Vesicular release of acetylcholine (ACh) at the neuromuscular junction (NMJ) produces miniature endplate currents (mEPCs) as ACh binds to ACh receptors (AChRs). In previous MCell (Monte Carlo simulation program) simulations the observed variability of mEPC decay times was much less than experimental results, despite use of detailed cleft topology and acetylcholinesterase distribution. Thus, we hypothesize that different gating kinetics from one AChR to another may explain the experimental variability. The rates for AChR opening and closing were varied based on the known range of mEPC decay times, and then the fractional amounts of the different AChRs were varied in the postsynaptic membrane according to a Gaussian distribution. Under these conditions, simulations still could not reproduce the experimental variability in mEPC decay time, suggesting that spatial segregation of AChRs with different gating properties may also be required.