Error Rate of Replication and Fitness in RNA Viruses

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Rates of spontaneous mutation per genome differ among species, indicating that this character is subjected to selection. The optimal mutation rate results from the need to maintain an accurate level of genetic information and the need of adaptation to environmental changes. The transmission cycle of RNA viruses include large fluctuations in the environment in which replication takes place and it is believed that the high mutation rates characteristic of RNA viruses, together with their short replication time and large populations favor their adaptation. However, as described in molecular evolution theories, the mutation rate has an upper limit set by the requirement of accurate transmission of the genetic information. When this threshold is crossed, disorganization of the mutant distribution of the quasispecies occurs, the genetic information is lost, and the population becomes extinct. This phenomenon is known as error catastrophe.

In this communication we present results showing the effect of the increment in the error rate through the use of mutagens in clonal populations of the Qβ bacteriophage. Whereas high fitness populations are not affected by the mutagen, we find that low fitness populations increase their fitness when the error rate is augmented. Our results suggest that mutations fixed in low fitness viruses have predominantly advantageous effects. Therefore, the distance to the error threshold would vary in viral populations depending on the genomic context in which new mutations are generated.