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“Insights into interaction network of genome maintenance from the hyperthermophilic archaeon Pyrococcus abyssi”

Abstract:
In the three domains of life, mechanisms to ensure genome integrity are, to date, not fully understood. For complex processes such as replication, many proteins work together in intricate systems, making their analysis highly difficult. To guide investigations, a previous study from the lab has provided an interaction network with proteins involved in genomic maintenance in the archaea Pyrococcus abyssi. Exploration of this network identified unexpected potential interactions. Among them, PCNA, maestro of DNA replication, could recruit the archaeal Mre11/Rad50 complex. Using the homologous proteins from Pyrococcus furiosus, we demonstrated both physical and functional interplay between PCNA and Mre11-Rad50, a complex involved in recombination process. A variation of the PCNA Interacting Protein motif (PIP-like motif) was identified in Mre11 and was also revealed among all sequences of Thermococcales Mre11. In addition, PCNA clamp was shown to limit Mre11/Rad50 nuclease activity altering the pattern of DNA end degradation. Analysis of the reaction products suggests that PCNA not only recruits Mre11/Rad50 at DNA ends, but also controls the extent of the nuclease activity, in a manner that is still consistent with the DNA end processing required for homologous recombination.