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School of Life Sciences and Biotechnology
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Education:

2002-2007 PhD, Organic Chemistry, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences, China
1998-2002 BS, Chemistry, East China Normal University, China

Positions Held

2020- Professor, Shanghai Jiao Tong University, School of Life Sciences and Biotechnology/ Zhangjiang Institute for Advanced Studies.
2012-2020 Professor, Wuhan University, School of Pharmaceutical Sciences.
2011-2011 Associate Professor, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences.
2008-2010 Assistant Professor, Shanghai Institute of Organic Chemistry, Chinese Academy of Sciences.
2007-2008 Postdoc, Massachusetts Institute of Technology, Department of Chemistry.

Honors

2023 National Technical Standards Innovation Base (Dairy Industry) Jin Li Innovation Project Award (2023, 3rd)
2022 Shanghai Academic Research Leader
2014 National Science Foundation for Excellent Young Scholars
2013 New Century Excellent Talents in University, Chinese Ministry of Education
2012 Luojia Professorship of Wuhan University

Panels and Committees

2024-2027 Member, Chinese Botanical Society, Phytochemistry and Resource Committee,
2023-2027 Editorial Board Member of Journal of Biological Engineering
2023-2026 Member, Shanghai Zhangjiang Science and Technology Venture Investment Co.Ltd, the Advisory Committee of Experts on Investment Decisions
2022-2024 Editorial Board Member of Journal of Zhejiang University-Science B
2021-2026 Member, Enzyme Engineering Committee of Chinese Society for Microbiology
2020-2025 Editorial Board Member of Bioresources and Bioprocessing
2020-2025 Editorial Board Member of Green Synthesis & Catalysis
2019-2027 Member, Protein Engineering and Fermentation Engineering Committee of China Medicinal Biotech Association
2018-2023 Member, Enzyme Engineering Committee of Hubei Proventional Society for Microbiology
2016-2020 Member, Industrial and Environmental Biotechnology Committee of Chinese Society of Biotechnology
2017-2020 Member, Youth Scholar Standing Committee, Biochemical Engineering Society of China
2016-2020 Member, Youth Scholar Committee, Chinese Society of Biotechnology
2014-present Associate Member of F1000

Research Fundings

2023-2025 PI, Enterprise Development Project/Steroid Biotransformation Technology
2023-2025 PI, Outstanding Youth Team Cultivation Program in Central Universities
2023-2026 PI, Shanghai Municipal Natural Science Foundation
2023-2026 PI, National Natural Science Foundation of China
2022-2025 PI, Shanghai Academic Research Leader Plan
2020-2023 PI, National Natural Science Foundation of China
2020-2023 PI, Enterprise Development Project/Steroid Biotransformation Technology
2019-2024 Co-PI, National Key R&D Project
2018-2021 PI, National Key R&D Project
2018-2021 PI, National Natural Science Foundation of China
2016-2019 PI, National Natural Science Foundation of China
2014-2016 PI, National Science Foundation for Excellent Young Scholars
2013-2016 PI, National Natural Science Foundation of China
2013-2015 PI, New Century Excellent Talents in University, Chinese Ministry of Education
2010-2012 PI, National Natural Science Foundation of China

Patents:

- Xudong Qu, Zhi Lin. Application of monoamine oxidase in the preparation of tropinone, Chinese Patent ZL 202111549936.6.
- Xudong Qu, Mengmeng Zheng. A steroidal C14α hydroxylase, expression vector and engineering bacteria and its application, Chinese Patent ZL 202111529838.6.
- Xudong Qu, Zhi Lin; A synthesis method of tropinone, Chinese Patent ZL 202111549905.0.
- Xudong Qu, Lu Zhu, Hongmin Ma, Zixin Deng; A method of improving thermal stability of polymorphic proteins and alcohol dehydrogenase with improved thermal stability, Chinese Patent ZL201710237756.1.
- Xudong Qu, Qianghui Zhou, Yannan Zhang, Junlin Wang; A biotransformation method for the hydroxylation of a series of steroids at position 19, Chinese Patent ZL201910152033.0.
- Qianghui Zhou, Xudong Qu, Junlin Wang, Yannan Zhang; Preparation method of 19 hydroxylated cortodosone derivatives and 19-hydroxyandrostenedione, Chinese Patent ZL201910517841.2.
- Xudong Qu, Chenghai Sun, Wenya Tian, A C3-aromatic pyrroloindole alkaloid and its synthesis method, Chinese Patent ZL201810971942.2.
- Xudong Qu, Lu Zhu, Hongmin Ma, Zixin Deng, An alcohol dehydrogenase mutant with improved thermal stability, Chinese Patent ZL201710378065.3.
- Xudong Qu, Jinmei Zhu, Application of imine reductase and its mutants in the synthesis of (S)-1-aryl-1,2,3,4-tetrahydroisoquinoline, Chinese Patent ZL201710791728.4.
- Chang Chenchen, Huang Rong, Deng Zixin, Qu Xudong, A biosynthetic method of introducing side chains of amino acid origin to polyketide backbone and related genes, Chinese Patent ZL201510086158.X.

