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ESR Study of Interfacial Hydration Layers of Polypeptides in Water-Filled Nanochannels and in Vitrified Bulk Solvents

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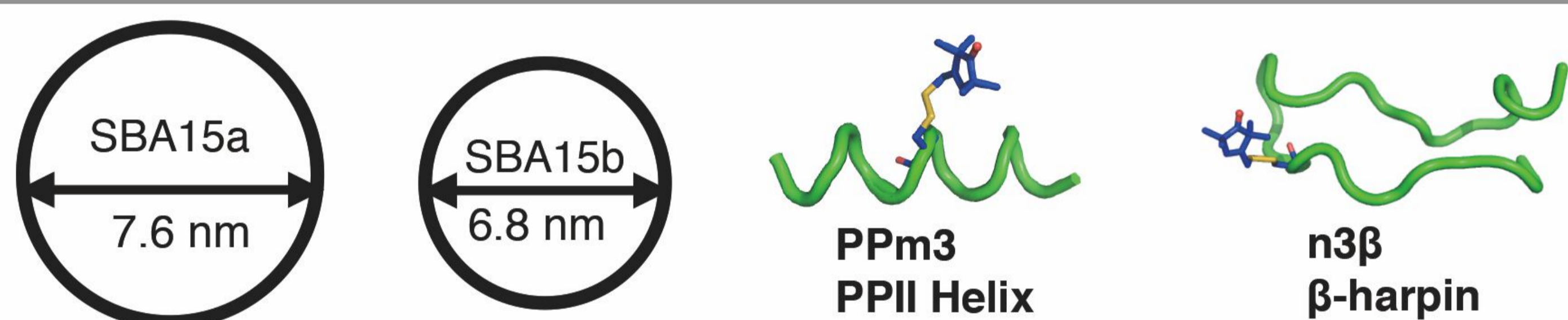
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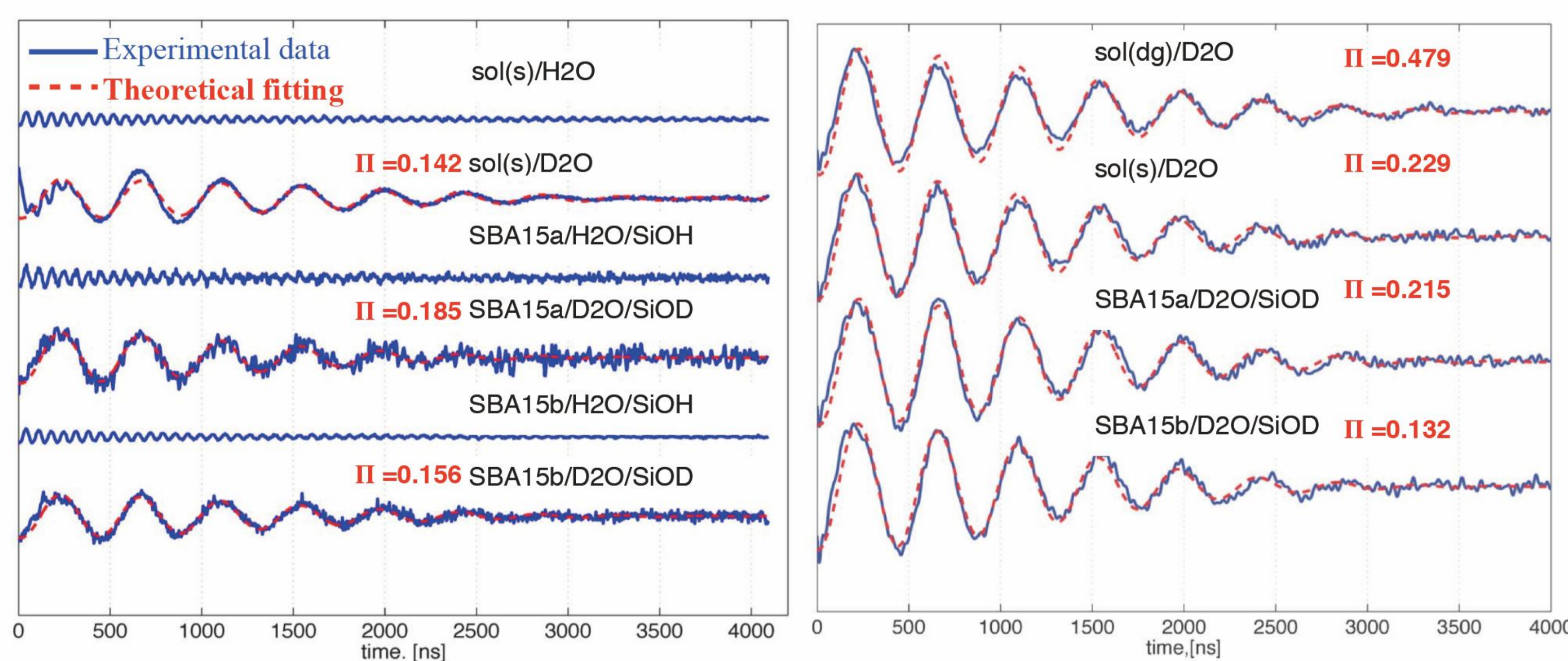
研究重點

