Figure S1: Simulations using the agent-based model (no replication limits). (a) The level of partial fixation is accurately predicted by Eq. 1 in the article (\(\tilde{m}\) dashed line). (b) Cumulative number of mutant divisions (one simulation). After partial fixation occurs, during a period of time \(T\) the approximate number of mutant divisions is \(T/\langle \tau \rangle \times \tilde{p} P \tilde{m}/(r \tilde{m} + \tilde{P} - \tilde{m})\). Where \(\tilde{P}\) and \(\tilde{p}\) are the equilibrium number and self-renewal probability of progenitors, and \(\langle \tau \rangle\) is the expected time between consecutive progenitor events. The formula is adapted from the corresponding Moran process formula in the article to express it as a function of time instead of number of events. (c) Distribution of the total number of mutant divisions when partial fixation occurs (by arbitrary time \(t = 200\)). Note the small S.D. compared to the mean (6267 simulations), which is indicative of control on the number of mutant progenitors (see article). The computed probability of partial fixation estimated from \(10^4\) simulations (not shown in figure) is also of in excellent agreement with Eq. 5: 0.6246 vs. 0.6267. The fundamental parameters (see article) are: \(\tilde{P} = 2000\), \(r = 4\) and \(\tilde{p}\) = 0.4.

Algorithm for the Agent-based model.

Let \(S\), \(P\) and \(D\) be the number of stem cells, progenitors and differentiated cells, \(v_S\) the division rate of stem cells, \(v_p\) the division rate of progenitors and \(d\) the death rate of differentiated cells. The self-renewal probabilities are: \(p_S\) for stem cells and \(p_P\) for progenitors. As detailed in the main article the division rates and self-renewal probabilities satisfy:
\[
\begin{align*}
\frac{dS}{dt} &= v_S(S)S(t) + v_P(P(t) + D(t), \\
\frac{dP}{dt} &= v_P(P)P(t) + D(t), \\
\frac{dD}{dt} &= v_D(D)D(t) + D(t).
\end{align*}
\]

If we call \(A(t) = v_S(S(t)S(t) + v_P(P(t) + D(t))\), then the probability that the next reaction involves a stem cell is \(v_S(S(t)S(t)/A(t)\), and the probabilities that it involves a progenitor or a differentiated cell are \(v_P(P(t)P(t)) + dD(t)/A(t)\) respectively. If the selected cell is a progenitor cell, then the probability that the next event is self-replication is \(p_P(t)\) and the probability tilde it is differentiation is \(1 - p_P(t)\). If self-replication occurs, the probability of choosing a mutant cell is \(rm(t)/(rm(t) + P(t) - m(t))\), where \(m(t)\) is the number of mutants. Once the type of progenitor is chosen (mutant or wild type), a random cell is selected from the appropriate sub-population. If there is a differentiation event each cell in the entire progenitor compartment has the same chance of being chosen. However, for both types of events (self-replication or differentiation), if the chosen cell has exhausted it replication capacity, division is halted and the cell is taken out of the population. Events dealing with stem cells are treated in an analogous way. The only possible event for a differentiated cell is death. The time when the next reaction occurs is exponentially distributed with mean \(1/A(t)\).