**Genetically Encoded Click Chemistry: New Tools for Protein-based Materials**

Wen-Bin Zhang\*

*College of Chemistry, Peking University, Beijing, 100871, P. R. China*

*\*wenbin@pku.edu.cn*

Genetically encoded chemistry provides versatile control over the process of chemical reactions and the resulting materials. The spontaneous formation of an isopeptide bond between a peptide tag and its protein partner is a genetically encoded, cell-compatible, highly specific and efficient chemistry for protein/peptide conjugation, as demonstrated in the chemically reactive pair of SpyTag/SpyCatcher.1 In this talk, I will give a brief overview of our work in the development of genetically encoded protein chemistry tools (especially those possessing features of click chemistry) and the use of such tools to create bioactive materials. Through protein engineering, we have successfully developed a chemical toolbox of genetically encoded chemical reactions. The ability to encode chemical information into protein sequences has allowed the direct cellular synthesis of cyclic proteins, tadpole proteins, star proteins, and other branched topologies.2 The reaction between proteins bearing multiple reactive groups also lead to all-protein-based bioactive hydrogels, whose macroscopic properties are fully genetically encodable.3 By combining this chemistry with protein folding, protein catenanes and other complex protein topologies can be prepared.4,5 In general, catenation was found to increase proteins’ stability toward proteolytic digestion and thermal denaturation.6 It has thus opened new ways to engineer protein’s properties, both in vivo and in vitro, which has general implications for protein-based materials.

**References**

(1) B. Zakeri, J.O. Fierer, E. Celik, E. C. Chittock, U. Schwarz-Linek, V. T. Moy, M. Howarth, *Proc. Natl. Acad. Sci. U.S.A.* **2012**, *109*, E690.

(2) W. B. Zhang, F. Sun, D. A. Tirrell, F. H. Arnold, *J. Am. Chem. Soc.***2013**, *135*, 13988.

(3) F. Sun, W. B. Zhang, A. Mahdavi, F. H. Arnold, D. A. Tirrell, *Proc. Natl. Acad. Sci. U.S.A.* **2014**, *111*, 11269.

(4) X. W. Wang, W. B. Zhang, W.-B. *Angew. Chem. Int. Ed.* **2016**, *55*, 3442.

(5) Liu, D.; Wu, W.-H.; Liu, Y.-J.; Wu, X.-L.; Cao, Y.; Song, B.; Li, X.; Zhang, W.-B. *ACS Cent. Sci.* **2017**, *3*, 473.

(6) X. W. Wang, W. B. Zhang, W.-B. *Angew. Chem. Int. Ed.* **2017**, *56*, 15014.

**Biography**

Wen-Bin Zhang is currently an Assistant Professor at the Department of Polymer Science and Engineering, College of Chemistry and Molecular Engineering of Peking University. He received his B.S. in Organic Chemistry from Peking University in 2004 and his Ph.D. in Polymer Science from the University of Akron in 2010. He continued at the University of Akron for his postdoctoral research under the supervision of Prof. Stephen Cheng for one year, before he moved to Caltech for a second postdoctoral training with Prof. David Tirrell in Protein Engineering and Biomaterials. His current research interests include the rational development of materials that bridge synthetic systems and biological systems for energy and health-related applications. In particular, he is interested in developing genetically encoded protein click chemistry and the use of such tools for protein topology engineering and protein-based bioactive materials.