Publications

(1) Representative research papers：

- Chenghai Sun, Bao-Di Ma, Guangjun Li, Wenya Tian, Lu Yang, Haidong Peng, Zhi Lin, Zixin Deng, Xu-Dong Kong*, Xudong Qu*. Engineering the substrate specificity of a P450 dimerase enables the collective biosynthesis of heterodimeric tryptophan-containing diketopiperazines. ***Angewandte Chemie International Edition*** 2023, 62, e202304994.
- Zhi Lin*, Zhiwei Hu, Linjun Zhou, Benben Liu, Zixin Deng, Xudong Qu*. A large conserved family of small molecule carboxyl methyltransferases identified from Microorganisms.

Proceedings of the National Academy of Sciences of the United States of America 2023, 120, e2301389120.

- Fuzhen Song, Mengmeng Zheng, Junlin Wang, Huanhuan Liu, Zhi Lin, Benben Liu, Zixin Deng, Hengjiang Cong, Qianghui Zhou*, Xudong Qu*. Chemoenzymatic synthesis of C14-functionalized steroids. ***Nature Synthesis*** 2023, 2, 729-739.
- Jinmei Zhu, Lu Yang, Jiequn Wu, Zixin Deng, Xudong Qu*. Engineering imine reductase for efficient biosynthesis of 1-aryl-tetrahydro-β-carbolines and their N-methylation products. ***ACS Catalysis*** 2022, 12, 9823-9830.
- Mengmeng Zheng, Jun Zhang, Wan Zhang, Lu Yang, Xiaoli Yan, Wenya Tian, Zhihao Liu, Zhi Lin, Zixin Deng, Xudong Qu*. An atypical acyl-CoA synthetase enables efficient biosynthesis of extender units for engineering a polyketide carbon scaffold ***Angewandte Chemie International Edition*** 2022, 61, e202208734.
- Xiaoli Yan, Jun Zhang, Hongqun Tan, Zhihao Liu, Kai Jiang, Wenya Tian, Mengmeng Zheng, Zhi Lin, Zixin Deng, Xudong Qu*. A Pair of atypical KAS III homologues with initiation and elongation functions programs the polyketide biosynthesis in asukamycin. ***Angewandte Chemie International Edition*** 2022, 61, e202200879.
- Haidong Peng, Yaya Wang, Kai Jiang, Xinru Chen, Wenlu Zhang, Yanan Zhang, Zixin Deng, Xudong Qu*. A dual role reductase from phytosterol catabolism enables efficient production of valuable steroid precursors. ***Angewandte Chemie International Edition*** 2021, 60, 5414-5420.
- Jun Zhang, Mengmeng Zheng, Zixin Deng, Dongqing Zhu*, Xudong Qu*. A permissive medium chain acyl-CoA carboxylase enables the efficient biosynthesis of extender units for engineering polyketide carbon scaffolds. ***ACS Catalysis*** 2021, 11, 12179-12185.
- Chenghai Sun, Zhenyao Luo, Wenlu Zhang, Wenya Tian, Haidong Peng, Zhi Lin, Xiaoli Yan, Yanan Zhang, Zixin Deng, Bostjan Kobe*, Xinying Jia*, Xudong Qu*. Molecular basis of regio- and stereo-specificity in biosynthesis of bacterial heterodimeric ketopiperazines. ***Nature Communications*** 2020, 11, 6251.
- Lu Yang, Jinmei Zhu, Chenghai Sun, Zixin Deng, Xudong Qu*. Biosynthesis of plant tetrahydroisoquinolines alkaloids through an imine reductase route. ***Chemical Science*** 2020, 11, 364-371 (2019 Chemical Science HOT Article Collection).
- Junlin Wang, Yanan Zhang, Linjun Zhou, Linpeng Wei, Wenbing Yin, Zixin Deng, Xudong Qu*, Qianghui Zhou*. A biocatalytic hydroxylation-enabled unified approach to C19-hydroxylated steroids. ***Nature Communications*** 2019, 10, 3378.
