Professor Xinghua (Victor) PAN, PhD, MD

Professor, Medical Sciences Division (MSD), Macau University of Science and Technology (MUST); Supervisor for PhD and MS candidates in biomedical sciences and pharmacy.

CURRENT RESEARCH INTERESTSIN IN BRIEF

- ✓ Single-Cell & Spatial Omics: technology innovation & application
- ✓ Multi-Omics Integration: tumor heterogeneity; AI for precision medicine
- ✓ Stem Cell Biology: regenerative medicine; aging and anti-aging
- ✓ Genomic Medicine: disease multiomics; TCM omics
- ✓ Bioinformatics: omics database and analysis; algorithm development

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CURRENT POSITION AND RECENT WORKING EXPERIENCES

2024-present, Professor, Precision Regenerative Medicine Research Centre (PRMRC), Medical Sciences Division (MSD), Macau University of Science and Technology (MUST), Macao, China. He is also affiliated with State Key Laboratory of Mechanism and Quality of Chinese Medicine (SKL-QRCM) at MUST. He takes an active part in research at the MUST Technology Innovation Research Institute in Hengqin.

Dr. Pan serves as a Postdoctoral Supervisor under the Macao Young Scholars Program, and a PhD Supervisor in Biomedical Science Program and in Clinical Medicine (Integrated Traditional Chinese and Western Medicine) Program within the Faculty of Medicine. He is also a PhD Supervisor and Master Supervisor in Pharmacy in the Faculty of Pharmacy, and PhD candidates in Traditional Chinese Medicine (TCM) in the Faculty of TCM, MSD, MUST.

2017-2024, he held the position as the Chairman and a Distinguished Professor in Department Biochemistry and Molecular Biology at Southern Medical University (SMU) in Guangzhou, China. During his tenure, he founded and served as the Director of Guangdong Provincial Key Laboratory of Single Cell Technology and Application (2018-2025), and currently Vice Chairman of its Academic Committee, and an adjunct Professor. In SMU he directed the Guangdong Provincial Key Laboratory of Biochip (2016-2018). Dr. Pan has been held Adjunct Professor at several leading hospitals, including Nanfang Hospital, Zhujiang Hospital, Guangdong Provincial People's Hospital, and Dongguan Maternal and Child Health Hospital. In addition, he has also been an adjunct PI of the Key Laboratory of Infectious Disease Prevention and Control of the Ministry of Education in South China, and adjunct PI of the Key Laboratory of Mental Health Research of the Ministry of Education, both at SMU. He was a Principal Investigator of an Open Fund Grant of Shenzhen Bay Laboratory, and he has been invited as an Adjunct Professor at Hangzhou Cancer Hospital, Sichuan University, Guangdong Pharmaceutical University, and Jiujiang University.

2004-2017, Dr. Pan worked at Yale University School of Medicine in the United States. He joined as an Associate Research Scientist serving at Department of Genetics, and was later promoted to Research Scientist with the qualification of Principal Investigator. During this period, he was also an active member of Yale Center Excellence in Genomics, Yale Cancer Center, and Yale Stem Cell Center. Later on he served as a consultant and continued his research in collaboration until 2019.

2000-2004, Dr. Pan was employed as a Research Scientist and Enzymology Director at the Genomics Section of Molecular Staging Inc. (later acquired by Qiagen) in USA. Concurrently he worked as a Visiting Researcher at Yale University.

As part of his academic commitment, Dr. Pan has trained over 60 postdoctoral researchers, visiting scholars, and PhD, MS and BS candidates. He has also given lectures in biochemistry, molecular biology, medical genetics, and cell biology to nearly 10,000 undergraduate undergraduates and postgraduates including those in medical degree programs.

EDUCATIONS AND TRAINING EXPERIENCES

Academic Degree Educations:

1980-1988, Bachelor of Medicine (MBBS or MD equivalent, 1980-1985) and Master of Science in Medicine (1985-1988) from Southern Medical University, Guangzhou, China.

