

Halting NS experiment

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"Only if the total number of fertile forms reproduced into one population can be artificially maintained the same for all members of one population over many generations can natural selection be halted. Try anything else. Try life spans or perhaps the number of eggs laid, anything you like.

None of them can halt natural selection within one population. Only the proposition I have provided for Total Darwinian Fitness (TDF) works. It is that simple."

John Edser

I have seen this proposed experiment mentioned in several threads, so I thought it might be useful to comment on other "halting" experiments.

In 1928 Muller first proposed an experiment to measure mutation accumulation in a chromosome of *Drosophila* by "halting" natural selection. Terumi Mukai began doing such an experiment in 1964 and continued through the 70's, sometimes maintaining these populations for 100's of generations. These experiments might be considered the classics. Since then many other such experiments have been done. Common species used include *Drosophila*, *E. coli* and *C. elegans* but other have been used.

Usually experiments that "halt" natural selection have one or two reasons but often there is some twist involved. One reason is to take a direct measurement of the rate of spontaneous mutation. Indirect measurements that compare DNA sequence data "see" only neutral or effectively neutral mutations and positively selected mutations. Deleterious mutations are invisible using sequence data since they are removed via natural selection. Often a second reason is to measure the effect a level of spontaneous mutations (including deleterious ones) has on fitness.

From the beginning a question existed as to what is the proper control. I think today the preference (when possible) is to separate the initial population into 2 or more parts, then put 1 (or more) in stasis by freezing, run the experiment for some period of time and then remove the control from stasis and do the measurements including changes in fitness. Fitness is measured in different ways.

Experiments always begin with a mostly homozygous population (you

don't want any deleterious recessives). Ideally the population would derive from a single homozygous individual.

Natural selection cannot be completely "halted". Even with clonal (or selfing) organisms, propagating each line through a single individual each generation, a lethal mutation cannot be propagated. Though even highly deleterious mutations can be since conditions are maintained as ideal as possible. For a sexual species, the minimum population size is 2. Maintaining this "effective" size means that any mutation with a selection coefficient less than .50 is effectively neutral. So with sexuals only the most very deleterious mutations see "natural selection".

In sexuals (*Drosophila*) often a marked balancer chromosome (that doesn't recombine) is used. Mutations accumulate on this single autosome that is propagated through a single heterozygous male in each line. Then final fitness measurements will be concerned with how having this marked chromosome affects an individual's fitness. Sometimes worded as measuring a fitness change in this chromosome.

William L Hunt