Foreword

The Lifelong Imprint of Early Nutrition

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A significant body of evidence indicates that the impact of maternal and fetal nutrition goes well beyond the neonatal period. Beginning with early gestation, the first 1000 days represent a time when nutritional factors can have a lasting impact for the rest of the life.[1] While the pathophysiologic effects of severe maternal undernutrition–induced intrauterine growth retardation are well described, severe gestational obesity and excessive nutrition have significant endocrine disruption effects, although the underlying mechanisms are not as well understood.[2] The Barker hypothesis provides a compelling mechanism for metabolic consequences of such perturbations and helps explain why too rapid nutritional recovery after birth can have detrimental consequences. Breast milk and breast-feeding provide a natural protective barrier to some of these consequences. In the end, it is a delicate balance between overnutrition and undernutrition. Supplementation of micronutrients has beneficial effects, but excessive use of these agents also can be detrimental.[3] Evidence points to an epigenetic role of vitamin C in neurodevelopment,[4] and role in cognitive development for folate and choline in addition to several other elements.[5] It is indeed a miracle that most babies do well despite these nutritional challenges and disruptions.

Recent years have also revealed the importance of the gut microbiome as a critical immune modulator in early life, and the impact breast-feeding has on it (**Fig. 1**).[1] As this figure shows, breast milk contains large amounts of bioactive molecules that improve immune defenses. Indeed, breast milk provides a unique pathway for immune modulation of the baby that goes well beyond passive transfer of immunoglobulins. These issues get complicated in the face of premature birth and neonatal complications associated with prolonged hospitalizations and nutritional challenges.

In this issue of the *Clinics in Perinatology*, Drs Swanson and Maheshwari have brought together an impressive lineup of authors and topics to address these critical

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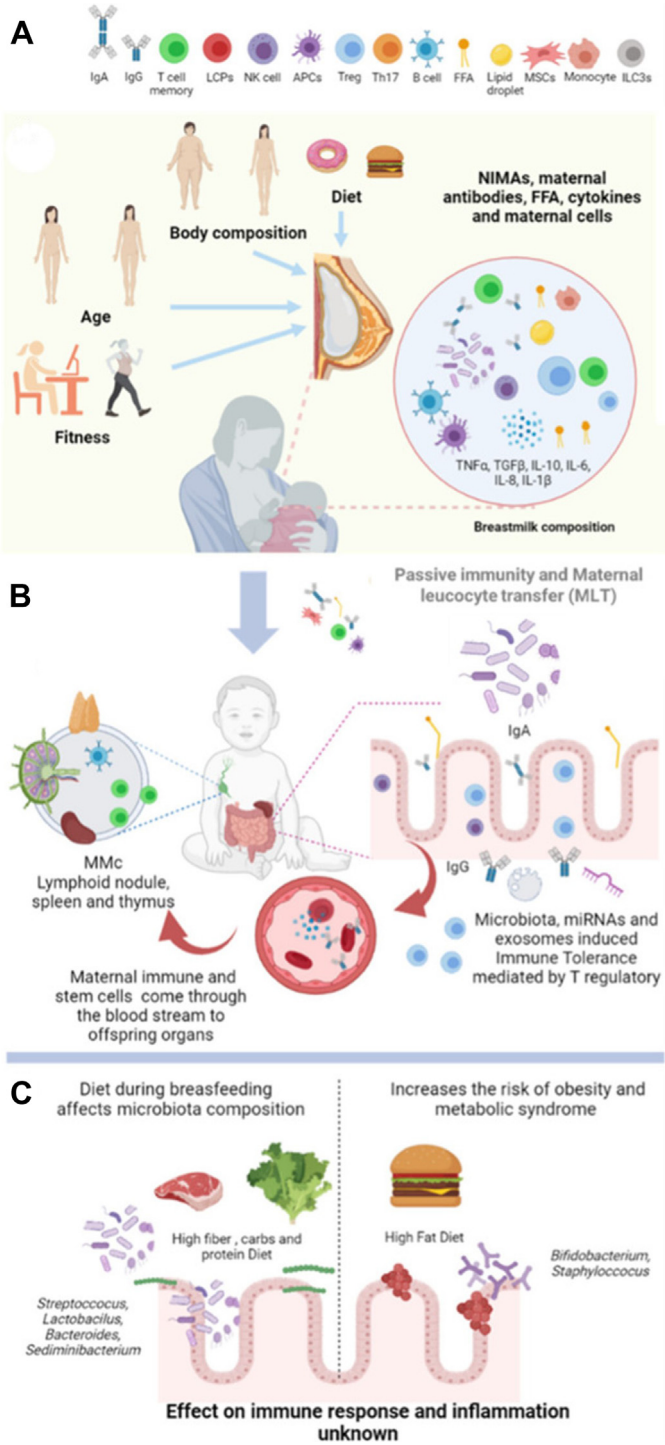

Fig. 1. Breast-feeding provides immunologic programming in the newborn. (*A*) Body weight, age, lifestyle, and diet quality influence breast milk composition, such as lipid

issues in maternal, fetal, and neonatal nutrition. As always, I am also thankful to the publishing staff at Elsevier, including Kerry Holland and Karen Justine Solomon, for their support in bringing this wonderful publication to you.

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species, microbiota, cytokines, and accumulation of immune cell types. (*B*) Maternal antibodies, noninherited maternal antigens, and maternal leukocytes travel through the stomach and intestine of the offspring. Also, maternal immune and stem cells invade the newborn blood, leading to maternal microchimerism to generate immune tolerance. Finally, microbiota and exosomes provide immune tolerance by T-cell accumulation in gut of the offspring. (*C*) A high-fat, carbohydrates, and protein diet intake disrupts microbiota composition by promoting staphylococcus and Bifidobacterium accumulation, whereas high fiber, carbohydrates, and protein lead to lactobacillus microbiota. (*From* Camacho-Morales A, Caba M, Garcia-Juarez M, Caba-Flores MD, Viveros-Contreras R, Martinez-Valenzuela C. Breastfeeding Contributes to Physiological Immune Programming in the Newborn. Front Pediatr. 9:744104.)