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Mathematical model of box-counting analysis in the human dentate nucleus during development

Many disorders of the cerebellum may be developmental in origin. In order to recognize impaired development and better to understand the etiology of various neurological disturbances of the cerebellum, a precise timetable of the cellular events that take place during normal development is needed. Therefore, the binary and skeletonized two dimensional neuronal images of Golgi impregnated sections of the human dentate nucleus at various gestational periods were subjected to fractal analysis in order to investigate the morphology of these cells during development. Since the results showed that both parameters increased during gestation, a mathematical model which quantitatively describes changes in morphology of neurons from the human dentate nucleus during development is proposed. While the binary fractal dimension linearly increased with gestational time, the skeletonized fractal dimension increased with time exponentially. The findings of the present study are generally in accordance with previous qualitative data and provide better understanding of the formation of the neuronal circuitry of the human dentate nucleus.