It is remain unclear how hydration water and protein interact with each other. However, with the help of ESR experiments and nanoconfinement techniques, more informations about biological interfacial water can be observed. Two peptides of different secondary structure and lengths are studied in vitrified bulk solvents and in water-filled nanochannels of different pore diameter (6.1~7.6 nm). We apply ESEEM technique to detect the first hydration layer of peptides in different pore size of nanochannel. Also, we observe the long range water density from spin label by ESE technique. The result indicates the peptide surrounding water exhibits density heterogeneity in the nanochannel.

研究成果



Interfacial water accessibility by ESEEM

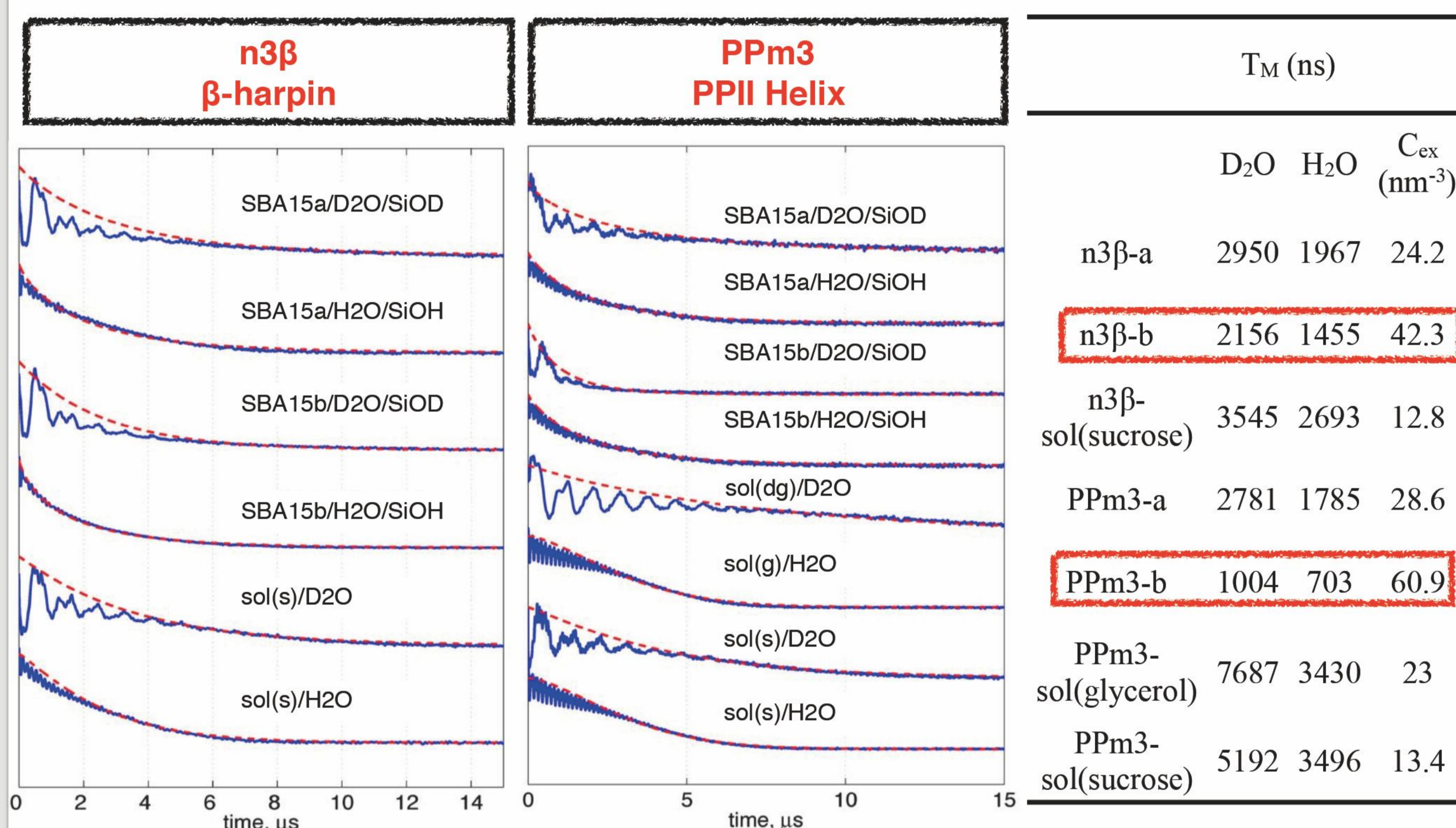


$$f(t) = k_D \cos(2\pi\nu_D t + \vartheta) \exp(-t^2 / \tau_0^2)$$

ν_D : Lamor Frequency of Deuterium
 k_D : Modulation depth
 ϑ : Phase

$$\Pi(D_2O) = \frac{2k_D}{[1 - \cos(2\pi\nu_D \tau)]} \times \left[\frac{\nu_D}{2\text{MHz}} \right]^2$$

