

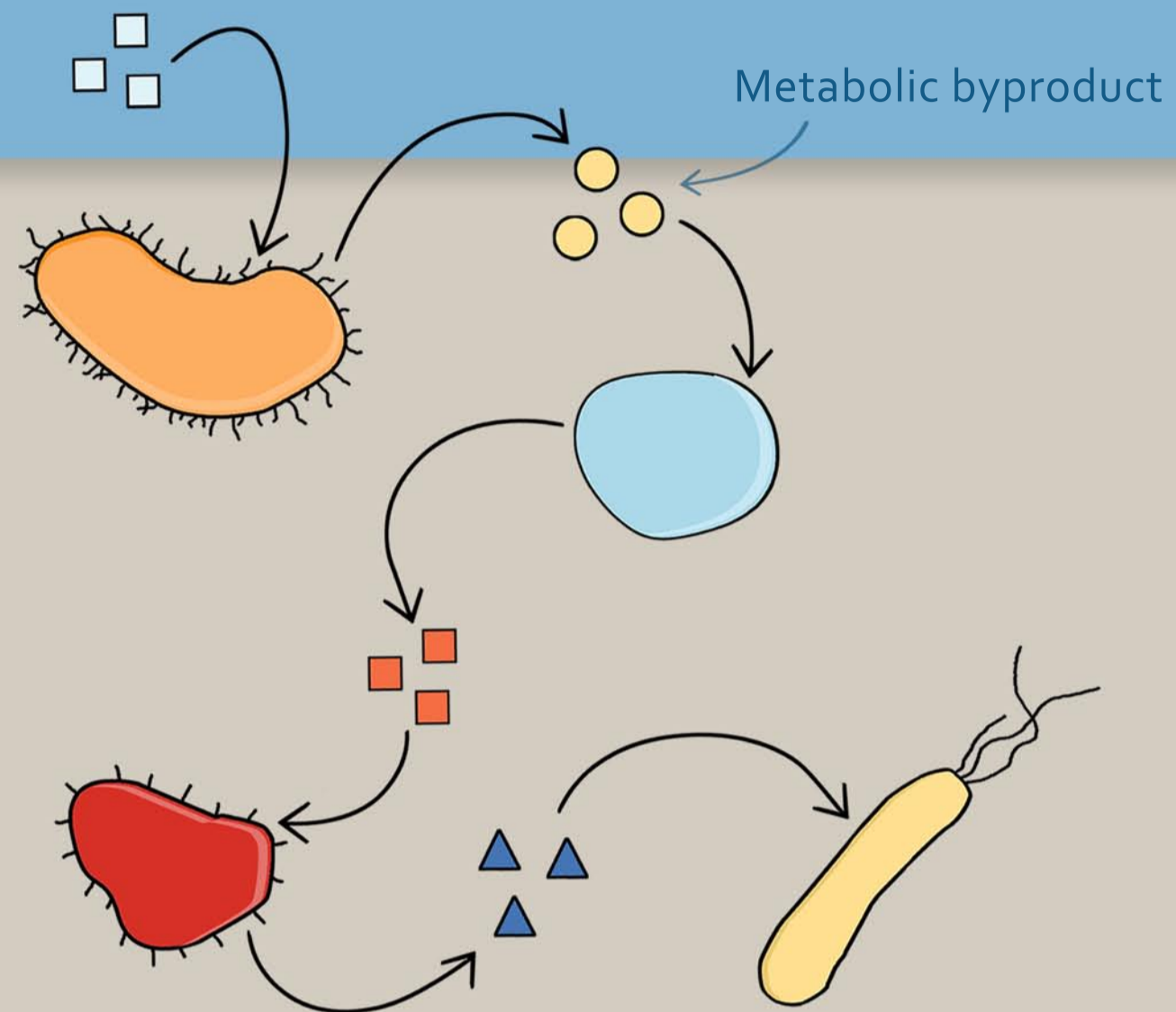


Are cross-feeding chains constrained by perturbations?

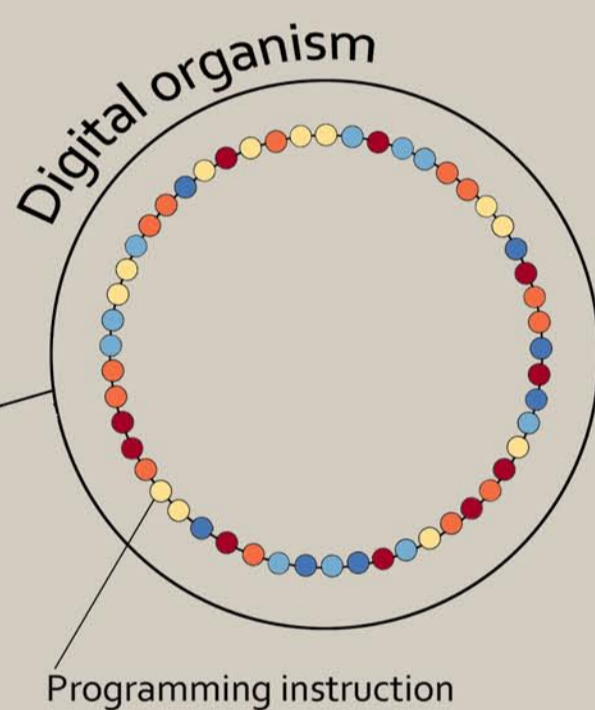
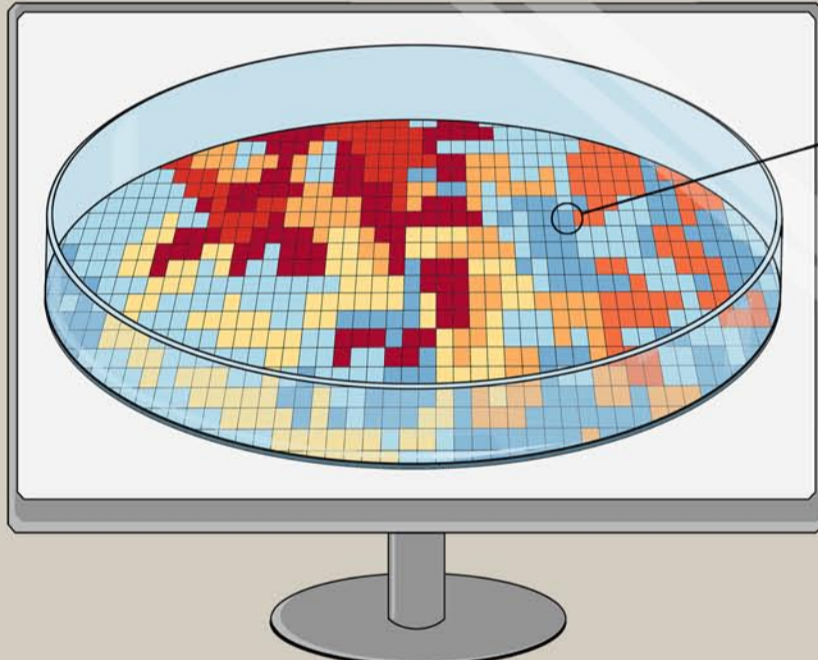
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BACKGROUND

