Optimums of the environmental conditions affect amyloidogenic properties of prokaryotic proteomes

K.S. Antonets,

All-Russia Research Institute of Agricultural Microbiology, Russia, St. Petersburg; St. Petersburg State University, Russia, St. Petersburg; kirantonez@gmail.com

P.B. Drozdova,

St. Petersburg State University, Russia, St. Petersburg

A.A. Nizhnikov,

All-Russia Research Institute of Agricultural Microbiology, Russia, St. Petersburg; St. Petersburg State University, Russia, St. Petersburg

Prokaryotic organisms can be found in a wide variety of places from hot springs to salt lakes and have different optimums of environmental factors such as temperature, acidity, and salinity. Extreme values of these factors influence the functioning of different cellular systems, among them the stability and conformation of proteins. One of the most stable forms of proteins is amyloid, so the accumulation of amyloidogenic regions in protein sequences can be used as the way to stabilize protein structure. The goal of the study was to examine whether there is a relationship between the habitat of prokaryotic species and the fraction of proteins with amyloidogenic regions.

We estimated the fraction of amyloidogenic proteins in the proteomes of different archaea and bacteria including some socially important species like members of *Enterobacteriaceae* family. We used the Waltz program to predict amyloidogenic regions in proteins. The prokaryotic organisms dramatically differ by environmental optumims of temperature, acidity and salinity. We found strong negative correlation between the amount of amyloidogenic proteins in the proteome and the optimal pH of the habitat for archaea. Temperature and salinity did not affect the amount of amyloidogenic proteins in archaea and bacteria. We also did not find any influence of pH on the amount of amyloidogenic proteins in bacteria. The increase in the fraction of amyloidogenic proteins in archaea was not related to the changes in frequencies of amino acids. More than that, we found that some functional groups of proteins specific for acidic conditions and involved energy production and transcription were

extremely enriched in amyloidogenic proteins.

Taken together, amyloidogenic regions might stabilize protein structure under acidic conditions and appeared in the course of the evolution in proteins of acidophilic archaea. Bacteria might have other molecular mechanisms of adaptation to low pH without increasing the amount of amyloidogenic proteins.

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