

# 个人简历

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中国科学院研究员  
生命有机国家重点实验室副主任  
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## 研究方向

- ✧ 复杂天然产物的生物合成（遗传学、生物化学和化学）研究员。
- ✧ 以产量提高和结构多样性为目的组合生物合成研究。
- ✧ 以基因组扫描为手段的新型天然产物发现研究。

## 工作经历

- ✧ 2003 年 8 月至今：入选中国科学院“百人计划”，上海有机化学研究所，研究员
- ✧ 2001 年 9 月至 2003 年 7 月：美国威斯康星大学麦迪逊分校药学院，研究助理
- ✧ 2000 年 9 月至 2001 年 8 月：美国加州大学戴维斯分校化学系，博士后

## 教育背景

- ✧ 1994 年 9 月至 2000 年 8 月：中国协和医科大学（中国医学科学院）获硕士（1997 年）、博士学位（2000 年，美国加州大学戴维斯分校化学系联合培养），导师：李元教授、沈奔教授。
- ✧ 1988 年 9 月至 1992 年 7 月：四川大学生物工程系，获学士学位。

## 主要获奖情况

- ✧ 2017 年国家“万人计划”科技创新领军人才；
- ✧ 2017 年中国科学院优秀导师奖；
- ✧ 2017 年工业生物技术年度创新先锋奖；
- ✧ 2015 年谈家桢生命科学创新奖；
- ✧ 2015 年科技部中青年科技创新领军人才；
- ✧ 2015 年国家百千万人才工程“有突出贡献中青年专家”；
- ✧ 2013 年日本化学会“Distinguished Lectureship Award”获得者；
- ✧ 2013 年上海市优秀学术带头人；
- ✧ 2012 年上海市领军人才；
- ✧ 2012 年中国科学院优秀研究生指导教师；
- ✧ 2011 年中国科学院优秀导师奖；
- ✧ 2010 年国务院政府特贴获得者；
- ✧ 2010 年中国药学会-赛诺菲安万特青年生物奖；

- ◇ 2010 年明治乳业生命科学奖（优秀奖）；
- ◇ 2009 年中科院“百人计划”终期评估“优秀”入选者；
- ◇ 国家自然科学基金委 2005 年度“杰出青年基金”获得者；
- ◇ 上海市科学技术委员会 2005 年度“启明星计划”、2009 年“启明星追踪计划”和“浦江人才计划”入选者

## 学术任职

- ◇ Cell 杂志子刊《Cell Chemical Biology》编委；
- ◇ 英国皇家化学会《Natural Product Reports》编委；
- ◇ 《Synthetic and Systems Biotechnology》编委；
- ◇ 《有机化学》编委；
- ◇ 中国微生物学会分子微生物学与生物工程专业委员会委员；
- ◇ 中国微生物学会分子生物化学专业委员会委员；
- ◇ 中国医药生物技术协会酶工程与发酵工程专业委员会常务委员；
- ◇ 中国化学会化学生物学专业委员会委员

## 代表性论文

1. Zhang, D.; Zhang, F.; **Liu, W.**, A KAS-III Heterodimer in lipstatin biosynthesis nondecarboxylatively condenses C8 and C14 fatty acyl-CoA substrates by a variable mechanism during the establishment of a C22 aliphatic skeleton. *Journal of the American Chemical Society* 2019, 141, 3993–4001.
2. Jia, L.; Tang, H.; Wang, W.; Yuan, T.; Wei, W.; Pang, B.; Gong, X.; Wang, S.; Li, Y.; Zhang, D.; **Liu, W.\***; Tang, W.\*, A linear nonribosomal octapeptide from *Fusarium graminearum* facilitates cell-to-cell invasion of wheat. *Nature Communications* 2019, 10, 922.
3. Qiu, Y.; Du, Y.; Wang, S.; Zhou, S.; Guo, Y.; **Liu, W.**, Radical S<sup>-</sup> adenosylmethionine protein NosN forms the side ring system of nosiheptide by functionalizing the polythiazolyl peptide S<sup>-</sup> conjugated indolic moiety. *Organic Letters* 2019, 21, 1502–1505.
4. Wang, J.; Lin, Z.; Bai, X.; Tao, J.; **Liu, W.**, Optimal design of thiostrepton-derived thiopeptide antibiotics and their potential application against oral pathogens. *Organic Chemistry Frontiers* 2019, 6, 1194–1199.
5. Liu, J.; Lin, Z.; Li, Y.; Zheng, Q.; Chen, D.; **Liu, W.**, Insights into the thioamidation of thiopeptins to enhance the understanding of the biosynthetic logic of thioamide-containing thiopeptides. *Organic & Biomolecular Chemistry* 2019, 17, 3727–3731.
6. Chen, D.; Zhao, Q.; **Liu, W.**, Discovery of caerulomycin/collismycin-type 2,2'-bipyridine natural products in the genomic era. *Journal of Industrial Microbiology & Biotechnology* 2019, 46, 459-468.
7. Liu, J.; Lin, Z.; Chen, H.; Guo, H.; Tao, J.; **Liu, W.**, Biosynthesis of the central piperidine nitrogen heterocycle in series a thiopeptides. *Chinese Journal of Chemistry* 2019, 37, 35-41.
8. Zhang, D.; Tang, Z.; **Liu, W.**, Biosynthesis of lincosamide antibiotics: reactions associated with degradation and detoxification pathways play a constructive role. *Accounts of Chemical Research* 2018, 51(6), 1496-1506.

