The mutation rate itself may change the order of adaptive mutations

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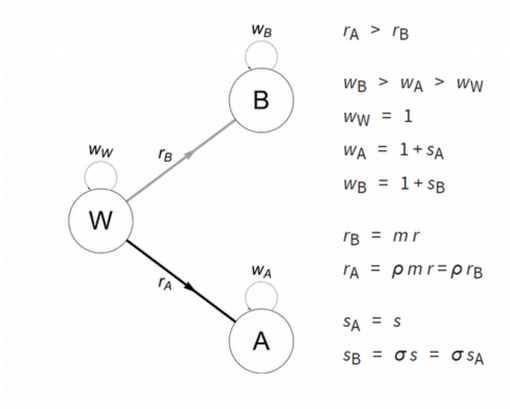
Introduction

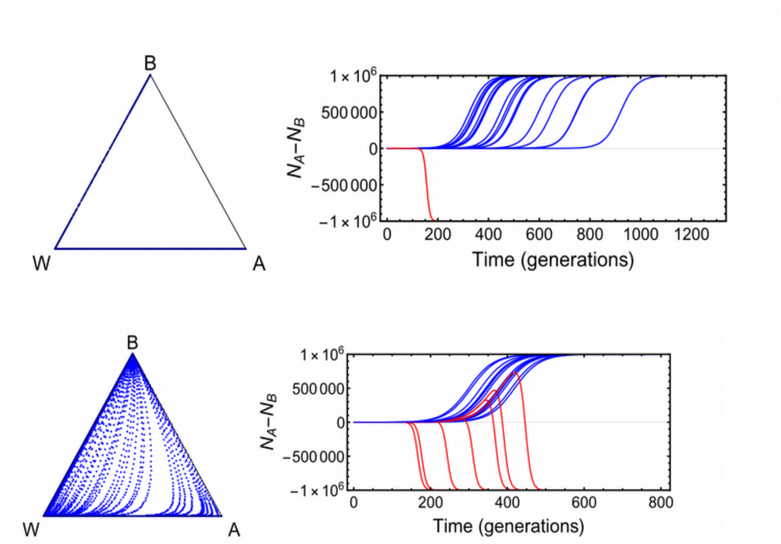
Yampolsky and Stoltzfus [1] presented evidence that a mutation bias, when opposite to a fitness bias, changes the probabilities of fixation of the alternative alleles depending on the overall mutability *m*. Our objective is to understand this effect, and from it to understand how different paths to a common final genotype may be biased with *m*, if so.

