**The importance of early stimulation from first day of life**

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Scientists working in the Developmental Neuroscience Laboratory (Nu-Lab) at NTNU believe that small babies are smarter than we think in general and are born with a brain that needs stimulation from day one for optimal development through the lifespan. Newborns are very curious and we should challenge their passion as this helps us discover various brain and psychological functions as early as possible. Importantly, we believe that stimulation has to be developmentally appropriate to avoid any harm to their sensitive psych and normal development.

To be more precise and objective, health-life challenges for human beings, like the current experience of Covid-19 pandemic, could lead to a number of impairments in social skills, emotional and affective dysregulations, weakening sensorimotor coordination or increasing cognitive challenges, language difficulties, behavioral or psychological problems among infants and toddlers mostly. This reminds us developmental neuroscientists of the importance of the need for scientific studies to investigate and understand what and how infants learn about themselves and the world, how they time their actions and anticipate forthcoming events, what they are processing and what factors are influencing the development from different perspectives, particularly the neural and psychological domain. On the other hand, in order to improve and diminish health-related concerns as much as possible for both preterm and full term born babies (the main target study groups at Nu-Lab), with any health conditions (either pre/mature), deeper research and advanced analyses are required to tackle and investigate brain and neuropsychological differences, and changes in both full term and preterm newborn babies.

Structured scientific research from our current and past studies and education resulting from rapid neurodevelopment of little ones provides us with opportunities to learn and practice different activities and skills to educate our children as early as possible. From neurobiological perspective, we now know that synaptic pruning in nervous system is happening as a natural process especially during the first years of life. Therefore, as brain cells are malleable and growing rapidly and getting more specialized during this time, very simple activities in the early stages of life are essential to stimulate natural curiosity, enrich interpersonal skills, sensorimotor functions, attributes and communicational skills from neural to the cognitive and behavioral levels. For example, effective activities including use of appropriate games based on age, collaborative activities, educating reasoning and problem solving, or improving creativity and executive functions such as planning and goal setting are very useful. However, not every function and skill is necessarily educated, or followed and manipulated by us as caregivers, parents, teachers and whoever else is involved in this neurodevelopmental trend. Nonetheless, to particularly provide a group of resources and let the small brains experience and discover by themselves, in their own natural ways, is highly necessary for their development and learning. According to scientific reports, infants are more vulnerable and easily affected in the first stages of their life. The younger the infants, the more disorganized their neurological and neuropsychological systems. Therefore, early detection and early stimulation as possible could potentially prevent or improve their functions and depending on environment and type of stimulation, brain connection can increase or decrease by approximately 25%. For example, visual stimulation enhances curiosity, attentiveness and concentration in their early stages of life.

From the past and ongoing studies at Nu-Lab we learned that any poor maturation in newborns by comparison between preterm, near term and full term ones has led to impaired visual perception and reaction to the looming danger especially in the first year of life. The human visual system is very complex and based on the scientific reports, a part of the brain’s anatomical structure needs to be normally developed before birth. But premature birth can interrupt this important development and lead to further dysfunctions in visual processing. As vision is our insight to the world, and it is clearly crucial for the normal development in cognitive and sensorimotor functions in daily life and especially is essential for development of postural control and balance. Therefore, we recommend families to take these 30 years of laboratories and clinical reports into their considerations and note that all these human studies cannot be performed without their valuable help. We express that scientific and structured studies are needed to assess and answer to basic research questions that are seeking for neural underpinnings and basis of the function of human mind and behavior. In many cases and times, it is very hard for us, scientists, to answer basic research questions because of ethical reasons concerning human studies, e.g., we cannot induce any brain and psychological dysfunctions to examine our research study in our own laboratories or clinics. Therefore, we rely on diseases and dysfunctions that naturally occurred. However, not every study is looking for abnormalities and dysfunctions, and not every research question aims to investigate problems as such. In many cases, scientific questions can be answered by examining normal (or close to normal) functions, and results will be used to enhance various components for healthy individuals or to further elaborate different types of clinical studies. The other method of study in our lab uses a longitudinal approach: we investigate the same element or factor to answer the same research question throughout the lifespan by recording at different ages. The importance of such studies is to monitor both mature and immature developments, to understand how the variable is affected with age with no special training programs, education or with pre-designed programs to enhance brain functions e.g., sensorimotor or visual motion perception during early stages of life. For instance, previous studies suggest that having massage or controlled locomotions for preterm born infants in the early years of life would accelerate development of vision and enhance neural plasticity. Other studies revealed that baby swimming programs are very effective for various aspects of development including sensorimotor functions. Arms, legs, neck muscles and joints seem to be possible to be strengthened this way, while different water activities and games in the water enhance vestibular systems, improve motor skills and autonomy, or cognitive functions. These results are observed particularly when children are experiencing a very warm environment physically and psychologically together with parents and other babies in the program. Indeed, with all the meaningful and valuable progress in both laboratories and clinical settings, these research questions and programs still need to be assessed in further details, replicated or deepened to better understand human brain, mind and body interaction during the first few years of life. Further research would help develop and promote enhancement or rehabilitation programs. One of the main goals our team in Nu-Lab is to develop and offer guidelines and techniques to improve or enhance a wide range of functions e.g., increase multiple intelligence, deinstitutionalize of children with special needs, neurodevelopmental and other neurological and psychiatric disorders, sensorimotor functions or to optimize learning for every individual. All these mentioned goals require having several elements or factors well developed by neuroscientists in a right time of the development to be successful.