9. Zhong, G.; Chen, H.; Liu, W., Reply to 'C–C bond cleavage in biosynthesis of 4-alkyl-L-proline precursors of lincomycin and anthramycin cannot precede C-methylation'. **Nature Communications** 2018, doi: 10.1038/s41467-018-05500-1.
10. Awakawa, T.; Fujioka, T.; Zhang, L.; Hoshino, S.; Hu, Z.; Hashimoto, J.; Kozone, I.; Ikeda, H.; Shin-Ya, K.; Liu, W.; Abe, I., Reprogramming of the antimycin NRPS-PKS assembly lines inspired by gene evolution. **Nature Communications** 2018, **9**, 3534.
11. Zheng, Q.; Gong, Y.; Guo, Y.; Zhao, Z.; Wu, Z.; Zhou, Z.; Chen, D.; Pan, L.\*; Liu, W.\*, Structural insights into a flavin-dependent [4+2] cyclase that catalyzes *trans*-decalin formation in pyrroindomycin biosynthesis. **Cell chemical biology** 2018, **25**, 718-727.
12. Wang, M.; Chen, D.; Zhao, Q.; Liu, W., Isolation, structure elucidation, and biosynthesis of a cysteate-containing nonribosomal peptide in *Streptomyces lincolnensis*. **Journal of Organic Chemistry** 2018, **83**(13), 7102-7108.
13. Li, J.; Li, Y.; Niu, G.; Guo, H.; Qiu, Y.; Lin, Z.; Liu, W.\*; Tan, H.\*, NosP-Regulated Nosiheptide Production Responds to Both Peptidyl and Small-Molecule Ligands Derived from the Precursor Peptide. **Cell chemical biology** 2018, **25**, 143-153.
14. Qiu, Y.; Du, Y.; Zhang, F.; Liao, R.; Zhou, S.; Peng, C.; Guo, Y.; Liu, W., Thiolation Protein-Based Transfer of Indolyl to a Ribosomally Synthesized Polythiazolyl Peptide Intermediate during the Biosynthesis of the Side Ring System of Nosiheptide. **Journal of the American Chemical Society**, 2017, **139**, 18186-18189.
15. Lin, Z.; Ji, J.; Zhou, S.; Zhang, F.; Wu, J.; Guo, Y.; Liu, W., Processing 2-Methyl-L-Tryptophan through Tandem Transamination and Selective Oxygenation Initiates Indole Ring Expansion in the Biosynthesis of Thiostrepton. **Journal of the American Chemical Society** 2017, **139**, 12105-12108.
16. Zhong, G.; Zhao, Q.; Zhang, Q.; Liu, W., 4-Alkyl-L-(dehydro)proline biosynthesis in Actinobacteria involves *N*-terminal nucleophile-hydrolase activity of  $\gamma$ -glutamyltranspeptidase homolog for C-C bond cleavage. **Nature Communications** 2017, **8**, 16109.
17. Chen, M.; Liu, J.; Duan, P.; Li, M.; Liu, W., Biosynthesis and molecular engineering of templated natural products. **National Science Review**, 2017, doi: 10.1093/nsr/nww045.
18. Lin, Z.; He, Q.; Liu, W., Bio-inspired Engineering of Thiopeptide Antibiotics advances the Expansion of Molecular Diversity and Utility. **Current Opinion in Biotechnology** 2017, **48**, 210-219.
19. Chen, M.; Zhang, Y.; Du, Y.; Zhao, Q.; Zhang, Q.; Wu, J.; Liu, W., Enzymatic Competition and Cooperation Branch the Caerulomycin Biosynthetic Pathway toward Different 2,2'-bipyridine members. **Organic & Biomolecular Chemistry** 2017, **15**, 5472-5475.
20. Chen, M.; Pang, B.; Du, Y.; Zhang, Y.; Liu, W., Characterization of the Metallo-dependent Amidohydrolases Responsible for "auxiliary" Leucanyl Removal in the Biosynthesis of 2,2'-bipyridine Antibiotics. **Synthetic and Systems Biotechnology** 2017, **2**, 137-146.
21. Zheng, Q.; Fang, H.; Liu, W., Post-translational modifications involved in the biosynthesis of thiopeptide antibiotics. **Organic & Biomolecular Chemistry** 2017, **15**, 3376-3390.
22. Li, X.; Zheng, Q.; Yin, J.; Liu, W.\*; Gao, S.\*, Chemo-enzymatic Synthesis of Equisetin. **Chemical Communications** 2017, **53**, 4695-4697
23. Zheng, Q.#; Wu, Z.#; Sun, P.#; Chen, D.; Tian, Z.; Liu, W., A linear hydroxymethyl tetramate undergoes an acetylation–elimination process for exocyclic methylene formation in the biosynthetic pathway of pyrroindomycins. **Organic & Biomolecular Chemistry** 2017, **15**, 88-91.

