The complexity ratchet: stronger than selection
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Experimental design:

- creates the potential for the acquisition of further genes, ultimately evolution leads to a \( \approx 10\times \) lower fitness. This shows that, even in a simple environment, up with a very high fitness while complex genotypes ended up with a much lower fitness. At the same time, most lineages were not able to find this simple genotype and were then stable for the rest of the experiment.

Using the Aevol digital genomics platform we designed an organism that could very well be simple. In conditions where complexity is not needed and that, reciprocally, the global function of complex structures is driven by selection.

The emergence of complex organisms in a simple environment is a strong argument in favor of a complexity ratchet, i.e. an irreversible mechanism that adds components to a system but that cannot get rid of existing ones, even though this could be more favorable. Indeed, in our experiments this ratchet clicks and goes on clicking despite the selective advantage of being simple. Evolution of fitness in complex organisms shows that the ratchet is empowered by negative epistasis. Our results show that complex biological structures can flourish in conditions where complexity is not needed and that, reciprocally, the global function of complex structures could very well be simple.