultivated in him a special interest in maternal and infant immunology. He is currently interested in understanding if malaria vaccine antigens are secreted in breastmilk during asymptomatic/active malaria infection. He anticipates that this Trainee Travel Fund will enable him to acquire important skills relevant to his future research on the role of breastfeeding in antimalarial immunity. Tonny will be jointly mentored by Professors Verhasselt and Egwang.