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Spatial structure of beta-amyloid A β_{1-40} in complex with a biological membrane model

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ABSTRACT

The spatial structure of beta-amyloid A β_{1-40} in complex with sodium dodecyl sulfate micelles as a model membrane system was investigated by ^1H - ^1H two-dimensional NMR (TOCSY, NOESY) spectroscopy and molecular dynamic method calculations. On the basis of NOE and chemical shifts changes data, spatial structure of the complex beta-amyloid-model of the cell surface membrane was obtained.

KEYWORDS

^1H NMR; Two-Dimensional NMR (TOCSY, NOESY) Spectroscopy; Alzheimer's Disease; Beta-Amyloid; Oligopeptides; Micelle

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References

- [1] Coles, M., Bicknell, W., Watson, A., Fairlie, D.P. and Craik, D.J. (1998) Solution structure of amyloid β -peptide (1-40) in a water-micelle environment. Is the membrane-spanning domain where we think it is? *Biochemistry*, 37, 11064-11077. doi: 10.1021/bi972979f
- [2] Dahlgren, K.L., Manelli, A.M., Stine, W.B., Baker, L.K., Krafft, G.A. and LaDu, M.J. (2004) Oligomeric and fibrillar species of amyloid- β peptides differentially affect neuronal viability. *Journal of Biological Chemistry*, 277, 32046-32053. doi: 10.1074/jbc.M201750200
- [3] Lansbury, P.T. (1999) Evolution of amyloid: What normal protein folding may tell us about fibrillogenesis and disease. *Proceedings of National Academy Sciences of the USA*, 96, 3342-3344. doi: 10.1073/pnas.96.7.3342
- [4] Lansbury, P.T. (2002) Neurodegenerative disease: Amyloid pores from pathogenic mutations. *Nature*, 418, 291. doi: 10.1038/418291a
- [5] Petkova, A.T., Leapman, R.D., Guo, Z.H., Yau, W.M., Mattson, M.P. and Tycko, R. (2005) Self-propagating, molecular-level polymorphism in Alzheimer's β -amyloid fibrils. *Science*, 307, 262-265. doi: 10.1126/science.1105850
- [6] Selkoe, D.J. (1995) Deciphering Alzheimer's disease: Molecular genetics and cell biology yield major clues. *Journal of National Institutes of Health*, 7, 57-64.
- [7] Walsh, D.M., Klyubin, I., Fadeeva, J.V., Cullen, W.K., Anwyl, R., Wolfe, M.S., Rowan, M.J. and Selkoe, D.J. (2002) Naturally secreted oligomers of amyloid protein potently inhibit hippocampal long-term potentiation in vivo. *Nature*, 416, 535-539. doi: 10.1038/416535a
- [8] Aisenbrey, C., Borowik, T., Bystrom, R., Bokvist, M., Lindstrom, F., Misiak, H., Sani, M.A. and Grobner, G. (2008) How is protein aggregation in amyloidogenic diseases modulated by biological membranes? *European Biophysics Journal*, 37, 247-255. doi: 10.1007/s00249-007-0237-0