24. Zheng, Q.; Wang, S.; Duan, P.; Liao, R.; Chen, D.; **Liu, W.**, An  $\alpha/\beta$ -hydrolase fold enzyme with a dual activity for endopeptidyl hydrolysis and epoxide ring-opening/ macrocyclization in thiostrepton biosynthesis. *Proceedings of the National Academy of Sciences of the United States of America* 2016, **113** (50):14318-14323.
25. Zheng, Q.; Wang, S.; Liao, R.; **Liu, W.**, Precursor-Directed Mutational Biosynthesis Facilitates the Functional Assignment of Two Cytochromes P450 in Thiostrepton Biosynthesis, *ACS Chemical Biology* 2016, **11**, 2673-2678
26. Duan, P.; Zheng, Q.; Lin, Z.; Wang, S.; Chen, D.; **Liu, W.**, Molecular engineering of thiostrepton via single "base"-based mutagenesis to generate side ring-derived variants. *Organic Chemistry Frontiers* 2016, **3**, 1254-1258
27. Wang, M.; Zhao, Q.; Zhang, Q.; **Liu, W.**, Differences in PLP-Dependent Cysteiny Processing Lead to Diverse S-Functionalization of Lincosamide Antibiotics. *Journal of the American Chemical Society* 2016, **138**, 6348-6351
28. Pang, B.; Zhong, G.; Tang, Z.; **Liu, W.**, Enzymatic [4+2] Cycloadditions in the Biosynthesis of Spirotetramates and Spirotetronates. *Methods in Enzymology* 2016, **575**, 39-63
29. Lin, Z.; Chen, D.; **Liu, W.**, Biosynthesis-based artificial evolution of microbial natural products, *SCIENCE CHINA Chemistry* 2016, **59**, 1175-1189
30. Zheng, Q.; Guo, Y.; Yang, L.; Zhao, Z.; Wu, Z.; Zhang, H.; Liu, J.; Cheng, X.; Wu, J.; Yang, H.; Jiang, H.; Pan, L.; **Liu, W.**, Enzyme-dependent [4+2] cycloaddition depends on lid-like interaction of the N-terminal sequence with the catalytic core in PyrI4. *Cell Chemical Biology* 2016, **23**, 352-360 (Featured Article).
31. Zheng, Q.; Tian, Z.; **Liu, W.**, Recent advances in understanding the enzymatic reactions of [4+2] cycloaddition and spiroketalization. *Current Opinion of Chemical Biology* 2016, **31**, 95-102.
32. Pang, B.; Wang, M.; **Liu, W.**, Cyclization of polyketides and non-ribosomal peptides on and off their assembly lines. *Natural Product Reports* 2016, **33**, 162-173.
33. Wang, S.; Zheng, Q.; Wang, J.; Chen, D.; Yu, Y.; **Liu, W.**, Concurrent modifications of the C-terminus and side ring of thiostrepton and their synergistic effects with respect to improving antibacterial activities. *Organic Chemistry Frontiers* 2016, **3**, 496-500.
34. Li, Y.; Li, J.; Tian, Z.; Xu, Y.; Zhang, J.; **Liu, W.\***; Tan, H.\*, Coordinative modulation of chlorothricin biosynthesis by binding of the glycosylated intermediates and end product to a responsive regulator ChIF1. *Journal of Biological Chemistry* 2016, **291**, 5406-5417.
35. Zheng, Q.; **Liu, W.**, Thiopeptide Antibiotics act on both Host and Microbe to Deliver Double Punch on Mycobacterial Infection. *Mycobacterial Diseases* 2016, **6**, 203.
36. Zhao, Q.; Wang, M.; Xu, D.; Zhang, Q.; **Liu, W.**, Metabolic coupling of two small-molecule thiols programs the biosynthesis of lincomycin A. *Nature* 2015, **518**, 115-119 (Featured in: Melancon III, C. Elusive source of sulfur unravelled. *Nature* 2015, **518**, 45-46; Abe, I., Zhang, L. *F1000Prime* 2015, doi: 10.3410/f.725320497.7933503602; Crawford, J., Topping, T. *F1000Prime* 2015, doi: 10.3410/f.725320497.7933503765).
37. Tian, Z.; Sun, P.; Yan, Y.; Wu, Z.; Zheng, Q.; Zhou, X.; Zhang, H.; Yu, F.; Jia, X.; Chen, D.; Mandi, A.; Kurtan, T.; **Liu, W.**, An enzymatic [4+2] cyclization cascade creates the pentacyclic core of pyrroindomycins. *Nature Chemical Biology* 2015, **11**, 259-265.
38. Wang, M.; Zhao, Q.; **Liu, W.**, The versatile low-molecular-weight thiols: Beyond cell protection. *Bioessays* 2015, **37**, 1262-1267.