1989-1993, PhD in genetics, Fudan University School of Life Sciences, Shanghai, China, under the supervision of Professor CC Tan (Jiazhen Tan, member of both Chinese Academy of Sciences and US National Academy of Sciences, with his PhD obtained with Thomas H. Morgan at California Institute of Technology) .

Postdoctoral appointments:

1993-1994, trained in molecular oncology at the State Key Laboratory of Molecular Oncology, Cancer Hospital of Chinese Academy of Medical Sciences and Peking Union Medical College (CAMS & PUMC) in Beijing, China, under Professor Min Wu (member of Chinese Academy of Sciences).

1997-1999, conducted genomics research at Yale University School of Medicine mentored by Professor Sherman M. Weissman, Yale Sterling Professor, and the Director of the Molecular Oncology and Development Program of Boyer Center for Molecular Medicine (member of US National Academy of Sciences).

Short-term specialized training programs through his early career:

1987, Drosophila cytogenetics, Peking University Department of Biology, China.

1994, Molecular oncology, University of Melbourne and Ludwig Cancer Institute, Australia, supported by an International Union Against Cancer (UICC) Scholarship.

1995, Artificial yeast chromosome technologies at Cold Spring Harbor Laboratory (CSHL), New York, under a CSHL Scholarship.

RESEARCH INTERESTS AND ACHIEVEMENTS

The Pan Lab integrates technological innovation and data science to decode the complexity and regulation of biological systems. The lab develops novel single-cell technologies and algorithms to map cellular heterogeneity and reprogramming across tumors (including solid tumors and leukemia), aging, stem cells, and regeneration. By leveraging multi-omics, artificial intelligence and bioinformatics, the team aims to advance precision medicine.

Technological Explorations:

Dr. Pan began his pioneering work in single-cell sequencing as a member of the international ENCODE consortium. He has since developed over a dozen innovative technologies for single-cell analysis across multiple domains, such as the follows:

Single-cell Genomics: Medium throughput scCNV-seq (msCNVS 2025), and Single cell whole genome amplification based on phi29 DNA polymerase with trehalose (WPA 2008), and contributions to the REPLIg system based on MDA concept (2003).

In clinical scenarios with rare cells, msCNVS represents an ideal solution that combines high robustness and high efficiency within the current technological framework.

Single-cell Transcriptomics: Two methods for single cell full-length RNA-seq (PMA and SMA, 2013), and medium throughput microbulk RNA-seq (MUST-seq 2021). PMA is recognized as a representative method of the 3rd scRNA-seq, based on mRNA cyclization and RCA amplification, beyond PCR-based scRNA-seq and reverse transcription-based scRNA-seq technologies.

Single-cell Epigenomics: Two methods for DNA methylome sequencing (scCGI-seq 2016, and msRRBS 2023) and a technique for closed chromatin profiling (2015). scCGI-seq is recognized as a representative method for single cell DNA methylome sequencing independent of nucleotide conversion, while msRRBS is the most efficient and robust approach among RRBS methods.

Single-Cell Multi-Omics: Co-analysis of the transcriptome and genome within the same single cells (2014, the first approach leading single cell multiomics); co-analysis of mRNA and telomere length in single cells (2021).

Single-cell sample-multiplex sequencing: Single-cell dual-multiplexing sequencing (NAMUL-seq 2025), and demultiplexing and annotating samples from label-free scRNA-seq combined gene expression profiles and genetic variation patterns (2026).

Single-cell Telomere Length Measurement: SCT-pqPCR (the average length, 2013) and USC-STELA (the short telomere load, 2019).

Pan Lab particularly continues to advance the methods msCNVS and msRRBS for clinical detection of genomic and epigenomic variations, specifically in embryo screening (PGT, NIPT) and cancer diagnostics and monitoring (liquid biopsy, circulating tumor cells/CTCs, minimal residual disease/MRD). The lab is also making efforts to scale up throughput for broader research applications.