Single step

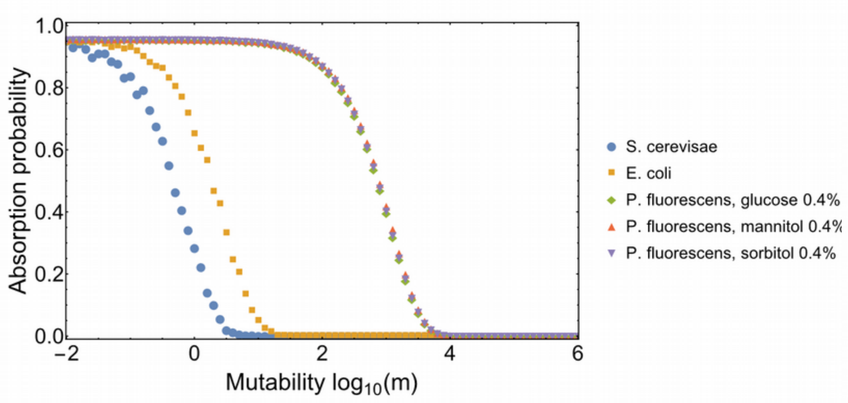
Model



Dynamics

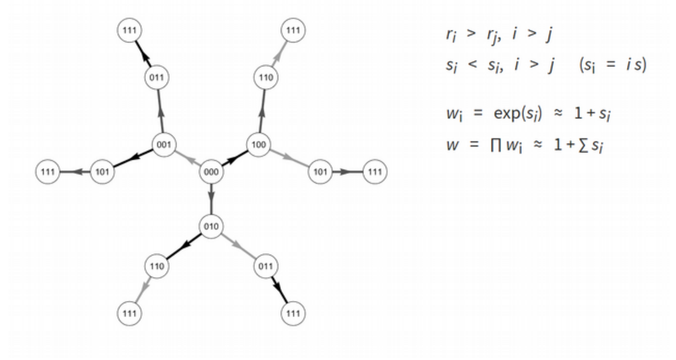


Effect

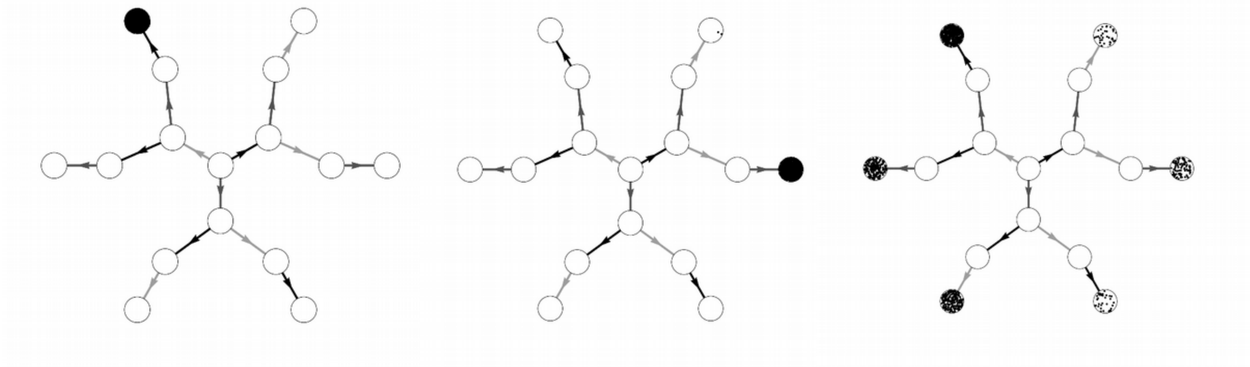


Multiple steps

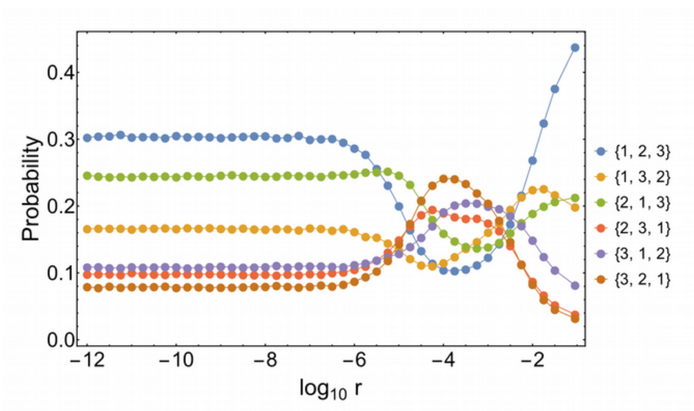
Model

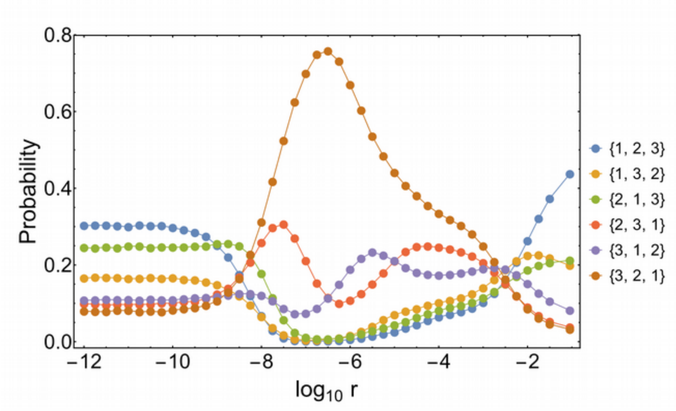


Final state



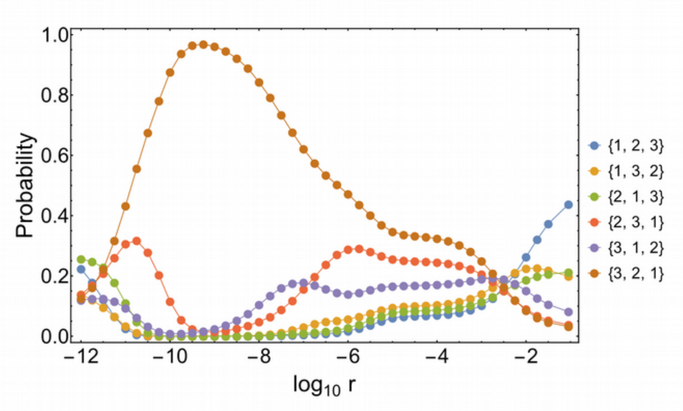
Effect

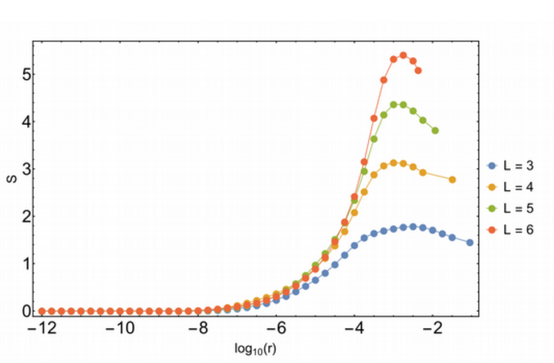


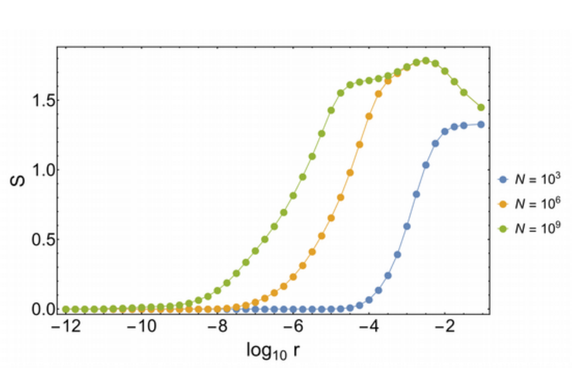


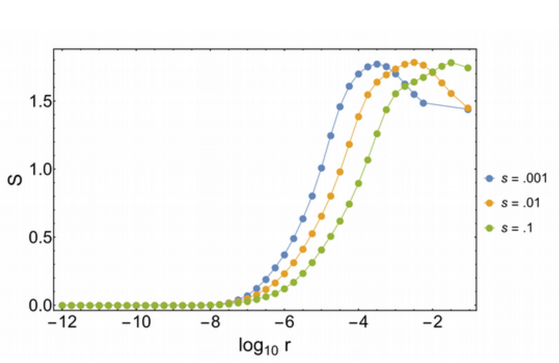
Predictability

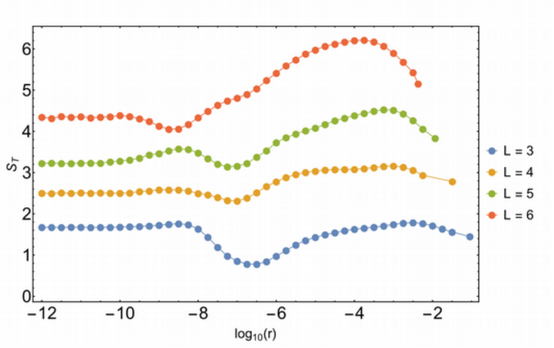
Summary

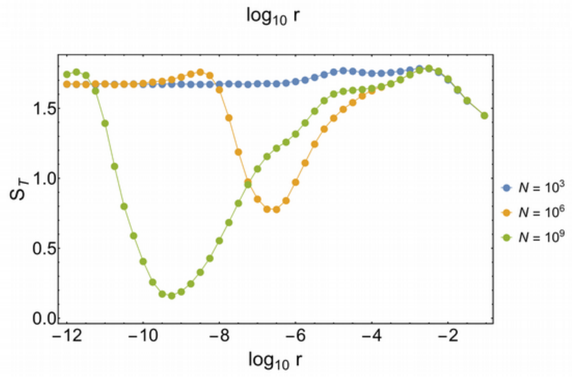


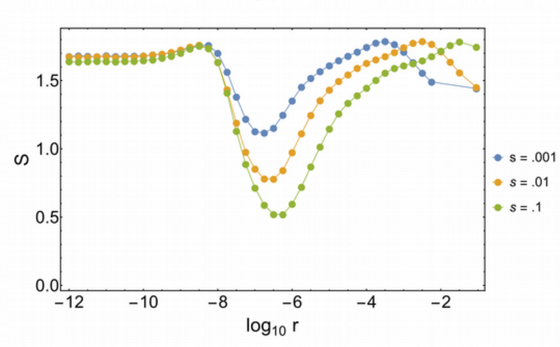












Conclusions

- Mutability may radically change the odds of fixation
- The turning point is sensitive to the organism;
- It may be not too sensitive to the selective pressure;
- At very low *m:*
  - Clonal interference is very rare;
  - High mutation rate is favored;
  - Who “tries” to fix more often, wins.
- At very high *m:*
  - Clonal interference is the rule*;*
  - High fitness is favored;
  - Who competes better, wins.
- The most fit allele fixes faster;
- Dynamics is the most variable for intermediate *m.*

Summary

- Mutability again changes the odds of fixation
- Paths with decreasing rates are favored for low *m*;
- Paths with decreasing fitness are favored for higher *m*;
- Larger population sizes favor the latter paths;
- *S* peaks at a common *m* across *L;*
- S_T has a minimum at intermediate *m*;
- The predictability of single processes
  - Decreases with N;
  - Shifts to lower *m* with decreasing *s.*
- The *m* for the minimum of S_T:
  - Decreases with *N*;
  - Does not depend too much of *s*.

Reference

1. Yampolsky, L.; Stoltzfus, A. EVOLUTION & DEVELOPMENT 2001, 3, 73 – 83.