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Neuroanatomy Assignment.

Developmental Genetics of the Cerebellum

The cerebellum is responsible for maintaining balance, posture and coordinating voluntary movement. The cerebellum develops from the hindbrain vesicle that gives rise to the posterior part of the alar plates of the metencephalon. The cerebellar hemisphere and vermis form by the 12th week. Accordion-like folds gradually start developing from about the fourth month.

Brain development and function requires the coordinated genesis, migration, and maturation of all of its cellular components. The product of the Reelin gene (Reelin) has been identified as a major determinant of neuronal migration that also plays a significant role in cellular maturation and synaptic function. Reelin gene (RELN) is located on chromosome 7q22.

Reelin is a large secreted extracellular matrix glycoprotein, besides its important role in early development reelin continues to work in the adult brain. It modulates synaptic plasticity by enhancing the induction and maintenance of long-term potentiation. It also stimulates dendrite and dendritic spine development and regulates the continuing migration of neuroblast generated in adult neurogenesis sites like the subventricular and sub granular zones.

The VLDLR gene provides instructions for making a protein called a very low-density lipoprotein (VLDL) receptor. This protein is active in many different organs and tissues, it is located on locus 9p24 on chromosome 9. The VLDL receptor works together with a protein called reelin. Reelin fits into the VLDL receptor like a key in a lock, which triggers a series of chemical reactions within the cell. During early brain development, the reelin signalling pathway helps to guide the movement of immature nerve cells (neuroblasts) to their appropriate locations in the brain. VLDLR-associated cerebellar hypoplasia is an inherited condition that affects the development of the brain. People with this condition have an unusually small and underdeveloped cerebellum.