39. Zheng, Q.; Wang, Q.; Wang, S.; Wu, J.; Gao, Q.; **Liu, W.**, Thiopeptide antibiotics exhibit a dual mode of action against intracellular pathogens by affecting both host and microbe. *Chemistry & Biology* 2015, **22**, 1002-1007 (**Featured Article** and **Featured in:** Wilkinson, B.; Alt, S. *F1000Prime* 2015, doi: 10.3410/f.725675341.793510399).
40. Sun, P.; Zhao, Q.; Wu, Z.; Zhang, W.; **Liu, W.**, 1,19-seco-Avermectin Analogues from a *ΔaveCDE* Mutant *Streptomyces avermectinius* Strain. *Journal of Natural Products* 2015, **78**, 301-305.
41. Wang, S.; Zheng, Q.; Wang, J.; Zhao, Z.; Li, Q.; Yu, Y.; Wang, R.; **Liu, W.**, Target-oriented design and biosynthesis of thiostrepton-derived thiopeptide antibiotics with improved pharmaceutical properties. *Organic Chemistry Frontiers* 2015, **2**, 106-109.
42. Liu, S.; Guo, H.; Zhang, T.; Han, L.; Yao, P.; Zhang, Y.; Rong, N.; Yu, Y.; Lan, W.; Wang, C.; Ding, J.; Wang, R.; **Liu, W.\***; Cao, C.\*, Structure-based mechanistic insights into terminal amide synthase in nosiheptide-represented thiopeptides biosynthesis. *Scientific Reports* 2015, **5**, 12744. doi: 10.1038/srep12744.
43. Medema, M. H.; Kottmann, R.; Yilmaz, P.; Cummings, M.; Biggins, J. B.; Blin, K.; Bruijn, I., d.; Chooi, Y. H.; Claesen, J.; Coates, R. C.; Cruz-Morales, P.; Duddela, S.; Düsterhus, S.; Edwards, D. J.; Fewer, D. P.; Garg, N.; Geiger, C.; Gomez-Escribano, J. P.; Greule, A. Hadjithomas, M.; Haines, A. S.; Helfrich, E. J. N.; Hillwig, M. L.; Ishida, K.; Jones, A. C.; Jones, C. S.; Jungmann, K.; Kegler, C.; Kim, H. U.; Kötter, P.; Krug, D.; Masschelein, J.; Melnik, A. V.; Mantovani, S. M.; Monroe, E. A.; Moore, M.; Moss, N.; Nützmänn, H-W.; Pan, G.; Pati, A.; Petras, D.; Reen, F. J.; Rosconi, F.; Rui, Z.; Tian, Z.; Tobias, N. J.; Tsunematsu, Y.; Wiemann, P.; Wyckoff, E.; Yan, X.; Yim, G.; Yu, F.; Xie, Y.; Aigle, B.; Apel, A. K.; Balibar, C. J.; Balskus, E. P.; Barona-Gómez, F.; Bechthold, A.; Bode, H. B.; Borriss, R.; Brady, S. F.; Brakhage, A. A.; Caffrey, P.; Cheng, Y-Q.; Clardy, J.; Cox, R. J.; Mot, R. D.; Donadio, S.; Donia, M. S.; van der Donk, W. A.; Dorrestein, P. C.; Doyle, S.; Driessen, A. J. M.; Ehling-Schulz, M.; Entian, K-D.; Fischbach, M. A.; Gerwick, L.; Gerwick, W. H.; Gross, H.; Gust, B.; Hertweck, C.; Höfte, M.; Jensen, S. E.; Ju, J.; Katz, L.; Kaysser, L.; Klassen, J. L.; Keller, N. P.; Kormanec, J.; Kuipers, O. P.; Kuzuyama, T.; Kyripides, N. C.; Kwon, H-j.; Lautru, S.; Lavigne, R.; Lee, C. Y.; Bai, L.; Liu, X.; **Liu, W.**; Luzhetskyy, A.; Mahmud, T.; Mast, Y.; Méndez, C.; Metsä-Ketelä, N.; Micklefield, J.; Mitchell, D. A.; Moore, B. S.; Moreira, L. M.; Müller, R.; Neilan, B. A.; Nett, M.; Nielsen, J.; O'Gara, F.; Oikawa, H.; Osbourn, A.; Osburne, M. S.; Ostash, B.; Payne, S. M.; Pernodet, J-L.; Petricek, M.; Piel, J.; Ploux, O.; Raaijmakers, J. M.; Salas, J. A.; Schmitt, E. K.; Scott, B.; Seipke, R. F.; Shen, B.; Sherman, D. H.; Sivonen, K.; Smanski, M. J.; Sosio, M.; Stegmann, E.; Süssmuth, R. D.; Tahlan, K.; Thomas, C. M.; Tang, Y.; Truman, A. W.; Viaud, M.; Walton, J. D.; Walsh, C. T.; Weber, T.; van Wezel, G. P.; Wilkinson, B.; Willey, J. M.; Wohlleben, W.; Wright, G. D.; Ziemert, N.; Zhang, C.; Zotchev, S. B.; Breitling, R.; Takano, E.; Glöckner, F. O., Minimum information about a biosynthetic gene cluster. *Nature Chemical Biology* 2015, **11**, 265-231.
44. Zhang, L.; Mori, T.; Zheng, Q.; Awakawa, T.; Yan, Y.; **Liu, W.**; Abe, I., Rational control of polyketide extender units by structure-based engineering of a crotonyl-CoA carboxylase/reductase in antimycin biosynthesis. *Angewandte Chemie International Edition* 2015, **54**, 13462–13465.
45. Chang, C.; Huang, R.; Yan, Y.; Ma, H.; Dai, Z.; Zhang, B.; Deng, Z.; **Liu, W.**; Qu, X., Uncovering the formation and selection of benzylmalonyl-CoA from the biosynthesis of

