

Are SH-SY5Y and MN9D cell lines adequate neurological models?

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SH-SY5Y and MN9D cell lines are commonly used cell models in researching neurotoxicity, oxidative stress, and neurodegenerative diseases such as Parkinson's and Alzheimer's diseases. Early studies suggested that SH-SY5Y cells do not convert intracellular neurotransmitters dopamine (DA) to norepinephrine (NE) even though the conversion enzyme (DBM) is present. However, our studies show that these cells neither synthesize nor store substantial levels of DA or NE, but that extracellular DA can be taken up and converted to NE, and this efficiency increases with age (cell passage). Kinetic studies show that NE is a better substrate for the membrane transporter than DA. Thus, undifferentiated high-passage SH-SY5Y cells could be a good noradrenergic model for in vivo studies. In contrast, TPA differentiated SH-SY5Y cells store substantially higher levels of DA and NE. These cells take up DA and NE more efficiently than undifferentiated cells suggesting they could be used either as partial noradrenergic or dopaminergic models. Another common model, MN9D cells, store high levels of DA under normal growth conditions, but do not convert it to NE. They show poor catecholamine uptake characteristics compared to SH-SY5Y cells, however n-butyric acid differentiated MN9D cells show more efficient DA uptake similar to undifferentiated SH-SY5Y, suggesting that they could be used as a reasonable dopaminergic model. This research contributes to a better understanding of commonly used research models of neurodegenerative diseases and may serve to alter the standard methods utilized in such types of research.