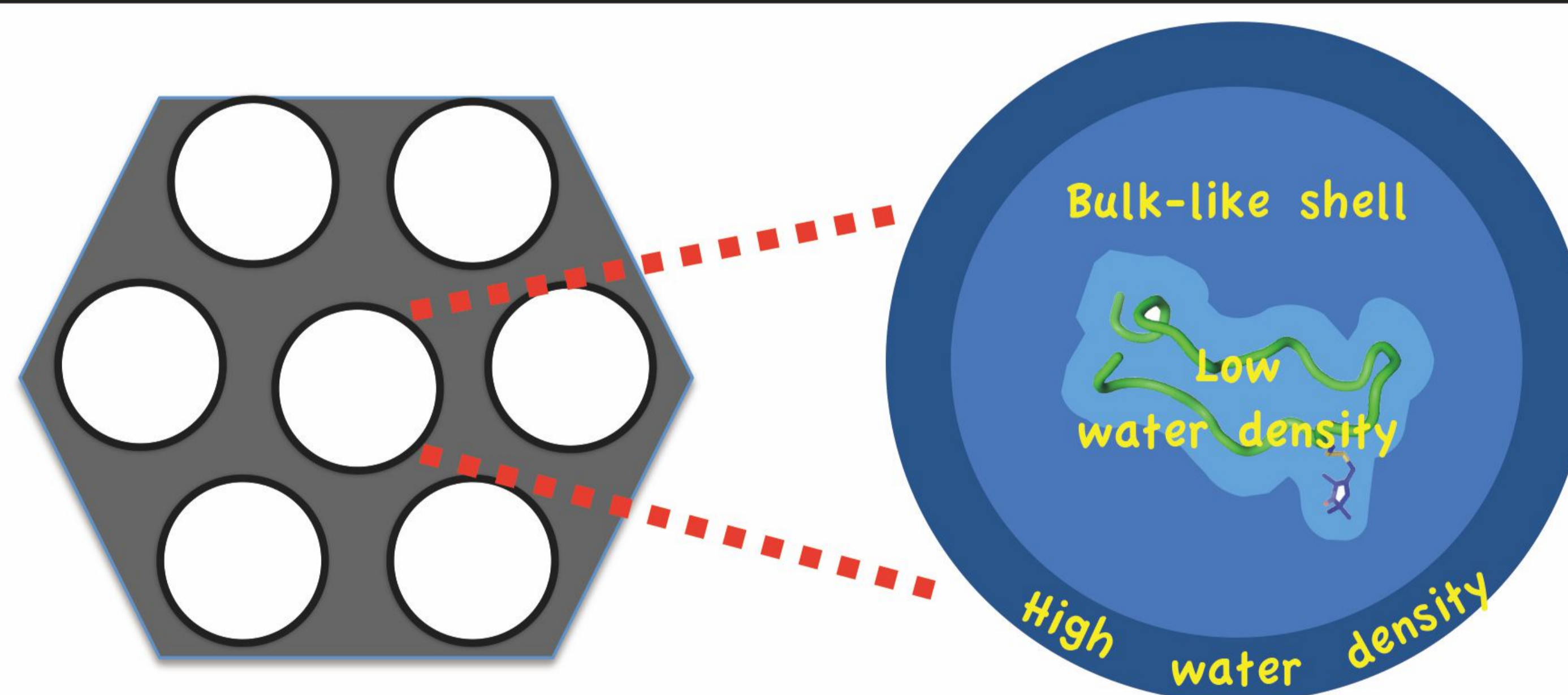
Long-range water accessibility by Pulsed ESE



$$C_{ex} = \Delta \left(\frac{1}{T_M} \right) \times \frac{4\pi h}{0.37\mu_0 (g\mu_B)^{1/2} (g_n\mu_n)^{3/2} (I(I+1))^{1/4}}$$

C_{ex} : Concentration of exchangeable protons

Summary



- The interfacial water is non-crystalline and changes little with the secondary structures.
- The nano-confined water exhibits **density heterogeneity** along the peptide surface normal.

研究生生活及心得

感謝中技社對我研究成果的鼓勵所頒發的獎學金，這筆錢對我來說，是相當重要的幫助。研究生在進行科技研究的過程往往會遭遇許多的挫折，而解決問題後獲得的成就感，只有走過的人才能體會，研究生是踏入科研殿堂的入門，感謝中技社多年來在台灣科學研究的付出，於研究生剛入門的過程中，給予他們包含我在內，能持續向前邁進的基石。