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- [9] Gehman, J., O' Brien, C., Shabanpoor, F., Wade, J. and Separovic, F. (2008) Metal effects on the membrane interactions of amyloid- β peptides. *European Biophysics Journal*, 37, 333-344. doi: 10.1007/s00249-007-0251-2
- [10] Jones, J. (2002) *Amino acid and peptide synthesis*. Oxford University Press, New York, 92.
- [11] Filippov, A. (2010) *Synthesis and aggregation studies on amyloid oligomers of Alzheimer' s abeta peptides*. Lulea University of Technology, Lulea, 26.
- [12] Merrifield, R.B. (1963) Solid phase peptide synthesis. I. The synthesis of a tetrapeptide. *Journal of the American Chemical Society*, 85, 2149-2154. doi: 10.1021/ja00897a025
- [13] Wuthrich, K. (1986) *NMR of proteins and nucleic acids*. Wiley-VCH, New York, 1-292.
- [14] Blokhin, D.S., Efimov, S.V., Klochkov, A.V., Yulmetov, A.R., Filippov, A.V., Antzutkin, O.N., Aganov, A.V. and Klochkov, V.V. (2011) Spatial structure of the decapeptide Val-Ile-Lys- Lys-Ser-Thr-Ala-Leu-Leu-Gly in water and in a complex with sodium dodecyl sulfate micelles. *Applied Magnetic Resonance*, 41, 267-282. doi: 10.1007/s00723-011-0257-x
- [15] Schwieters, C.D., Kuszewski, J.J., Tjandra, N. and Clore, G.M. (2003) The Xplor-NIH NMR molecular structure determination package. *Journal of Magnetic Resonance*, 160, 65-73. doi: 10.1016/S1090-7807(02)00014-9
- [16] Smith, R., Separovic, F., Milne, T.J., Whittaker, A., Bennett, F.M., Cornell, B.A. and Makriyannis, A. (1994) Structure and orientation of the pore-forming peptide melittin, in lipid bilayers. *Journal of Molecular Biology*, 241, 456-466. doi: 10.1006/jmbi.1994.1520
- [17] Henry, G.D. and Sykes, B.D. (1994) Methods to study membrane protein structure in solution. *Method in Enzymology*, 239, 515-535. doi: 10.1016/S0076-6879(94)39020-7
- [18] Lee, K.H., Fitton, J.E. and Wüthrich, K. (1987) Nuclear magnetic resonance investigation of the conformation of δ -haemolysin bound to dodecylphosphocholine micelles. *Biochimica et Biophysica Acta (BBA)—Protein Structure and Molecular Enzymology*, 911, 144-153. doi: 10.1016/0167-4838(87)90003-3
- [19] Motta, A., Pastore, A., Goud, N.A. and Castiglione Morelli, M.A. (1991) Solution conformation of salmon calcitonin in sodium dodecyl sulfate micelles as determined by two-dimensional NMR and distance geometry calculations. *Biochemistry*, 30, 10444-10450. doi: 10.1021/bi00107a012
- [20] Wang, G., Keifer, P. and Peterkofsky, A. (2003) Solution structure of the N-terminal amphitropic domain of Escherichia coli glucose-specific enzyme IIA in membrane-mimetic micelles. *Protein Science*, 12, 1087-1096. doi: 10.1110/ps.0301503
- [21] Marcotte, I. and Auger, M. (2005) Bicelles as model membranes for solid- and solution-state NMR studies of membrane peptides and proteins. *Concepts in Magnetic Resonance Part A*, 24A, 17-37. doi: 10.1002/cmr.a.20025
- [22] Ernst, R.R., Bodenhausen, B. and Wokaun, A. (1987) *Principles of nuclear magnetic resonance in one and two dimensions*. Oxford University Press, Oxford, 610.
- [23] Berger, S. and Braun, S. (2004) *200 and more NMR experiments*. Wiley-VCH, Weinheim, 810.
- [24] Jarvet, J., Danielsson, J., Damberg, P., Oleszczuk, M. and Graslund, A. (2007) Positioning of the Alzheimer $A\beta_{(1-40)}$ peptide in SDS micelles using NMR and paramagnetic probes. *Journal of Biomolecular NMR*, 39, 63-72. doi: 10.1007/s10858-007-9176-4
- [25] Vivekanandan, V., Brender, J.R., Lee, Sh.Y. and Ramamoorthy, A. (2011) A partially folded structure of amyloid-beta(1-40) in an aqueous environment. *Biochemical and Biophysical Research Communications*, 411, 312-316. doi: 10.1016/j.bbrc.2011.06.133
- [26] Usachev, K.S., Efimov, S.V., Yulmetov, A.R., Filippov, A.V., Antzutkin, O.N., Afonin, S. and Klochkov, V.V. (2012) Spatial structure of heptapeptide Abeta(16-22) (betaamyloid Abeta(1-40) active fragment) in solution and in complex with a biological membrane model. *Magnetic Resonance in Chemistry*, 50, 784-792. doi: 10.1002/mrc.3880.