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Foreword

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This special issue of *Biology of the Neonate* contains many relevant aspects on human milk and the importance of breast-feeding. Investigators, who have made major contributions to different fields of this topic, have summarized and commented upon our present knowledge. For all those working in the field of infant nutrition, this special issue is extremely welcome and will certainly be considered a reference book. We should be extremely grateful to Prof. Margit Hamosh who not only has edited the special issue, but also is the only or one of the authors of 4 of the 8 chapters.

In this foreword, which I feel extremely honoured to write, I do not intend to review the individual chapters, but will give some general views. In Sweden and other Nordic countries, we have noticed dramatic changes in the prevalence of breast-feeding during the last 50 years. In the late 1940s, it was 60% at 4 months, but then gradually dropped down to 15% in 1972 from which year breast-feeding again gradually became more and more prevalent up to 1980: 70% at 4 months. It then reached a plateau which remained until 1990 when the rate increased again to 80% in 1997, as illustrated in figure 1.

In retrospect, it may be of interest to speculate upon the role of health services including the medical profession at the time of these pronounced changes in the prevalence of breast-feeding. During the first decades of this century, it was obvious that breast-feeding was a sine qua non for infant survival which was mainly attributed to hygienic and macronutritional reasons. During the first years after the 2nd World War, some paediatricians in Sweden and other countries were very concerned about the decline in the rate of breast-feeding. For this reason, attempts were made to find evidence that human milk is superior to infant formulas produced by the industry. Thus, Mellander et al. [1] in 1959 published an extensive study in which physical development and the frequency of certain acute infections in a large population of breast-fed infants were compared with those in formula-fed infants. The only significant difference was that weight, length, and the number of ossification centres were significantly higher at 7.5 months in early-weaned than in late-weaned infants. In the 1960s and early 1970s, some breakthroughs were made which proved the importance of breast-feeding for the development of immunocompetence. Thus, in

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Fig. 1. Prevalence of exclusive breast-feeding at 2, 4, and 6 months (a) and of breast-feeding with supplementary or complementary feeding at 2, 4, 6, and 9 months (b) in Sweden 1978–1997.

1961, Hansson [2], by comparative immunological studies of the immunoglobulins of human milk and serum, showed that milk contains an IgA that differs from that in serum. A few years later, Tomasi et al. [3] published their findings that secretory IgA is the predominant immunoglobulin in several secretions, thus opening the field of mucosal immunology. About 10 years later, Winberg and Wessner [4] showed that breast milk provides the newly born with certain protection against neonatal *Escherichia coli* septicaemia and pyelonephritis. Since then our knowledge about the role of fresh colostrum and breast milk in creating an efficient immune defense system has been explored, as reviewed in this supplement.

In the 1970s, we learnt that the concentration of electrolytes and trace metals in human milk suits the needs of the infant. For in-

stance, the concentration of sodium is highest in colostrum milk and then declines during lactation, which means that the intake of sodium corresponds to what is needed for the expansion of extracellular fluid during growth [5]. The situation is similar as for secretory IgA with a high concentration in colostrum milk which then declines, making the supply about the same during the time of exclusive breast-feeding.

During the last decade, very much new information has been obtained about the roles of various micronutrients such as long-chain polyunsaturated fatty acids and growth factors, white cells, and various factors with antimicrobial activity or stimulants of the immune defense mechanisms. The concentration of micronutrients in human milk may depend upon the supply to the mother. Thus,

the concentrations of docosahexanoic acid and arachidonic acid vary with dietary intake of the mother [6]. As these compounds play an important role in growth, psychoneurological development, and vision, it is of extreme importance that deficiency states in mothers resulting in deficiency in breast-fed infants are prevented. In this connection, it may be mentioned that also other deficiency states may occur in breast-fed infants such as vitamin K deficiency, which is particularly prevalent in Japan and Southeast Asia. Deficiency of folic acid or vitamin B₁₂ in the mother may also cause deficiency states in infants due to lack in the breast milk. The case of severe megaloblastic anaemia in a 3-month-old breast-fed infant born to a mother with vitamin B₁₂ malabsorption was for instance described by us in 1955 [7].

Due to the high educational level of Swedish mothers, they soon became aware of the importance of breast-feeding after the discoveries which were made in the 1970s. This fact and a legislation which guarantees paid (80% of salary) maternal leave for 12 months and which was promoted by female members of the Parliament are the main reasons for the increase in the rate of breast-feeding in Sweden in the 1970s. The further increase in the 1990s may partly be because the Swedish maternity hospitals and obstetric wards started to create baby-friendly hospitals already in the 1980s with the aim of enabling all women to practice exclusive breast-feeding from birth and which then was launched by WHO/UNICEF in 1990.

Despite the enormous amount of information about the composition of human milk that has been obtained during the last few decades, very many fields have to be elucidated until we will fully understand the complete role of breast-feeding. For instance, it has been known for long that the microflora of the gut is different in breast-fed and formula-

fed infants, but we still do not understand which factors are responsible for this difference or the significance for future health. In the last years, many speculations have been forwarded regarding the importance of the gastrointestinal microflora. For instance, it has been considered that the development of the microflora has some relation to autoimmune diseases such as insulin-dependent diabetes and chronic inflammatory disease of the gut or to other immunopathological conditions such as coeliac and allergic diseases. Conflicting results have been reported on the basis of various epidemiological studies. If breast-feeding really has a protective effect, it remains to be shown for how long breast-feeding should continue. Reports regarding the beneficial effects of breast-feeding on the intellectual development of preterm infants have attained extremely high interest [8]. It thus has been very much discussed which factors in human milk are necessary for optimal development of cognitive functions or whether confounders may have an influence upon the outcome. Perhaps it is also worthwhile to make a distinction between the effects of breast-feeding with its rich mutual sensory stimulation and the effect of certain components in breast milk.

Although enormous progress about the beneficial effect of breast milk has been made in recent years, it is obvious that many questions remain to be elucidated. Thus, we have to learn more about the exact mode of action of many compounds thought to be beneficial, about the dynamics of human milk during lactation, and the significance of individual variations. Certainly, this special issue provides not only information about our present knowledge, but also inspiration for creative future research.

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