- splenocin and enterocin reveals a versatile way to introduce amino acids into polyketide carbon scaffolds. *Journal of the American Chemical Society* 2015, **137**, 4183-4190.
46. Wang, Y.; Liu, S.; Yao, P.; Yu, Y.; Zhang, Y.; Lan, W.; Wang, C.; Ding, J.; **Liu, W.**; Cao, C., Crystallographic analysis of NosA, which catalyzes terminal amide formation in the biosynthesis of nosiheptide. *Acta Crystallogr F* 2015, **71**, 1033-1037.
47. Pang, B.; Zheng, Q.; **Liu, W.**, Synthetic biology in natural medicine research. *Scientia Sinica Vitae* 2015, **45**, 1015-1026.
48. Chen, D.; Wu, J.; **Liu, W.**, Biosynthesis-based production improvement and structure modification of erythromycin A. *Chinese Journal of Biotechnology* 2015, **31**, 939-954.
49. Zheng, Q.; Wang, S.; **Liu, W.**, Discovery and efficient synthesis of a biologically active alkaloid inspired by thioestrepton biosynthesis. *Tetrahedron* 2014, **70**, 7686-7690.
50. Sun, P.; Zhao, Q.; Zhang, H.; Wu, J.; **Liu, W.**, Effect of Stereochemistry of Avermectin-Like 6,6-Spiroketal on Biological Activities and Endogenous Biotransformations in *Streptomyces avermectinius*. *ChemBioChem* 2014, **15**(5), 660-664.
51. Guo, H.; Wang, J.; Li, Y.; Yu, Y.; Zheng, Q.; Wu, J.; **Liu, W.**, Insight into bicyclic thiopeptide benefited from development of a uniform approach for molecular engineering and production improvement, *Chemical Science* 2014, **5**, 240-246.
52. Bai, T.; Zhang, D.; Lin, S.; Long, Q.; Wang, Y.; Ou, H.; Kang, Q.; Deng, Z.; **Liu, W.**; Tao, M., Operon for biosynthesis of lipstatin, the Beta-lactone inhibitor of human pancreatic lipase. *Applied and Environmental Microbiology* 2014, **80**(24), 7473-7483.
53. Yan, Y.; Chen, J.; Zhang, L.; Zheng, Q.; Han, Y.; Zhang, H.; Zhang, D.; Awakawa, T.; Abe, I.; **Liu, W.** Multiplexing of combinatorial chemistry in antimycin biosynthesis: expansion of molecular diversity and utility. *Angewandte Chemie International Edition* 2013, **39**, 12308-12312.
54. Sun, P.; Zhao, Q.; Yu, F.; Zhang, H.; Wu, Z.; Wang, Y.-Y.; Wang, Y.; **Liu, W.**, Spiroketal formation and modification in avermectin biosynthesis involves a dual activity of AveC. *Journal of the American Chemical Society* 2013, **135** (4), 1540-1548 (Hot off the press. *Nat. Prod. Rep.* 2013).
55. Wang, S.; Zhou, S.; **Liu, W.**, Opportunities and challenges from current investigations into the biosynthetic logic of nosiheptide-represented thiopeptide antibiotics. *Current Opinion in Chemical Biology* 2013, **17**, 626-634.
56. Chen, D.; Zhang, L.; Pang, B.; Chen, J.; Xu, Z.; Abe, I.; **Liu, W.**, FK506 maturation involves a cytochrome P450 protein-catalyzed four electron oxidation in parallel with C-31 O-methylation. *Journal of Bacteriology* 2013, 195(9), 1931-1939.
57. Shao, L.; Chen, J.; Wang, C.; Li, J.; Tang, Y.; Chen, D.; **Liu, W.**, Characterization of a key aminoglycoside phosphotransferase in gentamicin biosynthesis. *Bioorganic & Medicinal Chemistry Letters* 2013, **23**(5), 1438-1441.
58. Zhang, Q.; **Liu, W.**, Biosynthesis of thiopeptide antibiotics and their pathway engineering. *Natural Product Reports* 2013, **30**, 218-226.
59. Zhang, Q.; Pang, B.; Ding, W.; **Liu, W.\***, Aromatic polyketide produced by bacterial iterative type I polyketide synthases. *ACS Catalysis* 2013, **3**(7), 1439-1447.
60. Arnison, P. G.; Bibb, M. J.; Bierbaum, G.; Bowers, A. A.; Bugni, T. S.; Bulaj, G.; Camarero, J. A.; Campopiano, D. J.; Challis, G. L.; Clardy, J.; Cotter, P. D.; Craik, D. J.; Dawson, M.; Dittmann, E.; Donadio, S.; Dorrestein, P. C.; Entian, K. D.; Fischbach, M. A.; Garavelli, J. S.; Goransson, U.; Gruber, C. W.; Haft, D. H.; Hemscheidt, T. K.; Hertweck, C.; Hill, C.; Horswill, A. R.; Jaspars, M.; Kelly, W. L.; Klinman, J. P.; Kuipers, O. P.; Link, A. J.; **Liu, W.**; Marahiel, M. A.; Mitchell, D. A.; Moll,

- B. S. Moore, R. Muller, S. K. Nair, I. F. Nes, G. E. Norris, B. M. Olivera, H. Onaka, M. L. Patchett, G. N.; Piel, J.; Reaney, M. J.; Rebuffat, S.; Ross, R. P.; Sahl, H. G.; Schmidt, E. W.; Selsted, M. E.; Severinov, K.; Shen, B.; Sivonen, K.; Smith, L.; Stein, T.; Sussmuth, R. D.; Tagg, J. R.; Tang, G. L.; Truman, A. W.; Vederas, J. C.; Walsh, C. T.; Walton, J. D.; Wenzel, S. C.; Willey J. M.; van der Donk, W. A. *Natural Product Reports* 2013, **30**, 108-160.
61. Wu, Q.; Wu, Z.; Qu, X.; **Liu, W.**, Insights into pyrroindomycin biosynthesis reveal a uniform paradigm for tetromate/tetronate formation. *Journal of the American Chemical Society* 2012, **134**, 17342-17345.
62. Duan, L.; Wang, S.; Liao, R.; **Liu, W.**, Insights into quinaldic acid formation in thiostrepton biosynthesis facilitating fluorinated thiopeptide generation. *Chemistry & Biology* 2012, **19** (4), 443-448.
63. Qu, X.; Pang, B.; Zhang, Z.; Chen, M.; Wu, Z.; Zhao, Q.; Zhang, Q.; Wang, Y.; Liu, Y.; **Liu, W.**, Caerulomycins and collismycins share a common paradigm for 2,2'-bipyridine biosynthesis via an unusual hybrid polyketide-peptide assembly logic. *Journal of the American Chemical Society* 2012, **134** (22), 9038-9041.
64. Zhang, Q.; van der Donk, W. A.; **Liu, W.**, Radical-mediated enzymatic methylation: a tale of two SAMS. *Accounts of Chemical Research* 2012, **45** (4), 555-564.
65. Chen, D.; Zhang, Q.; Zhang, Q.; Cen, P.; Xu, Z.; **Liu, W.**, Improvement of FK506 production in *Streptomyces tsukubaensis* by genetic enhancement of the supply of unusual polyketide extender units via utilization of two distinct site-specific recombination systems. *Applied and Environmental Microbiology* 2012, **78** (15), 5093-5103.
66. Smanski, M. J.; Qu, X. D.; **Liu, W.**, Shen, B. Biosynthesis of pharmaceutical natural products and their pathway engineering. In Breakthroughs and *Perspectives in Organic Chemistry—Views Based on the Achievements in the First Decade of the 21st Century*. Ding, K. L.; Dai, L. X. Eds. John Wiley-VCH Verlag GmbH & Co. KGaA, 2011, pp125-180.
67. Yan, Y.; Zhang, L.; Ito, T.; Qu, X.; Asakawa, Y.; Awakawa, T.; Abe, I.; **Liu, W.**, Biosynthetic pathway for high structural diversity of a common dilactone core in antimycin production. *Organic Letter* 2012, **14** (16), 4142-4145.
68. Li, J.; Qu, X.; He, X.; Duan, L.; Wu, G.; Bi, D.; Deng, Z.; **Liu, W.\***; Ou, H. Y.\*, ThioFinder: a web-based tools for the identification of thiopeptide gene clusters in DNA sequence. *PloS One* 2012, **7** (9), e45878.
69. Qu, X. D.; Lei, C.; **Liu, W.**, Transcriptome mining of active biosynthetic pathways and their associated products in *Streptomyces flaveolus*. *Angewandte Chemie International Edition* 2011, **50**, 9651-9654.
70. Wu, J. Q.; Zhang, Q. L.; Deng, W.; Qian, J. C.; Zhang, S. L.; **Liu, W.**, An artificial attB site for specific recombination facilitates genetic manipulations towards improving the erythromycin A production in an industrial *Saccharopolyspora erythraea* strain. *Applied and Environmental Microbiology* 2011, **77** (21), 7508-7516.
71. Zhang, Q.; **Liu, W.**, Complex biotransformations catalyzed by radical S-adenosylmethionine enzymes. *Journal of Biological Chemistry* 2011, **286** (35), 30245-30252.
72. Zhang, Q.; Li, Y. X.; Chen, D. D.; Yu, Y.; Duan, L. A.; Shen, B.; **Liu, W.**, Radical-mediated enzymatic carbon chain fragmentation-recombination. *Nature Chemical Biology* 2011, **7** (3), 154-160 (Featured in: BIOCHEMISTRY targeting tryptophan. *Science* 2011, **311**, 1366; Radical break-up, blissful make-up. *Nat. Chem. Biol.* 2011, **7**, 133-134; Chemical biology: radical