- Wenya Tian, Chenghai Sun, Mei Zheng, Mingjia Yu, Yanan Zhang, Haidong Peng, Dongqing Zhu, Jeffery Harmer, Zixin Deng, Shilu Chen, Mohedi Mobli, Xinying Jia*, Xudong Qu*. Efficient biosynthesis of heterodimeric C3-aryl pyrroloindoline alkaloids. ***Nature Communications*** 2018, 9, 4428.
- Yuan Li, Wan Zhang, Hui Zhang, Wenya Tian, Lian Wu, Shuwen Wang, Jun Zhang, Chenghai Sun, Yuhui Sun, Zixin Deng, Xudong Qu*, Jiahai Zhou*. Structural basis of a broadly selective acyltransferase from the polyketide synthase of splenocin. ***Angewandte Chemie International Edition*** 2018, 57, 5823-5827.
- Jinmei Zhu, Hongqun Tan, Lu Yang, Zheng Dai, Lu Zhu, Hongmin Ma, Zixin Deng, Zhenghua Tian, Xudong Qu*. Enantioselective synthesis of 1-aryl-substituted tetrahydroisoquinolines employing imine reductase. ***ACS Catalysis*** 2017, 7, 7003-7007.
- Chengcheng Chang, Rong Huang, Yan Yan, Hongmin Ma, Zheng Dai, Benying Zhang, Wen Liu, Zixin Deng, Xudong Qu*. 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.
- Qiongqiong Wu, Zhuhua Wu, Xudong Qu*, Wen Liu*. Insights into pyrroindomycin biosynthesis reveal a uniform paradigm for tetramate/tetronate formation. ***Journal of the American Chemical Society*** 2012, 134, 17342-17345.
- Xudong Qu*, Bo Pang, Zicong Zhang, Ming Chen, Zhuhua Wu, Qunfei Zhao, Qinglin Zhang, Yingyan Wang, Yun Liu, Wen Liu*. 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, 9038-9041.

(2) Reviewer papers and book chapters：

- Mengmeng Zheng, Zhi Lin, Shuangjun Lin*, Xudong Qu*. Chemoenzymatic synthesis of steroidal products: recent advances. ***European Journal of Organic Chemistry*** 2023 DOI: 10.1002/ejoc.202301066.
- Chenghai Sun, Wenya Tian, Zhi Lin*, Xudong Qu*. Biosynthesis of pyrroloindoline-containing natural products. ***Natural Product Reports*** 2022, 39, 1721-1765.
- Zhi Lin, Xudong Qu*. Emerging diversity in polyketide synthase. ***Tetrahedron Letters*** 2022, 110, 154183.
- Lu Yang, Xudong Qu*, Application of imine reductase in the synthesis of chiral amines, ***Synthetic Biology Journal*** 2022, 3, 516-529.
- Zhi Lin, Zhiwei Hu, Xudong Qu, Shuangjun Lin*. Advances and challenges in microbial production of benzylisoquinoline alkaloids. ***Synthetic Biology Journal*** 2021, 2, 716-733.
- Jinmei Zhu, Zixin Deng, Xudong Qu*. Identification of imine reductases for asymmetric synthesis of 1-aryl-tetrahydroisoquinolines. ***Applied Biocatalysis: The Chemist's Enzyme Toolkit***, Wiley-VCH, 2020.
- Zhang Wan, Linjun Zhou, Chunyu Li, Deng Zixin, Xudong Qu*. Rational engineering acyltransferase domain of modular polyketide synthase for expanding substrate specificity. ***Methods in Enzymology*** 2019, 622, 271-292.
- Michael Smanski, Xudong Qu, Wen Liu, Ben Shen*. Chapter 4-Biosynthesis of pharmaceutical natural products and their pathway engineering. ***Organic Chemistry-Breakthroughs and Perspectives***, Wiley-VCH, 2012.

