Cao Kai Yue

Position:	Research Assistant Professor
Faculty:	State Key Laboratory of Quality Research in Chinese Medicine, Macau University of Science and Technology
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Dr. Cao obtained his Bachelor's degree in Chinese Medicine from Jiangxi University of Traditional Chinese Medicine in 2012. He earned his Master's degree in Chinese Medicinal Science from the Institute of Chinese Medical Sciences (ICMS), University of Macau in 2014, followed by a Ph.D. degree in Chinese Medicine from Macau University of Science and Technology (MUST) in 2020. From 2021 to 2024, he completed postdoctoral training in the field of RNA Chemical Biology at the State Key Laboratory of Quality Research in Chinese Medicine (MUST), and was promoted to be a Research Assistant Professor in January 2025.

Dr. Cao possesses extensive expertise in the research of traditional Chinese medicine (TCM)-derived small RNA, with specialized proficiency in applying multi-omics technologies to chromatographic separation, chemical characterization, and bioactivity evaluation of natural small RNAs from TCM and medicinal plants. His research focuses on the pharmacological activities and mechanisms of TCM-derived small RNA, aging-related biological functions of endogenous small RNA, and oral delivery systems for nucleic acid therapeutics. Notably, he achieved the world's first discovery of pharmacological activities in plant-derived tRNA and its fragments, published as a cover paper in *Molecular Therapy-Nucleic Acids* (https://www.must.edu.mo/skl/news/zhxw/43800-article0324141319). He has published over 10 research papers in *Molecular Therapy-Nucleic Acids*, *International Journal of Biological Macromolecules*, *Non-coding RNA Research*, *mSystems*, and *Analytical Chemistry*, while obtaining approvals of 3 Chinese patents and 4 international patents. His landmark innovations have been successfully transferred to pharmaceutical enterprises. Dr. Cao achieved the First

Prize in Macao Technological Invention Award (2024) and the Silver Medal in the Guangdong-Hong Kong-Macao Greater Bay Area High-Value Patent Cultivation and Layout Competition (2024). Additionally, he serves as Council Member of both the Specialty Committee of Immunology of Traditional Chinese Medicine and Traditional Chinese Medicine Health Products under the World Federation of Chinese Medicine Societies. Also, Dr. Cao serves as a member of Youth Editorial Board of *Phytochemical Analysis*. As an active peer reviewer, he contributes to high-impact journals including *Molecular Therapy* (2023 IF=12.1), *International Journal of Biological Macromolecules* (2023 IF=7.7), and *The FASEB Journal* (2023 IF=4.4).

Research Interests

- Characterization of active small RNAs from TCM and development of their related products.
- Aging-related biological function of endogenous small RNAs and development of anti-aging therapeutics.
- Relationship of gut microbiota tRNA and the host.
- Development of oral delivery systems for nucleic acid therapeutics.

Academic Qualifications

2020.7	Ph. D, Macau University of Science and Technology, Macao SAR, China
2014.8	M.Phil., University of Macau, Macao SAR, China
2012.8	B.Sc., Jiangxi University of Traditional Chinese Medicine, Nanchang, China

Work Experience

2025.1 - Present	Research Assistant Professor, State Key Laboratory of Quality Research in Chinese Medicine, Macau University of Science and Technology
2021.1 - 2024.12	Post-doctoral Research Fellow, State Key Laboratory of Quality Research in Chinese Medicine, Macau University of Science and Technology
2015.6 - 2015.8	Research Assistant, State Key Laboratory of Quality Research in Chinese Medicine, Macau University of Science and Technology
2014.8 - 2015.5	Researcher, Zhuhai Body Revival Health and Technology Co. Ltd.

Book

Kai-Yue Cao (Editorial Board). in J. Zhao and S.P. Li (Editor) Macao Mushroom (澳門蕈菌). Science Press, Beijing, 2019.

Publications

1. **Kai-Yue Cao**, Da Zhang, Long-Bo Bai, Tong-Meng Yan, Yan Chen, Yu-Yang Jiang, Zhi-Hong Jiang*. Targeting NUCKS1 with a fragment of $tRNA^{Asn(GUU)}$ of Chinese yew for the treatment of colorectal cancer. ***Non-coding RNA Research 2025*****,** 11: 38-47 (**IF=5.9**, BIOCHEMISTRY & MOLECULAR BIOLOGY, Ranking: 52/313, Q1).

2. Da Zhang, Lee-Fong Yau, Long-Bo Bai, Tian-Tian Tong, **Kai-Yue Cao**, Tong-Meng Yan, Ling Zeng, Zhi-Hong Jiang*. Hydroxyapatite-based nano-drug delivery system for nicotinamide mononucleotide (NMN): significantly enhancing NMN bioavailability and replenishing *in vivo* nicotinamide adenine dinucleotide (NAD^+) levels. ***Journal of Pharmacy and Pharmacology 2023*****,** 75: 1569-1580 (**IF=3.3**, PHARMACOLOGY & PHARMACY, Ranking: 138/278, Q2).