Basic Biomedical Researches:

Pan Lab is dedicated to uncovering the fundamental mechanisms and principles that govern diverse physiological and disease states, with the ultimate goal of advancing clinical translation. The lab employs cutting-edge omics technologies, including single-cell and spatial omics, radiomics, bioinformatics, and machine learning, to pursue its research objectives. By integrating multi-omics data from large-scale clinical samples with advanced cellular and molecular approaches, animal models, the lab harnesses emerging artificial intelligence algorithms to drive discovery and innovation. The lab has constructed a pan-cancer atlas of common meta-programs and developed the deep learning model StateNet for analyzing cell state fingerprints to

characterize cancer specificity. In recent years, Pan lab's research has been focusing on the following areas:

Solid Tumors: The lab investigates key drivers of tumor progression, with a focus on solid tumors particularly liver cancer (and its associated inflammation and fibrosis), thyroid cancer, lung cancer, colorectal cancer and brain cancer. Research areas include the study of intratumoral heterogeneity (ITH), tumor initiation and malignant evolution, invasion and metastasis, drug resistance, cell death mechanisms, and regulation of the cellular microenvironment. Furthermore, by integrating multiple large-scale patient cohorts, the lab aims to identify diagnostic and therapeutic targets and to develop precision medicine models for diagnosis, treatment response, drug repurposing, prognostic risk assessment, and patient stratification.

Leukemia: Similarly, the lab investigates myelodysplastic syndromes (MDS), acute myeloid leukemia (AML), and acute lymphoblastic leukemia (ALL), focusing on the roles of tumor stem/progenitor cells and the bone marrow immune microenvironment (TIME) in regulating leukemia initiation, progression and evolution. By elucidating the basis of drug response, this research aims to construct robust models for therapeutic stratification.

Stem Cells & Regeneration: The lab investigates the roles of various stem and progenitor cells—particularly hematopoietic stem/progenitor cells (HSPCs), mesenchymal stem cells (MSCs), and tissue stem cells—in development, aging, tissue injury, degeneration, and regeneration (ex. blood system, hair follicle, and liver). To advance both mechanistic research and translational development, the lab employs induced pluripotent stem cell (iPSC), organoid, and gene editing technologies.

In addition, the lab explores neurological disorders (ex., T21 syndrome), inflammatory and immune diseases, and the mechanisms and applications of traditional Chinese medicine, integrating multi-omics approaches to drive these investigations.

Through active interdisciplinary collaborations with clinicians and scientists across multiple fields, the lab strives to translate technological innovation into fundamental biomedical insights and tangible clinical impact.

Summary of Publications and Innovations:

Publications: Dr. Pan has authored or co-authored 160 publications (Google Scholar) with a total impact factor exceeding 1,000, accumulating approximately 11,000 citations. His current H-index is 45 and i10-index is 75 (as of April 15, 2026). His work has appeared in leading journals including: PNAS (7 papers), STTT (1), Advanced Science (4), Nature Communications (4), Nucleic Acids Research (3), Journal of Advanced Research (3), Cancer Research (2), Cell Discovery (1),

Oncogene (1), Cell (1), Nature (4) and so on. He has contributed to 3 Nature papers through his participation in the ENCODE and PsychENCODE consortia. In 2019, Dr. Pan served as lead editor for the e-book Introduction to Single-Cell Omics (edited from Frontiers Research Topic "Single Cell Omics"), which has received over 400,000 total views and 66,000 article downloads to date. His research has been featured in interviews with Genetic Engineering & Biotechnology News (GEN, 2015), PNAS Club (2013), and Technology Networks (Genomics Research) (2018).

Patents: Dr. Pan has obtained 15 invention patents issued in the United States and China, along with several PCT applications, complemented by several software copyrights and a pipeline of pending patent applications.

ScholarGPS Percentile Rankings (standard ranking, excluding papers with more than 20 co-authors) indicate that Dr. Pan's work ranks in the top 1.12% (107/9537) globally in the field of single-cell analysis by the end of 2025.

