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# Introductory Chapter: Neonatology - Combining Intensive Care and Family-Friendly Atmosphere

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## 1. Introduction

The new millennium is of course the epoch of technologies. New technologies are already everywhere in our life: information technologies, reproductive technologies, new materials, and world globalization. What can this lead to in the inner world of mother and child, in everlasting mystery of childbirth, and in the struggle of physicians for every lifesaving?

This book combines different chapters united by the same idea to improve medical aid to neonate and its parents by the means of modern technologies.

Each of them gives an overview of a very important area of perinatology beginning from technologies applied during the first minutes of life till methods that help family to be socialized.

It is very important to know that perinatal period is a period of adaptation of fetus and child organism to the environment. "Adaptation" means changes in genes working that will allow a child to have the most advantageous metabolism and behavior in future life. The more we know about genotype, the more it is clear that it is not the only one factor that determines phenotype. The environmental factors such as nutrition, microbiota, mother's behavior, and others can be the strong regulators of gene work. Such factors are called epigenetic factors. During some periods of intensive changes of gene activity, the so-called critical window, these factors can lead to permanent changes in gene activity and form a phenotype. In other words epigenetic factors have a programming role in critical periods. The patterns of reaction to infection, stress, food deprivation, and other environmental factors in later periods of life including aging are formed in gestational period and neonatal period. Perinatal period is the most important critical period in mammal's life. It is a period when the health of future generations can be programmed for all the life period [1].

The mechanisms of programming are already discovered. The process of gene methylation is called "the prima donna" of epigenetic. Methylation inactivates gene transcription [2]. In embryo before implantation, the majority of genes are methylated, and all the next development is a series of demethylation and methylation. Other mechanisms are histone modifications, regulatory miRNA, and tiRNA [3, 4].

Nutrition is a strong external factor of programming. It is a signal of availability of nutrient resources, their quantity and quality [5]. Nutrition contains methyl ( $-CH_3$ ) group donors: folates, B12, B6, choline, methionine, and betaine. Also nutrition is a platform for macro- and microorganism interaction. And finally it is a functional molecular donor and direct regulator of gene function.

The mother's under- and overnutrition can lead to placenta regulatory gene changes. The placenta can, for example, increase glucose transport to fetus, but in some critical situations, its functioning may be "selfish" through accumulating nutrients for its own needs [6]. The placenta regulates also the synthesis of neuroactive factors, serving as a major source of serotonin to the fetal forebrain [7].

In the fetus itself, major changes following nutrition impairment are happening in genes and their products regulating reaction to stress, fat, and glucose metabolism [8, 9]. Is now shown in big cohort studies that body composition, rate of metabolic syndrome, obesity, atherosclerosis, type 2 diabetes, and rate of cardiovascular death depend on nutrition in prenatal period and infancy [10]. For example in the population of the survivors of Dutch Hunger Winter at the age of 60–65, birth weight negatively correlated with the rate of glucose intolerance, hyperlipidemia, and arterial hypertension, and there was found less DNA methylation of the maternally imprinted IGF2 gene [11, 12]. Learning ability, behavior, and fertility in adult life are also dependent on nutrition in critical period [13–15]. Psychiatric diseases are also partially programmed by continuous dietary deficiency by inactivation of expression of genes for myelin development and oligodendrocyte-related genes [16].

What can we do to regulate undesirable effects of complicated pregnancy? We should know that the infancy period is also a critical period and neonatologists and other specialists can do a lot to regulate future development, especially in premature neonates.

It is important to minimize stressful factors such as hypo- and hyperoxia, pain, and caloric and protein deficit. The moment of adaptation to extrauterine life is of a great importance. The first hours of life are "golden hours," and they are important not only in the context of lifesaving but in the context of programming.

After birth nutritional programming continues through nutrients, regulatory factors, and microflora of milk, but there are specific ways of continuing direct gene regulation through microvesicles containing mRNA transcripts, which possess reverse transcriptase activity [17].

To provide breast milk feeding [18] with or without combination with artificial parenteral or enteral nutrition, to take care of forming microbiota [19], is a way to prevent a big number of negative metabolic changes.

Finally, the mothers' behavior and her integration in child care also have a programming effect. Animal experiments and big cohort studies [20–22] showed that less anxious and more positive mother more often takes a child and contacts with him or her and this has enormous effect on offspring's reaction to stress in cognitive development in future life.

This book gives an overview of modern strategies in neonatology that can influence health of adult.

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