

MECHANISM FOR PROTEINS DESTABILIZATION AT LOW TEMPERATURES

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Proteins undergo unfolding when lowering the temperature by means of a process known as cold denaturation. Pure cold denaturation (without using denaturants) is obtained when applying high pressures.

In this paper we describe in detail a recent proposal to explain the cold denaturation process based on the high density liquid state of water [1]. Above the pressure where water freezes to the dense ice phase, the mechanism for cold denaturation with decreasing pressure temperature is the loss of local low density water structure.

This proposal has been tested by means of multicanonical simulations of a protein model in a water bath and has been compared with experimental results of bovine pancreatic ribonuclease A [1].

The correct understanding of this process may be useful to artificially implement activation and inactivation of a protein at low temperatures. This procedure may have direct applications into the emerging world of nanobiotechnologies machinery.

References:

[1] M.I. Marqués, J.M. Borreguero, H. E. Stanley and N. V. Dokholyan Phys. Rev. Lett., **91** (2003) 138103.