Summary of Grant Supports：

The research conducted by Dr. Pan and his team has been supported by a range of competitive grants spanning different stages of his career:

Early Career in China: National Natural Science Foundation of China (NSFC Youth Fund) and China Postdoctoral Science Foundation (1990s);

Work in the United States: U.S. National Institutes of Health (NIH), National Science Foundation (NSF), and the State of Connecticut (early 2000s);

Recent Work in Mainland China: National Natural Science Foundation of China (NSFC), Ministry of Science and Technology (MOST), National Health Commission / Ministry of Education, Guangdong Natural Science Foundation, and Shenzhen Municipal Science and Technology Program (vis open fund from Shenzhen Bay Laboratory);

Current Work in Macau: Macau Science and Technology Development Fund (FDCT x2 projects as PI) and a faculty research grant from Macau University of Science and Technology (FRG).

SCHOLASTIC SERVICES AND HONORS

Journal Reviewer and Editor:

Dr. Pan holds several key editorial positions in leading academic publications and educational initiatives. He serves as Founding Associate Editor of Precision Clinical Medicine (Oxford University Press) and Monocytomics (MCM), Executive Editor for the special topic "Single Cell and Spatial Omics" of the Chinese Journal of

Biochemistry and Molecular Biology, Associate Editor for the research topic “Single Cell Omics” for Frontiers, and Founding Editor-in-Chief of Single Cell Biology. Additionally, he is an Editorial Board Member of Scientific Reports and the Journal of Biological Methods (JBM), and serves on the editorial board of couples of books, including the core textbook Fundamentals of Medical Molecular and Cell Genetics under the Ministry of Education's 101 Plan.

Dr. Pan serves as an invited peer reviewer for over 30 internationally recognized journals. These include:

Nature Portfolio: Molecular Psychiatry, Nature Communications, Nature Protocols, Scientific Data, Scientific Reports.

Genomics & Bioinformatics: Genome Biology, Genome Medicine, Aging Cell, Protein & Cell, GigaScience, Gene, Genomics Proteomics & Bioinformatics, Journal of Genetics and Genomics, Current Bioinformatics, Computational and Structural Biotechnology;

Cancer Researches: Cancer Communications, Cancer Letters, JNCC (Journal of the National Cancer Center), BBA Reviews on Cancer, Oncology Reports, Cancers.

BMC Series: Molecular Cancer, BMC Genomics, BMC Biotechnology, BMC Medical Genetics.

Frontiers Series: Frontiers in Immunology, Frontiers in Cell and Developmental Biology, Frontiers in Genetics, Frontiers in Bioengineering and Biotechnology.

Other Leading Journals: EMBO Molecular Medicine, Cell Proliferation, Science China Life Sciences, Science Bulletin, Bone Research, Biology of Reproduction, Molecular Ecology Resources, Clinical and Translational Medicine, International Journal of Molecular Sciences, JoVE, Zoological Research, Hereditas (Chinese), Acta Academiae Medicinae Sinicae (Chinese), Chinese Journal of Cell Biology (Chinese).

Grant Reviewer:

Dr. Pan has served or currently serves as a committee member or invited reviewer for numerous research funding bodies, including:

International: Medical Research Council (MRC, UK), Foundation against Cancer Belgium (Stichting tegen Kanker / Fondation contre le Cancer).

National (China): National Natural Science Foundation of China (NSFC), Ministry of Science and Technology (MOST), Chinese Academy of Sciences (CAS).

Provincial & Municipal: Guangdong Natural Science Foundation; foundations of Zhejiang, Fujian, and Guangxi provinces; and municipal research foundations in

Shenzhen, Guangzhou, Foshan, Dongguan, Nanjing, Zhongqing, Chengdu, Xi'an, and Jiujiang.

Academic degree and professional title reviewer:

Dr. Pan has been appointed as an invited expert for doctoral dissertation review by the Degree and Graduate Education Development Center of the Ministry of Education

(blind trial before defense and spot check after defense). He has also served as a committee member and invited reviewer for doctoral degree defenses and professorship evaluations at numerous universities, including Shanghai Jiao Tong University, Tsinghua University, Sun Yat-sen University, South China University of Advanced Technology, Guangdong Medical University, and Guangzhou Medical University, and so on.

