Studies of biological systems under high hydrostatic pressure and the instrumentation required for that

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Abstract

High hydrostatic pressure (HHP) is one of the stressors, which can perturbate or denaturate proteins. To investigate the impact of HHP, incoherent neutron scattering is a well-adapted method giving access to information on molecular dynamics. In this overview, I will first present some instrumental setups taking particularly into account the requirements by neutron scattering experiments. In a second time, I will show applications in several domains:

The question of protein adaptation to HHP environments is extremely important to shed light on evolutionary questions and for the understanding of functioning under such harsh conditions. Some recent results will be presented here [1, 2]

Moreover, proteins undergo a series of transitions as a function of temperature, including the dynamical transition cold and heat denaturation. As cold denaturation occurs for most proteins at negative temperatures, HHP is a tool to shift the transition to more accessible temperatures, i.e. higher temperatures for the cold denaturation and lower temperatures for the heat denaturation. We investigated the impact of HHP on the transition and energy landscape [3] for some model proteins, what will also be discussed here (see figure 1).

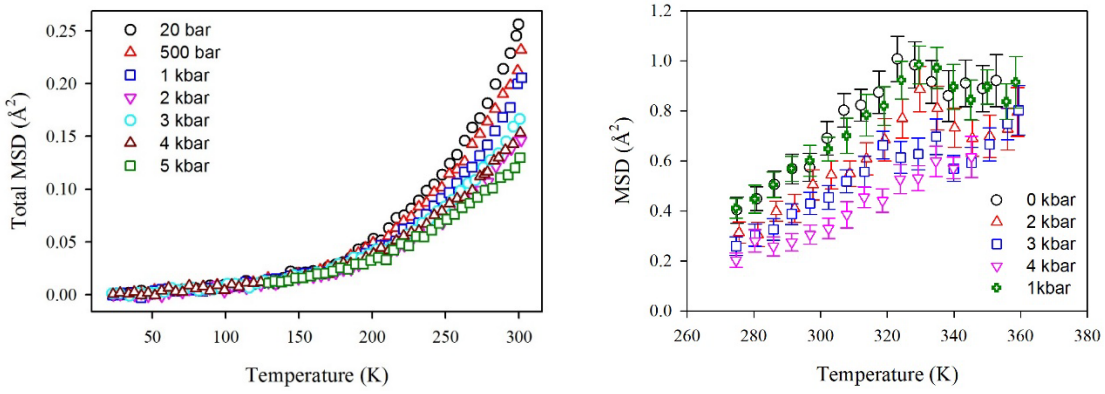

Figure 1: Mean square displacements (MSD) extracted from elastic incoherent neutron scattering under HHP on myoglobin in a large temperature range.

References

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[3] F. Librizzi, R. Carrotta, J. Peters, A. Cupane, The effects of pressure on the energy landscape of proteins, Sci Rep-Uk 8 (2018).