(3) Other research papers：

- Shixue Jin, Huixue Chen, Jun Zhang, Zhi Lin, Xudong Qu, Xinying Jia*, Chun Lei*. Elucidation and engineering of the biosynthetic pathway of mollemycin A for enhancing its production. ***Applied Microbiology and Biotechnology*** 2023 submitted.
- Wengui Wang, Yingyue Song, Shuya Xing, Jinfeng Li, Wei Feng, Xudong Qu*, Shoufeng Wang*. Ag-catalyzed, selectfluor-mediated external acid-free minisci reaction in aqueous solution. ***ChemistrySelect*** 2023, 8, e20230095.
- Zhijun Tang, Bo Pang, Chang Liu, Shengjie Guo, Xudong Qu, Wen Liu*. Formation and loading of a (2S)-2-ethylmalonamyl starter unit in the assembly line of polyketide-nonribosomal peptide hybrid sanglifehrin A. ***Angewandte Chemie International Edition*** 2023, 62, e202217090.
- Wenya Tian, Xinru Chen, Zixin Deng, Xudong Qu*. Biosynthesis of Tetronates by a Nonribosomal Peptide Synthetase-Polyketide Synthase System. ***Organic Letters*** 2023, 25, 1628-1632.
- Fengqiao Zhu, Wengui Wang, Xudong Qu*, Shoufeng Wang*. Research progress in chemical semi-synthetic modification of thiopeptide antibiotics. ***Acta Chimica Sinica*** 2022, 80, 1448-1462. (In Chinese)
- Lan Jiang, Kangjie Lv, Guoliang Zhu, Zhi Lin, Xue Zhang, Cuiping Xing, Huanting Yang, Weiyan Zhang, Zhixin Wang, Chengwei Liu, Xudong Qu, Tom Hsiang, Lixin Zhang, Xueting Liu*. Norditerpenoids biosynthesized by variediene synthase-associated P450 machinery along with modifications by the host cell *Aspergillus oryzae*. ***Synthetic and Systems Biotechnology*** 2022, 7, 1142-1147.
- Kai Jiang, Xiaoli Yan, Zixin Deng, Chun Lei*, Xudong Qu*. Expanding the chemical diversity of fasamycin via genome mining and biocatalysis. ***Journal of Natural Products*** 2022, 85, 943–950.
- Zhuotao Tan, Yaoying Han, Yaping Fu, Xiaowang Zhang, Mengjiao Xu, Qi Na, Wei Zhuang, Xudong Qu, Hanjie Ying, Chenjie Zhu*. Investigating the structure-reactivity relationships between nicotinamide coenzyme biomimetics and pentaerythritol tetranitrate reductase. ***Advanced Synthesis Catalysis*** 2022, 364, 103-113
- Lu Zhu, Yang Song, Chenchen Chang, Hongmin Ma, Lu Yang, Zixin Deng, Wei Deng*, Xudong Qu*. Engineering Leifsonia alcohol dehydrogenase for thermostability and catalytic efficiency by enhancing subunit interactions. ***ChemBioChem*** 2021, 22, 3178-3183.
- Weibo Qiao, Wei Feng, Lu Yang, Changfu Li, Xudong Qu, Yansheng Zhang*. De novo biosynthesis of the anti-cancer compound euphol in Saccharomyces cerevisiae. ***ACS***

Synthetic Biology 2021, 10, 2351-2358.