Conference organization and speeches:

Dr. Pan has led or co-organized numerous academic conferences at both national and international levels. Among these, he initiated and has co-chaired the 1st to 4th International Conference on Single-cell and Spatial Omics (TICSSO) and its associated summits, held from 2022 to 2026 (TICSSO-1 in Hangzhou/Guangzhou, TICSSO-2 in Shenzhen, TICSSO-3 in Shanghai/Guangzhou, and TICSSO-4 in Beijing in 2026). He served as the chair of the virtual Forum of Single Cell Elite (FOSCE) for sessions #1 to 10, held from 2021 to 2023 during the pandemic. He also served as the chair leading the organization of the 2018 Global Innovation Summit and the 26th Annual Conference of the Chinese Association for Science and Technology in the United States (held at Yale University campus, in New Haven, Connecticut, USA), and co-organized several other conferences in the same series. As head of the Department of Biochemistry and Molecular Biology, he organized the inaugural Basic Medicine Forum (2017) at Southern Medical University. He also co-organized the West China International Conference on Precision Medicine (2016–2024) and the MUST International Precision Regenerative Medicine Symposium (2024, 2025). In addition, he has delivered invited speeches at over 200 prestigious academic meetings over the past 15 years.

Scholastic organization leaderships, services and honors:

Dr. Pan currently is a Vice Chairman of Guangdong Biochemical and Molecular Biology Society of Chinese Society of Biochemistry and Molecular Biology (CSBMB), a member of CSBMB Basic Medical Professional Committee, a member of the Biomedical Professional Committee of the All-China Federation of Overseas Chinese, an Executive Committee member of the Guangdong Medical Genetics Society, an Executive Committee member of the Genetics and Reproduction Committee of the Cross Strait Medical and Health Exchange Association. He is also a

member of the Academic Committee of the Key Laboratory of Precision Medicine in Sichuan Province, and the Chief Advisory of the Academic Committee (former Committee Chairman) of the Jiangxi Provincial Key Laboratory of Systemic Biomedical Sciences.

He was elected as the President, then the Chairman of Board of Governor, and the Chairman of Board consecutively of the 26th, 27th and 28th committees consecutively from 2018 to 2020, and again the Chairman of Board of the 32nd committee in 2024 of Chinese Association of Science and Technology in USA. He was invited as a member of the International Advisory Committee for Advances in NGS in India.

He was invited as an Expert of Hangzhou Cancer Hospital, an Researcher (Professor) of Jinan University (Guangzhou), a Guest Professor of Sichuan University, Guangdong Pharmaceutical University, and Jiujiang College. He was granted as Nanjing Leading Talent, Guangzhou High Level Talent, and Ganpo Talent-Distinguished Professor of Jiangxi Province. He was also granted UICC (International Union Against Cancer) Scholarship, CSHL (Cold Spring Harbor Laboratory) Scholarship, and PolyGenomics Fellowship.

He was elected a Fellow of the Royal Society of Medicine (UK), and he received the CastUSA Single Cell Genomics Pioneer Award.

REFERENCES:

Being interviewed by scientific magazines:

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https://www.technologynetworks.com/genomics/articles/studying-the-genome-one-cell-at-a-time-308054

http://blog.pnas.org/2013/05/new-ruler-for-telomere-length/

An the leading Editor of a research topic and its corresponding eBook:

https://www.frontiersin.org/research-topics/4004/single-cell-genomics-technology-andapplication

A member of Editorial Boards:

https://academic.oup.com/pcm/pages/Editorial_Board

http://cjbmb.bjmu.edu.cn/EN/column/item10.shtml

https://polscientific.com/journal/JBM/about/editorial_board

https://www.accscience.com/journal/MCM/about/editorial_board

The international conferences 2023 TICSSO-1, 2024 TICSSO-2, 2025 TICSSO-3 and 2026 TICSSO-4:

https://www.163.com/dy/article/KOD4MATA0556721A.html

https://www.prnewswire.com/news-releases/the-first-international-conference-on-single-cell-and-spatial-omics-is-held-in-guangzhou-china-the-golden-age-of-single-cell-analysis-301819021.html;

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https://www.prnewswire.com/news-releases/the-second-international-conference-on-single-cell-and-spatial-omics-ticsso-2--showcasing-the-state-of-the-art-bioscience-achievements-302111962.html

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