

## **Gravitation and the vestibular system as a source for development and for sustained health**

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The gravitational force of our planet, by its way of acting on us, is of great importance for our physical and intellectual development. “The force of gravity prevails continuously everywhere on this planet and is of prime importance in permitting the nervous system to perform all aspects of its function. As Stanley-Jones ( 1960 ) has pointed out, the sensory receptors of the vestibular apparatus in the inner ear responding to the force of gravity are non-adaptive and are the most important energy source for increased neuronal activity“ ( Hydén 1969 ).

At Vestibularis™, a school of fundamental movement education, in Mönsterås, Sweden, more than 600 children and youngsters with sensory motor - and / or concentration problems have been trained according to a specially devised method of training, Education in Balance™, with the special aim of giving the nervous system a second chance to ‘re-connect’ and to mature. Most of the clients are healthy individuals within the normal range of intelligence.

During the training there is always improvement when it comes to movement behaviour. Working from the hypothesis that vestibular stimulation matters, another experience is increased awareness and a better ability to use higher cognitive levels. ‘So we have developed this simple rule that sort of brings together everything into one single entity we call the self. *It stands on the vestibular nucleus and pokes its head into the brain* - it has an up and a down to it, it has a visual component, a sound component, and so on’ (Llinás 2002).

The training is divided into five integrated parts and follows the sequence of neural development.

1. Stereotypical (Thelan 1979, Thelan, Fischer 1983), fetal and neonatal movements. Devised by Blythe, Goddard Blythe (2002) Niklasson and Niklasson (2001) following the patterns of the ‘Primitive Reflex’ system. “The early movements of the fetus and neonate, which were previously viewed as passive byproducts of rapid neural wiring are now viewed as interactive, that is, having a reciprocal effect on the underlying structure and function of the central nervous system”(McPhillips et al 2000).

2. Vestibular stimulation, we have found to be of importance for the integration of the stereotypical movements into the nervous system (Guyton 1991, Niklasson 2001). “Stimulation of the vestibular nuclei generates muscle tone and liberates the nervous system from these infantile reflex patterns” (Robbins 1977).

3. Games with the special aim of enhancing muscle strength and body awareness.

4. Tactile stimulation.

5. Gross motor milestones. The unfolding (Bohm 1987) of rolling, creeping, crawling, walking and even talking (Niklasson in work) mirror the child’s ability to defy the gravitational force (Fay 1954, McGraw 1941).

6. Exercises in an erect position. The last part of the programme is balance training in erect position.

The client is training at home fifteen minutes a day according to a specially devised program and is re-assessed every eighth week during a period of at least 2.5 years.

7. Auditory Discrimination Training (ADT) is running parallel to the sensory motor training.

A stream of vestibular input to the brain is generated by just balancing the head against gravity. All kinds of movements will then alter this input. One consequence of this is that by

moving the body one alters the state of the brain. The vestibular nuclei within the brain stem are closely connected to the reticular formation. The reticular formation is one of the oldest parts of the nervous system and it is very complex, running fibres to and from every internal organ, sense organ, muscle and brain region. According to Scheibel and Scheibel ( 1960 ) the average reticular neuron is connected to about 40.000 cells within the cerebral cortex.

“Because the vestibular nuclei are intervoven into the reticular formation, any vestibular process may effect the entire reticular formation, while an activity anywhere in the reticular formation may influence vestibular responses” (Robbins 1977).

“Other phylogenetically old and early developing pathways, such as some of the reticulospinal tracts, probably participate also, as has been suggested earlier (...) for internuclear connections probably reach cells of the reticular formation early in development, since the reticular formation is an old system phylogenetically (...)” (Humphrey 1964). The reticular formation is not fully myelinated until after puberty and according to Schilder it will take the growing child up to fifteen years to learn to move and to orient the body against the gravitational force.

Through the reticular formation and via the vestibular system the organism is prepared to deal with different sensations to be able to form adaptive responses.

My experience from Education in Balance leads me to propose that health research as well as research toward a science of consciousness should benefit from incorporating knowledge about the vestibular system and knowledge about how gravitation affects the human body. I give support to Pettigrew’s conclusion (2004) “ Gravity may provide a new arena for the interaction of the physics and biology of consciousness “.