3. Fei Ren, **Kai-Yue Cao (Co-first author)**, Rui-Ze Gong, Peng Tao, Yi Xiao, Zhi-Hong Jiang*. The role of post-transcriptional modification on a new $tRNA^{Ile(GAU)}$ identified from *Ganoderma lucidum* in its fragments' cytotoxicity on cancer cells. ***International Journal of Biological Macromolecules 2023***, 229: 885-895 (**IF=8.02**, POLYMER SCIENCE, Ranking: 7/95, Q1).

4. Kua Hu, Tong-Meng Yan, **Kai-Yue Cao**, Fang Li, Qiong Lai, Jin-Cheng Liu, Jun-Ping Kou, Zhi-Hong Jiang*. A tRNA-derived fragment of ginseng protects heart against ischemia/reperfusion injury *via* targeting lncRNA MIAT/VEGFA pathway. ***Molecular Therapy-Nucleic Acids 2022***, 29: 672-688 (**IF=10.18**, MEDICINE, RESEARCH & EXPERIMENTAL, Ranking: 16/139, Q1).

5. **Kai-Yue Cao**, Yu Pan, Tong-Meng Yan, Zhi-Hong Jiang*. Antitumor activities of tRNA-derived fragments and tRNA halves from non-pathogenic *Escherichia coli* strains on colorectal cancer and their structure-activity relationship. ***mSystems 2022***, 7: 00162 (**IF=7.33**, MICROBIOLOGY, Ranking: 27/137, Q1).

6. **Kai-Yue Cao**, Tong-Meng Yan, Ji-Zhou Zhang, Ting-Fung Chan, Jie Li, Chong Li, Elaine Lai-Han Leung, Jin Gao, Bao-Xian Zhang, Zhi-Hong Jiang*. A tRNA-derived fragment from Chinese yew suppresses ovarian cancer growth *via* targeting *TRPA1*. ***Molecular Therapy-Nucleic Acids 2022***, 27: 718-732 (**Cover Story, IF=10.18**, MEDICINE, RESEARCH & EXPERIMENTAL, Ranking: 16/139, Q1).

7. Tong-Meng Yan, Yu Pan, Meng-Lan Yu, Kua Hu, **Kai-Yue Cao**, Zhi-Hong Jiang*. Full-

Range Profiling of tRNA Modifications Using LC–MS/MS at Single-Base Resolution through a Site-Specific Cleavage Strategy. ***Analytical Chemistry 2021***, 93: 1423-1432 (**IF=6.98**, CHEMISTRY, ANALYTICAL, Ranking: 8/87, Q1).

8. **Kai-Yue Cao**, Yu Pan, Tong-Meng Yan, Zhi-Hong Jiang*. Purification, characterization and cytotoxic activities of individual tRNAs from *Escherichia coli*. ***International Journal of Biological Macromolecules 2020***, 142: 355-365 (**IF=6.95**, POLYMER SCIENCE, Ranking: 8/94, Q1).

9. **Kai-Yue Cao**, Chun-Feng Qiao, Jing Zhao, Jing Xie, Shao-Ping Li*. Quantitative analysis of acankoreoside A and acankoreagenin in the leaves of *Schefflera octophylla* and *Schefflera actinophylla* using pressurized liquid extraction and high-performance liquid chromatography coupled with evaporative light scattering detection. ***Journal of Separation Science 2015***, 38: 2201-2207 (**IF=2.74**, CHEMISTRY, ANALYTICAL, Ranking: 21/75, Q2).

10. **Kai-Yue Cao**, Chun-Feng Qiao, Xian-Qiang Chen, Chong-Zhi Wang, Chun-Su Yuan, Jing Zhao, Shao-Ping Li*. Chemical constituents from leaves of *Oplopanax horridus*. ***Chinese Herbal Medicines 2014***, 6: 328-331.

11. Kit-Leong Cheong, Ding-Tao Wu, De-Jun Hu, Jing Zhao, **Kai-Yue Cao**, Chun-Feng Qiao, Bang-Xing Han, Shao-Ping Li*. Comparison and characterization of the glycome of *Panax* species by high-performance thin-layer chromatography. ***Journal of planar chromatography-Modern TLC 2014***, 27: 449-453 (**IF=0.611**, CHEMISTRY, ANALYTICAL, Ranking: 65/75, Q4).

Patents

1. Zhi-Hong Jiang, Fei Ren, **Kai-Yue Cao**, Rui-Ze Gong. Double-stranded RNA molecule and medical application thereof (雙鏈 RNA 分子及其醫藥用途). Chinese Patent No. ZL202210514529, granted on 24th September 2024.

