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Domain swapping in solution induced by irradiation –case study human cystatin C and other proteins

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During small angle X-ray scattering studies of proteins in solutions, radiation damages may occur during exposure to the synchrotron radiation, which most often involves the protein aggregation process, but global conformational changes such as the domain swapping phenomenon is also possible.

The domain swapping phenomenon has been known for several decades and has been identified in numerous protein structures [1]. Particularly was observed for proteins of flexible structure. The phenomenon of domain swapping also accompanies of the amyloidogenesis process. This situation applies also to human cystatin C, where dimerization and oligomerization of this protein occurs through domain swapping [2,3].

In our previous studies, we observed domain swapping in the crystal structure of human cystatin C, where it probably occurred during the crystallization process. Recently we also observed, that this phenomenon for human cystatin C also occurs in solution and is caused by irradiation during SAXS experiments using synchrotron radiation [4]. During the lecture it will be discussed the radiation induced domain swapping of human cystatin C and other proteins.

[1] Liu, Y., Eisenberg, D. Protein Sci. 11(6), 1285-1299 (2002).

[2] Janowski, R., Kozak, M., Jankowska, E., Grzonka, Z., Abrahamson, M., Grubb, A. & Jaskolski, M. Nature Struct. Mol. Biol. 8, 316–320 (2001).

[3] Janowski, R., Kozak, M., Abrahamson, M., Grubb, A. & Jaskolski, M. Proteins: Struct. Funct., Bioinf. 61, 570–578 (2005).

[4] Taube, M., Pietralik, Z., Szymanska, A., Szutkowski, K., Clemens, D., Grubb, A., Kozak, M. Sci Rep 9, 8548 (2019).

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