The Utilization of Monte Carlo Techniques to Simulate the Repressilator: A Cyclic Oscillatory System
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The repressilator is a synthetic transcription regulator that operates in a cyclic oscillatory manner. This system is comprised of three proteins (LacI, tetR, cI) which act as transcription regulators on one another. Previously the repressilator has been simulated using ordinary differential equations. The underlying assumption with using this method is that the system overall is in a properly mixed state at all times. However, there is a flaw in this assumption because oscillatory systems tend to locally evolve into inadequately mixed states. To overcome this problem MCCell (Monte Carlo Cellular Simulator) was used to simulate molecule positions, movements and interactions of the repressilator with spatial realism. The results demonstrate a more accurate representation of the oscillator and ultimately this method can be used to study systems of much shorter oscillation periods.