- transformation. **Nat. China** 2011, doi: 10.1038/nchina.2011.9; **Faculty of 1000 2011**, post-publication peer review).
73. Liao, R. J.; Liu, W., Thiostrepton Maturation Involving a Deesterification-Amidation Way To Process the C-Terminally Methylated Peptide Backbone. **Journal of the American Chemical Society** 2011, **133** (9), 2852-2855.
74. Qu, X. D.; Jiang, N.; Xu, F.; Shao, L.; Tang, G. L.; Wilkinson, B.; Liu, W., Cloning, sequencing and characterization of the biosynthetic gene cluster of sanglifehrin A, a potent cyclophilin inhibitor. **Molecular Biosystems** 2011, **7** (3), 852-861 (Featured in: **Faculty of 1000 2011**, post-publication peer review).
75. Zhang, Q.; Chen, D. D.; Lin, J.; Liao, R. J.; Tong, W.; Xu, Z. N.; Liu, W., Characterization of NocL Involved in Thiopeptide Nocathiacin I Biosynthesis A 4Fe-4S CLUSTER AND THE CATALYSIS OF A RADICAL S-ADENOSYLMETHIONINE ENZYME. **Journal of Biological Chemistry** 2011, **286** (24), 21287-21294.
76. Zhang, Q.; Wu, J.; Qian, J.; Chu, J.; Zhuang, Y.; Zhang, S.; Liu, W., Knocking out of tailoring genes eryK and eryG in an industrial erythromycin-producing strain of *Saccharopolyspora erythraea* leading to overproduction of erythromycin B, C and D at different conversion ratios. **Letters in Applied Microbiology** 2011, **52** (2), 129-137.
77. Ding, W.; Deng, W.; Tang, M. C.; Zhang, Q.; Tang, G. L.; Bi, Y. R.; Liu, W., Biosynthesis of 3-methoxy-5-methyl naphthoic acid and its incorporation into the antitumor antibiotic azinomycin B. **Molecular Biosystems** 2010, **6** (6), 1071-1081.
78. Ding, W.; Lei, C.; He, Q. L.; Zhang, Q. L.; Bi, Y. R.; Liu, W., Insights into Bacterial 6-Methylsalicylic Acid Synthase and Its Engineering to Orsellinic Acid Synthase for Spirotetronate Generation. **Chemistry & Biology** 2010, **17** (5), 495-503.
79. Ding, Y.; Yu, Y.; Pan, H. X.; Guo, H.; Li, Y. M.; Liu, W., Moving posttranslational modifications forward to biosynthesize the glycosylated thiopeptide nocathiacin I in *Nocardia* sp ATCC202099. **Molecular Biosystems** 2010, **6** (7), 1180-1185.
80. Wang, J.; Yu, Y.; Tang, K. X.; Liu, W.; He, X. Y.; Huang, X.; Deng, Z. X., Identification and Analysis of the Biosynthetic Gene Cluster Encoding the Thiopeptide Antibiotic Cyclothiazomycin in *Streptomyces hygrosopicus* 10-22. **Applied and Environmental Microbiology** 2010, **76** (7), 2335-2344.
81. Yu, Y.; Guo, H.; Zhang, Q.; Duan, L. A.; Ding, Y.; Liao, R. J.; Lei, C.; Shen, B.; Liu, W., NosA Catalyzing Carboxyl-Terminal Amide Formation in Nosiheptide Maturation via an Enamine Dealkylation on the Serine-Extended Precursor Peptide. **Journal of the American Chemical Society** 2010, **132** (46), 16324-16326.
82. He, Q. L.; Jia, X. Y.; Tang, M. C.; Tian, Z. H.; Tang, G.; Liu, W., Dissection of Two Acyl-Transfer Reactions Centered on Acyl-S-Carrier Protein Intermediates for Incorporating 5-Chloro-6-methyl-O-methylsalicylic Acid into Chlorothricin. **ChemBioChem** 2009, **10** (5), 813-819.
83. Liao, R. J.; Duan, L.; Lei, C.; Pan, H. X.; Ding, Y.; Zhang, Q.; Chen, D. J.; Shen, B.; Yu, Y.; Liu, W., Thiopeptide Biosynthesis Featuring Ribosomally Synthesized Precursor Peptides and Conserved Posttranslational Modifications. **Chemistry & Biology** 2009, **16** (2), 141-147 (Featured in: This week in techniques: Biosynthetic pathway for the production of thiopeptide antibiotics. **SciBX** 2(10), 2009, Doi: 10.1038/scibx.2009.423; Thiopeptide antibiotic biosynthesis. **Angew. Chem. Int. Ed.**