- Chenghai Sun, Haidong Peng, Wenlu Zhang, Mei Zheng, Wenya Tian, Yanan Zhang, Zixin Deng, Xudong Qu*. Production of heterodimeric diketopiperazines employing a Mycobacterium-based whole-cell biocatalysis system. ***The Journal of Organic Chemistry*** 2021, 86, 11189-11197. (Invited paper)
- Wang Shu, Zhanbing Cheng, Yanbing Xu, Jian-bo Wang, Zhenhua Tian*, Xudong Qu*. Structure-guided protein design of fluoroacetate dehalogenase for kinetic resolution of rac-2-bromobutyric acid. ***Green Synthesis and Catalysis*** 2020, 1, 60-65.
- Huanqing Niu, Xinzeng Sun, Jiarui Song, Chenjie Zhu, Yong Chen, Nan Gao, Xudong Qu, Hanjie Yin, Dong Liu*. Knockout of pde gene in *Arthrobacter* sp. CGMCC 3584 and transcriptomic analysis of its effects on cAMP production. ***Bioprocess and Biosystems Engineering*** 2020, 43, 839-850.
- Hongqun Tan, Xuejun Yang, Qi Dai, Zixin Deng, and Xudong Qu*. Unravelling the biosynthetic flexibility of UK-2A enables enzymatic synthesis of its structural variants. ***ACS Synthetic Biology*** 2019, 8, 2659-2665.
- Kai-Zhi Jia, Li-Wen Zhu, Xudong Qu, Shengying Li, Yuemao Shen, Qingsheng Qi, Youming Zhang, Yue-Zhong Li, Ya-Jie Tang*. Enzymatic O-glycosylation of etoposide aglycone by exploration of the substrate promiscuity for glycosyltransferases. ***ACS Synthetic Biology*** 2019, 8, 12, 2718-2725.
- Jingjun Mo, Shuwen Wang, Wan Zhang, Chunyu Li, Zixin Deng, Lixin Zhang, Xudong Qu*. Efficient editing DNA regions with high sequence identity in Actinomycetal genomes by a CRISPR-Cas9 system. ***Synthetic and Systems Biotechnology*** 2019, 4, 86-91. (Most cited papers in 2019 to 2020)
- Yongjian Qiao, Jiayan Yan, Jia Jia, Jiao Xue, Xudong Qu, Yunfeng Hu, Zixin Deng, Hongkai Bi*, Dongqing Zhu*. Characterization of the biosynthetic gene cluster for the antibiotic armeniaspirols in Streptomyces armeniacus. ***Journal of Natural Products*** 2019, 82, 318-323
- Xiaoli Yan, Benying Zhang, Wenya Tian, Qi Dai, Xiaoqin Zheng, Ke Hu, Xinxin Liu, Zixin Deng, Xudong Qu*. Puromycin A, B and C, cryptic nucleosides identified from Streptomyces alboniger NRRL B-1832 by PPtase-based activation. ***Synthetic and Systems Biotechnology*** 2018, 3, 76-80.
- Xianyi Mei, Xiaoli Yan, Hui Zhang, Mingjia Yu, Guangqing Shen, Linjun Zhou, Zixin Deng, Chun Lei*, Xudong Qu*. Expanding the bioactive chemical space of anthrabenzoxocinones through engineering the highly promiscuous biosynthetic modification steps. ***ACS Chemical Biology*** 2018, 13, 200-206.
- Eerli Tian, Binbin Gu, Ying Han, Xudong Qu, Houwen Lin, Zixin Deng, Kui Hong*. Hainanmycin A, a cyclo-heptadeca macrolide bearing a cyclopentenone moiety from the mangrove-derived Streptomyces sp. 219807. ***Tetrahedron Letters*** 2017, 58, 4348-4351
- Lu Zhu, Shuwen Wang, Wenya Tian, Yanan Zhang, Yang Song, Jun Zhang, Bo Mu, Chao Peng, Zixin Deng, Hongmin Ma*, Xudong Qu*. Stabilization of multimeric proteins via inter-subunits cyclization. ***Applied and Environmental Microbiology*** 2017, 83, e01239-17.
- Benying Zhang, Wenya Tian, Shuwen Wang, Xiaoli Yan, Xinying Jia, Gregory K. Pierens, Wenqing Chen, Hongmin Ma, Zixin Deng, Xudong Qu*. Activation of natural products biosynthetic pathways via a protein modification level regulation. ***ACS Chemical Biology*** 2017, 12, 1732-1736. (Cover picture).
- Zhuotao Tan, Hongmin Ma, Qing Li, Lingling Pu, Yan Cao, Xudong Qu, Chengjie Zhu, Hanjie Ying*. Biosynthesis of optically pure chiral alcohols by a substrate coupled and biphasic system with a short-chain dehydrogenase from Streptomyces griseus. ***Enzyme and Microbial Technology*** 2016, 93, 191-199.
- Haidong Peng, Erman Wei, Jiali Wang, Yanan Zhang, Lin Cheng, Hongmin Ma, Zixin Deng, Xudong Qu*. Deciphering piperidine formation in polyketide-derived indolizidines reveals a thioester reduction, transamination, and unusual imine reduction process. ***ACS Chemical Biology*** 2016, 11, 3278-3283.
- Yaya Wang, Jiali Wang, Shuqi Yu, Fan Wang, Hongmin Ma, Changwu Yue, Minghao Liu, Zixin Deng, Ying Huang*, Xudong Qu*. Identifying the minimal enzymes for unusual carbon-sulfur bonds formation in the thienodolin biosynthesis. ***ChemBioChem*** 2016, 17,

