13 - C. Synaptic pruning

C. Synaptic pruning

© SPMM Course 3. Neurodevelopment A. Neurogenesis Early fetal life is a prolific period of neurogenesis. An active zone of nerve cell production is seen immediately around the ventricles of the neural tube. This is called a subventricular zone. Neurons produced here migrate outwards to the cortical plate. Thalamic axons that project to the cortical plate initially synapse on a transient layer of neurons called the subplate neurons. In normal development, the axons subsequently detach from the subplate neurons and proceed superficially to synapse on the true cortical cells. The subplate neurons then degenerate. In some patients with schizophrenia an abnormal persistence of subplate neurons has been noted, suggesting a failure of axonal path-finding. It is now known that continuous neurogenesis takes place in certain brain regions (particularly the dentate gyrus of the hippocampus and olfactory bulb) in adults. Stress reduces hippocampal neurogenesis; enriched environments, exercise and antidepressants promote hippocampal neurogenesis. There is some controversy around whether adult neurogenesis is observed in other brain regions. B. Neuronal Migration/Myelination Neuronal migration takes place in the first 6 months of gestation. Two types of migration are noted: radial and tangential. Radial migration is the primary mechanism by which excitatory neurons reach the cortex. Radial glial cells form scaffolding through their foot processes to guide the migrating neuronal cells. Successive populations of migrating neurons travel past the previously settled neurons (inside out pattern) to form radial stacks of cells (Rakic’s cortical columns). Most inhibitory interneurons in the external and internal granular layers are tangentially migrated neurons. Abnormalities in neuronal migration result in neurons failing to reach the cortex and residing in ectopic positions. This is called heterotopia. Myelination begins prenatally at around 4th gestational month; it is largely complete in early childhood (by 2 years), but does not reach its full extent especially in association cortices until late in the third decade of life. C. Synaptic pruning Synaptogenesis occurs very rapidly from the second trimester through the first ten years of life. The peak of synaptogenesis occurs within the first 2 postnatal years. By mid-childhood, more neurons and cellular processes are established than required for adult's brains. Thereafter a process of pruning or synaptic elimination takes place to select and preserve the most useful while eliminating the unnecessary neuronal connections in the adult's brain. This synaptic pruning continues through the early teen years. Neuronal numbers can be studied using a wide variety of markers including the density of D2 receptors. Before 5 years of age, D2 receptor density is greater than adult levels but regresses during the second

---

Revision #1
Created 2026-01-04 20:02:52 UTC by Omar Ayman
Updated 2026-01-04 20:02:52 UTC by Omar Ayman