'Fetal Programming, Functional Teratology, and Perinatal Preventive Medicine'

During critical periods of pre- and early postnatal life hormones, metabolites and neurotransmitters are decisively involved in the differentiation, maturation, and functional 'programming' of their own central nervous controllers. Therefore, in abnormal concentrations they can act as endogenous 'functional teratogens' during self-organization of complex neuro-endocrine regulatory systems, leading to permanent malorganization and, consequently, malfunctions throughout later life. Such a hormone-dependent 'functional teratogenesis' can be induced by alterations of the fetal (intrauterine) and/or early postnatal nutritional and metabolic environment, because hormones act as endogenous mediators (effectors) transmitting informations from the environment to the genome.

Against this background, our research work focusses on epidemiological and clinical as well as experimental studies on the consequences of, especially, altered hormone concentrations during critical periods of fetal and neonatal life for a lasting 'malprogramming' of the 'neuro-endocrine-immune-network' and, e.g., regulatory systems of food intake, body weight, and metabolism, etc..

Major Research Topic

Impact of fetally and/or early postnatally altered nutrition (maternal hyperglycaemia, overnutrition, undernutrition) as predisposing risk factors for obesity, diabetes, and associated / consecutive cardiovascular disturbances throughout later life.

A Current Working Hypothesis

Fetal and neonatal hyperinsulinism/hyperleptinism/hypercortisolism may lead to perinatally acquired persisting malorganization/ malfunction of hypothalamic regulatory centres of body weight, food intake and metabolism (e.g., persistent hypothalamic resistance to the satiety signals insulin and leptin; increased basal expression of orexigenic neuropeptides) and, consecutively, permanently increased disposition to obesity, diabetes, and resulting cardiovascular disturbances.

Current Investigations

Epidemiological and clinical studies on the impact of familial, intrauterine, and early postnatal parameters (metabolic, nutritional, anthropometric, endocrine) for the development of body weight, metabolism and central nervous functions in children of mothers with diabetes during pregnancy (Type I or gestational diabetes; the 'Kaulsdorf Cohort Study,' 'KCS')

Morphological, morphometrical, biochemical, and genetic investigations of hypothalamic circuits in newborn and adult offspring of gestational diabetic mother rats with or without islet transplantation, in neonatally overfed rats, as well as complex characterization of their perinatally acquired metabolic and functional phenotype.
Research perspectives

With regard to the broadly accumulating evidence on fetally acquired persisting dispositions to chronic diseases, this increasingly highly competitive field of research on epigenetic ‘fetal programming’ (i.e., ‘fuel-mediated functional teratogenesis’) will play a key role for new concepts in the fields of genuine preventive medicine in the nearby future, especially due to optimization of health care for mothers and newborns.