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EARTH SCIENCE

SPEAKERS CLUB

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Rapid protein evolution in bacteria, archaea, and viruses from subsurface environments

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Genetic mutation in prokaryotes occurs through a variety of stochastic and guided phenomena. Variability may arise from random mutation, repeat generation during replication, and targeted hypermutation of specific genes. The latter can be mediated by diversity-generating retroelements, or DGRs, which give rise to a degree of gene variability that is unrivaled elsewhere in nature. Using a comparative genomic effort, we uncovered novel DGRs in marine archaeal viruses, and in yet uncultivated organisms from the terrestrial subsurface. Moreover, bioinformatic analyses linked this mechanism to organisms with minimal genomes and ultra-small cell sizes covering a vast phylogentic range. The novel DGRs appear to represent a new subclass, constituting more than a twofold expansion with respect to previously described diversifiers. I will describe this series of discoveries to demonstrate how intraterrestrial viruses and microbes mutate themselves to push forward their evolutionary fitness. These findings highlight targeted mutation as a crucial evolutionary strategy in microorganisms that are widespread and represent a key component of the Tree of Life.