

Review of: "The evolution of E. coli is NOT driven by genetic variance but by thermodynamics."

Johannes Wirtz¹

¹ Universität Köln

Potential competing interests: No potential competing interests to declare.

I won't comment on the data from the Lenski Experiment itself and I don't want to go into detail about the discussion of the estimated fitness curves resulting from it. What I think needs to be said is that the central statement of Fisher's theory of natural selection concerns the *derivative* (

$$\sigma^2 \bar{w}$$

)

of the mean fitness, stating that this quantity is proportional to the amount of genetic variance *that affects fitness at a given point in time*. The possibility of mutations occurring over the course of the history of a species may have been of lesser importance to Fisher, but in and out of themselves, one cannot call the fitness curves from the Lenski experiment a violation of that theorem, since the latter was never meant to be applied to a time range but rather to individual points in time. This seems to be misrepresented here as well as in "The gene - an appraisal" - in that work, it is even admitted that the initial slope of the fitness curves could be shown to be in a proportional relation with the available genetic variance. In that case, it seems that Fisher's theory was indeed correctly applied in that only one point in time (the very beginning of the experimental runs) was considered.

The article also does not comment much on which mutations are responsible for which fitness effect (whether they were part of the initial set of polymorphisms or obtained over the course of the experiment) and at what stage their effect became visible. If the same power law would have been observed if all founding populations had started out with the same genotypes and zero variation, assuming that it was possible to create such a situation, this would indeed have been an interesting observation, though one could still debate whether this would violate Fisher's theory, considering what I wrote above.

I will not comment too much on the connection between the fitness curves and the laws of thermodynamics, as I am not a physicist; I would say, this is an interesting observation to be kept in mind, even though there are "many" power laws and more work would be necessary to tell whether the ones resulting from evolution are directly linked to the ones observed in thermodynamics.

