

S4 Model: Mitosis

In this scenario, we add mitosis to the life-cycle. Mitosis mimics the continual turnover of mitochondria that occurs within a cell. (Mitochondria form interconnected networks that continually undergo fission/fusion.) We examine how the model behaves when mitosis is inserted before selection and when it is inserted after selection. To model mitosis, we sample n mitochondria with replacement from a cell that contains i mutant (out of n) mitochondria. We denote the probability of sampling i^* mutant mitochondria with replacement from a cell with i mutant mitochondria as $X(i^*; n, i/n)$. When mitosis occurs before selection, the post-mitosis population is determined by

$$P(\mathbf{M}^{t, \tau_4} = (i^*, U_1 B_2)) = \sum_{i=0}^n X(i^*; n, \frac{i}{n}) P(\mathbf{M}^{t, \tau_3} = (i, U_1 B_2)).$$

When mitosis occurs after selection, the post-mitosis population is given by

$$P(\mathbf{M}^{t, \tau_6} = (i^*, U_1 B_2)) = \sum_{i=0}^n X(i^*; n, \frac{i}{n}) P(\mathbf{M}^{t, \tau_5} = (i, U_1 B_2)).$$