Chains of byproduct cross-feeding are common in microbial communities – for example in the human gut. Interestingly, most chains are considerably shorter than what the species' metabolic capabilities should allow for. Here, we use digital evolution to investigate if recurring perturbations are a reason why.



Avida



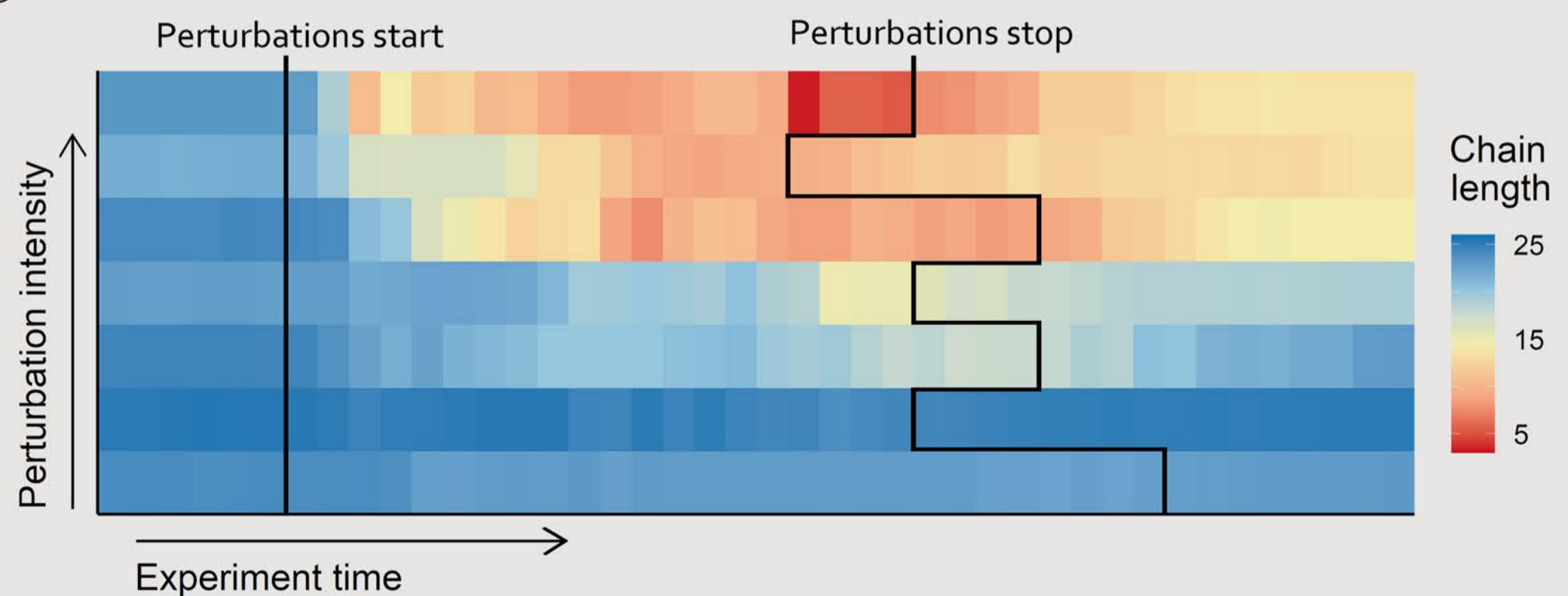
METHODS: digital evolution

Avida works like a virtual petri dish on which a population of digital organisms can grow. The organisms self-replicate, mutate and can evolve the ability to consume resources – including each others' byproducts.

I perturbed cross-feeding digital communities by repeatedly killing a fraction of the population.

CONCLUSIONS

Results suggest that recurring perturbations can shorten chains of cross-feeding interactions. Effects may even persist after perturbations stop.



Methods: details

Avidians are self-replicating computer programs that occasionally mutate. Space limitation imposes an evolutionary pressure for rapid replication, causing Avidians to compete for extra CPU power, granted to those which consume resources. Here, one resource was available from the start and 49 were created as consecutive byproducts. Communities were seeded with an organism incapable of resource consumption and evolved for about 6000 generations. A fraction of each population was then killed at 100 random points in time. Chain length was defined for each organism as the level of the last resource it consumed.