巨大中空錯体への閉じ込めにより誘起されたタンパク質－糖鎖の弱い相互作用の評価

（東大院工[1]・分子科学研究所[2]）○田所 美璃[1]・中間 貴寛[1]・藤田 誠[1,2]
Evaluation of weak protein–sugar interactions induced by confinement in giant hollow coordination complexes ([1]*Graduate School of Engineering, The University of Tokyo,* [2]*Institute for Molecular Science*) ○Miri Tadokoro[1], Takahiro Nakama[1], Makoto Fujita[1,2]

Structural analysis methods for protein–sugar weak interactions remain limited despite their biological significance. We have analyzed the functions and structures of a protein encapsulated in an $M_{12}L_{24}$ complex that self-assembles from Pd(II) ions (M) and bis(pyridine) ligands (L)[1,2]. In this study, we have evaluated protein–sugar weak interactions induced within a confined space of $M_{12}L_{24}$ complexes towards their structural analysis (Fig. 1). Lysozyme was co-encapsulated with oligosaccharides in an $M_{12}L_{24}$ complex through the condensation with a bis(pyridine) ligand and the subsequent self-assembly[1,2], and its enzymatic activity was measured (Fig. 1a). The activity of lysozyme was significantly reduced only when it was co-encapsulated with sugars in the complex while free sugars did not affect the activity. This inhibition resulted from the binding of the sugars to the active site of lysozyme, demonstrating that the co-encapsulation can induce weak protein-sugar interactions (Fig. 1b).
Keywords: protein encapsulation; sugar; self-assembly; weak interaction; protein structure analysis

タンパク質と糖鎖の弱い相互作用は、その生物学的な重要性に対し構造的な解析手段は限定的である。当研究室では、配位子(L)と Pd(II)イオン(M)の自己集合で形成する $M_{12}L_{24}$ 巨大中空錯体にタンパク質を包接し、その性質・構造解析を試みてきた[1,2]。本研究では、構造解析法の開発に向け、$M_{12}L_{24}$ 錯体の孤立空間への閉じ込めによるタンパク質–糖鎖間の弱い相互作用の誘発を評価した(Fig. 1)。リゾチームと糖鎖を配位子との縮合、続く自己集合により中空錯体に共包接し[1,2]、その酵素活性を測定した(Fig. 1a)。遊離の糖鎖の存在下では変化しなかったリゾチームの活性は、糖鎖と共に包接された場合にのみ著しく低下した。これは、糖鎖の活性部位へ結合による触媒能阻害であり、共包接によるタンパク質–糖鎖相互作用の誘起が実証された(Fig. 1b)。

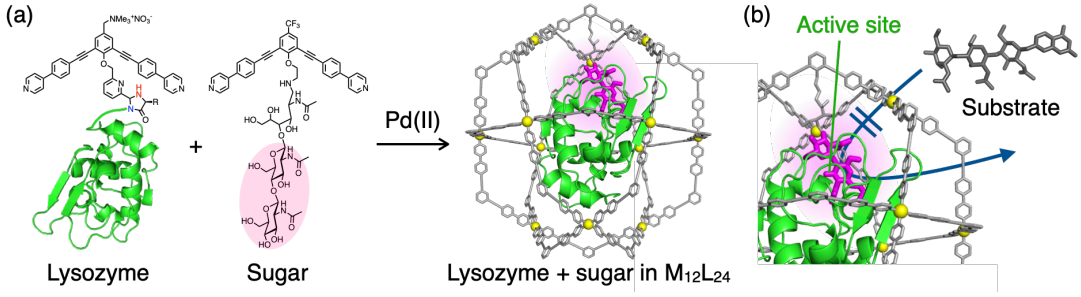

Figure 1 (a) Schematic representation of co-encapsulation of lysozyme and sugar in an $M_{12}L_{24}$ cage. (b) Induction of lysozyme–sugar weak interactions that inhibit its enzymatic activity in the confined space.

1) D. Fujita *et al.*, *Chem* **2021**, *7*, 2672–2683. 2) M. Tadokoro *et al.*, The 102nd CSJ Annual Meeting, 2022, P2-1pm-25.