- 2009, **48**, 6770-6773; Recent advances in thiopeptide antibiotic biosynthesis. *Nat. Prod. Rep.* 2010, **27**, 153-164).
84. Yu, Y.; Duan, L.; Zhang, Q.; Liao, R. J.; Ding, Y.; Pan, H. X.; Wendt-Pienkowski, E.; Tang, G. L.; Shen, B.; **Liu, W.**, Nosiheptide Biosynthesis Featuring a Unique Indole Side Ring Formation on the Characteristic Thiopeptide Framework. *ACS Chemical Biology* 2009, **4** (10), 855-864 (**Featured in:** Recent advances in thiopeptide antibiotic biosynthesis. *Nat. Prod. Rep.* 2010, **27**, 153-164).
85. **Liu, W.**; Yu, Y, Combinatorial Biosynthesis of pharmaceutical natural products. Biocatalysis for the pharmaceutical industry-discovery, development and manufacturing. *In Biocatalysis for the Pharmaceutical Industry*. Tao, J. H.; Lin, G. Q.; Liese, A. Eds. John Wiley & Sons Pte Ltd, 2009, pp229-245.
86. Chen, Y.; Deng, W.; Wu, J. Q.; Qian, J. C.; Chu, J.; Zhuang, Y. P.; Zhang, S. L.; **Liu, W.**, Genetic modulation of the overexpression of tailoring genes eryK and eryG leading to the improvement of erythromycin a purity and production in *Saccharopolyspora erythraea* fermentation. *Applied and Environmental Microbiology* 2008, **74** (6), 1820-1828.
87. Fang, J.; Zhang, Y. P.; Huang, L. J.; Jia, X. Y.; Zhang, Q.; Zhang, X.; Tang, G.; **Liu, W.**, Cloning and characterization of the tetrocarcin a gene cluster from *Micromonospora chalcea* NRRL 11289 reveals a highly conserved strategy for tetronate biosynthesis in spirotetronate antibiotics. *Journal of Bacteriology* 2008, **190** (17), 6014-6025.
88. Galm, U.; Wang, L. Y.; Wendt-Pienkowski, E.; Yang, R. Y.; **Liu, W.**; Tao, M. F.; Coughlin, J. M.; Shen, B., In vivo manipulation of the bleomycin biosynthetic gene cluster in *Streptomyces verticillus* ATCC15003 revealing new insights into its biosynthetic pathway. *Journal of Biological Chemistry* 2008, **283** (42), 28236-28245.
89. Li, L.; Deng, W.; Song, J.; Ding, W.; Zhao, Q. F.; Peng, C.; Song, W. W.; Tang, G.; **Liu, W.**, Characterization of the saframycin a gene cluster from *Streptomyces lavendulae* NRRL 11002 revealing a nonribosomal peptide synthetase system for assembling the unusual tetrapeptidyl skeleton in an iterative manner. *Journal of Bacteriology* 2008, **190** (1), 251-263.
90. Zhang, J.; Van Lanen, S. G.; Ju, J. H.; **Liu, W.**; Dorrestein, P. C.; Li, W. L.; Kelleher, N. L.; Shen, B., A phosphopantetheinylating polyketide synthase producing a linear polyene to initiate enediyne antitumor antibiotic biosynthesis. *Proceedings of the National Academy of Sciences of the United States of America* 2008, **105** (5), 1460-1465 (**Featured in:** Enediynes taught how to work better. *C&E News* 2007, 85, 25).
91. Zhao, Q. F.; He, Q. L.; Ding, W.; Tang, M. C.; Kang, Q. J.; Yu, Y.; Deng, W.; Zhang, Q.; Fang, J.; Tang, G.; **Liu, W.**, Characterization of the azinomycin B biosynthetic gene cluster revealing a different iterative type I polyketide synthase for naphthoate biosynthesis. *Chemistry & Biology* 2008, **15** (7), 693-705 (**Featured in:** Antibiotic biosynthesis: from Genes to Enzymes. *Nat. China* 2008, Doi: 10.1038/nchina.2008.196).
92. **Liu, W.**; Zhang, S. L.; Chen, Y.; Deng, W.; Wu, J. Q., Improvement of Erythromycin a purity and production at the fermentation stage of *Saccharopolyspora erythraea* by metabolic engineering. *Journal of Biotechnology* 2008, **136** (Supplement 1): S21-S21.
93. Kennedy, D. R.; Gawron, L. S.; Ju, J. H.; **Liu, W.**; Shen, B.; Beerman, T. A., Single chemical modifications of the C-1027 enediyne core, a radiomimetic antitumor drug, affect both drug potency and the role of ataxia-telangiectasia mutated in cellular responses to DNA double-strand breaks. *Cancer Research* 2007, **67** (2), 773-781.