799-803.

- Jianzhao Qi, Dan Wan, Hongmin Ma, Yuanzhen Liu, Rong Gong, Xudong Qu, Yuhui Sun, Zixin Deng, Wenqing Chen*. Deciphering carbamoylpolyoxamic acid biosynthesis reveals unusual acetylation cycle associated with tandem-reduction and sequential-hydroxylation by single enzymes. ***Cell Chemical Biology*** 2016, 23, 935-944.
- Chengcheng Chang, Rong Huang, Yan Yan, Hongmin Ma, Zheng Dai, Benying Zhang, Wen Liu, Zixin Deng, Xudong Qu*. Uncovering the formation and selection of
- Mingjia Yu, Zheng Dai, Xudong Qu*, Xu Gao*. Draft genome sequence of marine bacterium Streptomyces sp. strain CNQ431, a producer of the cytokine inhibitor splenocin. ***Genome Announcements*** 2015, 3, e01383-14.
- Yaya Wang, Zixin Deng, Xudong Qu*. Characterization of a SAM-dependent fluorinase from a latent biosynthetic pathway for fluoroacetate and 4-fluorothreonine formation in Nocardia brasiliensis. ***F1000Research*** 2014, 3: 61.
- Yan Yan, Lihan Zhang, Takuya Ito, Xudong Qu*, Yoshinori Asakawa, Takayoshi Awakawa, Ikuro Abe, Wen Liu*. Biosynthetic pathway for high structural diversity of a common dilactone core in antimycin production. ***Organic Letters*** 2012, 14, 4142-4145.
- Jing Li[#], Xudong Qu[#], Xinyi He, Lian Duan, Guojun Wu, Dexi Bi, Zixin Deng, Wen Liu*, Hongyu Ou*. ThioFinder: A web-based tool for the identification of thiopeptide gene clusters in DNA sequences. ***PLOS ONE*** 2012, 7, e45878.
- Xudong Qu, Chun Lei, Wen Liu. Transcriptome mining of active biosynthetic pathways for natural product discovery. ***Angewandte Chemie International Edition*** 2011, 50, 9651-9654.
- Xudong Qu, Nan Jiang, Fei Xu, Lei Shao, Gongli Tang, Barrier Wilkinson, Wen Liu*. Cloning, sequencing and characterization of the biosynthetic gene cluster of sanglifehrin A, a potent cyclophilin inhibitor. ***Molecular BioSystems*** 2011, 7, 852-861.
- Weerawat Runguphan[#], Xudong Qu[#], Sarah O'Connor*. Integrating carbon halogen bond formation into medicinal plant metabolism. ***Nature*** 2010, 468, 461-464.
- Xinying Jia, Zhenghua Tian, Lei Shao, Xudong Qu, Qunfei Zhao, Jian Tang, Gongli Tang*, Wen Liu*. Genetic characterization of the chlorothricin gene cluster as a model for spirotetronate antibiotic biosynthesis. ***Chemistry & Biology*** 2006, 13, 575-585.
- Lei Shao[#], Xudong Qu[#], Xinying Jia[#], Qunfei Zhao, Zhenghua Tian, Min Wang, Gongli Tang*, Wen Liu*. Cloning and characterization of a bacterial iterative type I polyketide synthase gene encoding the 6-methylsalicyclic acid synthase. ***Biochemical and Biophysical Research Communications*** 2006, 345, 133-139.