2. Zhi-Hong Jiang, **Kai-Yue Cao**, Yu Pan, Tong-Meng Yan. Nucleic acid molecules and uses thereof. U.S. Patent No. 17/247,265, granted on 9th January 2024.

3. Zhi-Hong Jiang, Tong-Meng Yan, **Kai-Yue Cao**. Method and pharmaceutical composition for treating cancer. U.S. Patent No. 16/120,606, granted on 19th October 2021.

4. Zhi-Hong Jiang, Tong-Meng Yan, **Kai-Yue Cao**. Methods and pharmaceutical compositions for the treatment of cancer (用於治療癌症的方法及藥物組合). Chinese Patent No. ZL201811503623, granted on 7th September 2021.

5. Zhi-Hong Jiang, **Kai-Yue Cao**, Yu Pan, Tong-Meng Yan. Double-stranded RNA molecule and application thereof (一種雙鏈 RNA 分子及其用途). Chinese Patent No. ZL202010083971, granted on 15th June 2021.

6. Zhi-Hong Jiang, **Kai-Yue Cao**, Yu Pan, Tong-Meng Yan. Nucleic Acid Molecules and Uses Thereof. IP Australia No. 2020103946, granted on 10th February 2020.

7. Zhi-Hong Jiang, Tong-Meng Yan, **Kai-Yue Cao**. Method and pharmaceutical composition for treating cancer. IP Australia No. 2018101287, granted on 21st November 2018.

Conference Papers

1. **Kai-Yue Cao**, Fei Ren, Long-Bo Bai, Zhi-Hong Jiang*. Ganoderma-derived tRNA fragment exhibits inhibition effects on liver cancer *via* silencing TNS4 (靈芝 tRNA Fragment 通過沉默 TNS4 發揮抗肝癌藥效), ***The 34th CCS Congress***, Guangzhou, China, June 2024.

2. **Kai-Yue Cao**. Investigations on anticancer effects of gut microbiota-derived tRNA and tRF: *Escherichia coli* as a case (腸道菌 tRNA 和 tRF 的抗癌研究：以大腸桿菌為例), Oral Presentation, ***ChinaGut Conference***, Nanjing, May 2021.

3. **Kai-Yue Cao**, Tong-Meng Yan, Kua Hu, Yu Pan, Fei Ren, Zhong-Yao Tang, Meng-Lan Yu, Zhi-Hong Jiang*. A tRF derived from $tRNA^{His(GUG)}$ from *Taxus chinensis* suppresses ovarian cancer progression *via* targeting TRPA1. ***The 11th China Chemical Biology Conference***, Guangzhou, November 2019.

4. **Kai-Yue Cao,** Tong-Meng Yan, Wan-Rong Zong, Kua Hu, Yu Pan, Zhong-Yao Tang, Fei Ren, Jing-Rong Wang, Zhi-Hong Jiang*. Antitumor studies on tRNA derived Fragments (tRFs) from *Taxus chinensis var. mairei*. ***The 31st CCS Congress***, Hangzhou, May 2018.

5. **Kai-Yue Cao**, Kua Hu, Yu Pan, Tong-Meng Yan, Wan-Rong Zong, Lee-Fong Yau, Zhong-Yao Tang, Jing-Rong Wang, Zhi-Hong Jiang*. An efficient platform for purification of specific tRNAs from plants. Poster Presentation, ***The 6th RNAi China***, Kunshan, October 2017.

6. Tong-Meng Yan, Meng-Lan Yu, Yu Pan, **Kai-Yue Cao**, Kua Hu, Fei Ren, Zhong-Yao Tang, Zhi-Hong Jiang*. Full-Range LC-MS Profiling of tRNA Modifications at Single-Base Resolution Through a Site-Specific Cleavage Strategy. Poster Presentation, ***The 7th RNAi China***, Kunshan, October 2019.

Qualifications

• Member, The Specialty Committee of Immunology of Traditional Chinese Medicine of the World Federation of Chinese Medicine Societies

• Member, The Specialty Committee of Traditional Chinese Medicine Health Products of the World Federation of Chinese Medicine Societies

Awards

1. 2024 Macao Technological Invention Award (1st Prize, **3**/4), Establishment of key techniques for developing small RNA drugs derived from tRNA of traditional Chinese medicines, (Project No. 005/2024/AI), 2024.11.
2. The 6th Guangdong-Hong Kong-Macao Greater Bay Area High-Value Patent Cultivation and Layout Competition (Silver Medal, **2**/7), Techniques for development of siRNA therapeutics derived from TCM tRNA, 2024.12.
3. The 6th Innovation & Entrepreneurship Contest of CMS (2nd Prize, **1**/3), Full-Chain Development Platform for Small RNA Drugs Based on TCM tRNA, 2024.12.