94. Shen, B.; Cheng, Y. Q.; Christenson, S. D.; Jiangi, H.; Ju, J. H.; Kwon, H. J.; Lim, S. K.; **Liu, W.**; Nonaka, K.; Seo, J. W.; Smith, W. C.; Standage, S.; Tang, G. L.; Van Lanen, S.; Zhang, J., Polyketide Biosynthesis beyond the Type I, II, and III Polyketide Synthase Paradigms: A Progress Report. *In Polyketides: Biosynthesis, Biological Activity, and Genetic Engineering*, Rimando, A. M.; Baerson, S. R., Eds. 2007; Vol. 955, pp 154-166.
95. Van Lanen, S. G.; Oh, T. J.; **Liu, W.**; Wendt-Pienkowski, E.; Shen, B., Characterization of the maduropeptin biosynthetic gene cluster from *Actinomadura madurae* ATCC 39144 supporting a unifying paradigm for enediyne biosynthesis. *Journal of the American Chemical Society* 2007, **129** (43), 13082-13094.
96. Jia, X. Y.; Tian, Z. H.; Shao, L.; Qu, X. D.; Zhao, Q. F.; Tang, J.; Tang, G.; **Liu, W.**, Genetic characterization of the chlorothricin gene cluster as a model for spiriotetronate antibiotic biosynthesis. *Chemistry & Biology* 2006, **13** (6), 575-585.
97. Shao, L.; Qu, X. D.; Jia, X. Y.; Zhao, Q. F.; Tian, Z. H.; Wang, M.; Tang, G.; **Liu, W.**, Cloning and characterization of a bacterial iterative type I polyketide synthase gene encoding the 6-methylsalicylic acid synthase. *Biochemical and Biophysical Research Communications* 2006, **345** (1), 133-139.
98. **Liu, W.**; Nonaka, K.; Nie, L. P.; Zhang, J.; Christenson, S. D.; Bae, J.; Van Lanen, S. G.; Zazopoulos, E.; Farnet, C. M.; Yang, C. F.; Shen, B., The neocarzinostatin biosynthetic gene cluster from *Streptomyces carzinostaticus* ATCC 15944 involving two iterative type I polyketide synthases. *Chemistry & Biology* 2005, **12** (3), 293-302.
99. Van Lanen, S. G.; Dorrestein, P. C.; Christenson, S. D.; **Liu, W.**; Ju, J. H.; Kelleher, N. L.; Shen, B., Biosynthesis of the beta-amino acid moiety of the enediyne antitumor antibiotic C-1027 featuring beta-amino acyl-S-carrier protein intermediates. *Journal of the American Chemical Society* 2005, **127** (33), 11594-11595.
100. Murrell, J. M.; **Liu, W.**; Shen, B., Biochemical characterization of the SgcA1 alpha-D-glucopyranosyl-1-phosphate thymidyltransferase from the enediyne antitumor antibiotic C-1027 biosynthetic pathway and overexpression of sgcA1 in *Streptomyces globisporus* to improve C-1027 production. *Journal of Natural Products* 2004, **67** (2), 206-213.
101. Christenson, S. D.; **Liu, W.**; Toney, M. D.; Shen, B., A novel 4-methylideneimidazole-5-one-containing tyrosine aminomutase in enediyne antitumor antibiotic C-1027 biosynthesis. *Journal of the American Chemical Society* 2003, **125** (20), 6062-6063.
102. **Liu, W.**; Ahlert, J.; Gao, Q. J.; Wendt-Pienkowski, E.; Shen, B.; Thorson, J. S., Rapid PCR amplification of minimal enediyne polyketide synthase cassettes leads to a predictive familial classification model. *Proceedings of the National Academy of Sciences of the United States of America* 2003, **100** (21), 11959-11963.
103. Shen, B.; **Liu, W.**; Nonaka, K., Enediyne natural products: Biosynthesis and prospect towards engineering novel antitumor agents. *Current Medicinal Chemistry* 2003, **10** (21), 2317-2325.
104. Zazopoulos, E.; Huang, K. X.; Staffa, A.; **Liu, W.**; Bachmann, B. O.; Nonaka, K.; Ahlert, J.; Thorson, J. S.; Shen, B.; Farnet, C. M., A genomics-guided approach for discovering and expressing cryptic metabolic pathways. *Nature Biotechnology* 2003, **21** (2), 187-190.
105. **Liu, W.**; Christenson, S. D.; Standage, S.; Shen, B., Biosynthesis of the enediyne antitumor antibiotic C-1027. *Science* 2002, **297** (5584), 1170-1173 (featured in: New enzymes in warhead. *Nat. Biotechnol.* 2002, **20**, 984-985; Towards bioengineering anticancer drugs. *Chem. & Biol.* 2002, **9**, 956-958; Newly mapped bacterial genes may contain blueprints for new anticancer drugs.

- The Lancet**, 2002, **360**, 550; Path to enediynes: Engineering of biosynthetic route could lead to better anticancer drugs. **C&E News**, 2002, **80**, 33; Chemical Highlights 2002: Biochemistry. **C&E News**, 2002, **80**, 40).
106. Liu, W.; Shen, B., Genes for production of the enediyne antitumor antibiotic C-1027 in *Streptomyces globisporus* are clustered with the *cagA* gene that encodes the C-1027 apoprotein. **Antimicrobial Agents and Chemotherapy** 2000, **44** (2), 382-392 (**Featured in:** Enediyne research continues apace. **C&E News**, 2000, **78**, 47-49).
107. Thorson, J. S.; Shen, B.; Whitwam, R. E.; Liu, W.; Li, Y.; Ahlert, J., Enediyne biosynthesis and self-resistance: A progress report. **Bioorganic Chemistry** 1999, **27** (2), 172-188.