中藥質量研究
國家重點實驗室
(澳門科技大學)

State Key Laboratory of
Quality Research in Chinese Medicines
(Macau University of Science and Technology)
The State Key Laboratory of Quality Research in Chinese Medicine (Macau University of Science and Technology) was approved by the Ministry of Science and Technology and formally established on January 25, 2011. So far, it has been the only state key laboratory in the field of Chinese medicine. In January 2014, it passed the inspection of the constructional phase (3 years). In July 2017, it passed the first inspection of the developmental phase (3 years) and received a unanimous praise from the expert delegations.

The establishment of the State Key Laboratory of Quality Research in Chinese Medicine is an important initiative for the central government to promote the international development of Chinese medicine, and to advance the moderate diversification of economic development and technological upgrading in Macao. The laboratory aims:

I. to become a research base with advanced international standards in Chinese medicine quality control and innovative drugs,

II. to obtain first-hand innovation research achievements and independent intellectual property ownerships,

III. to bring together and cultivate talents in Chinese medicine and to develop international high-level academic exchanges and cooperation,

IV. to focus on integrating cutting-edge multidisciplinary technologies,

V. to establish open style scientific and technological platforms catered for the study on quality of Chinese medicine and innovative drugs quality research

VI. to carry out in-depth explorative, innovative and major key technological research.

Laboatory has more than 51 members, including those who received their postgraduate education in universities in the United States, the United Kingdom, Canada, and South Africa, and those who received their postgraduate education in China, Germany, France, and Italy. All of them have been engaged in Chinese medicine research for many years.

The State Key Laboratory of Quality Research in Chinese Medicine (Macau University of Science and Technology) is a joint research lab of Macau University of Science and Technology and Macao Science and Technology Park. The laboratory team has a strong research capability and has made significant contributions to the development of Chinese medicine.

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The laboratory team has developed a number of innovative research projects, such as the study on the quality of Chinese medicine and innovative drugs quality research. The laboratory has published a number of influential research papers in Chinese medicine journals, and has been recognized as a national key laboratory by the Ministry of Science and Technology.

The laboratory has established a number of strategic partnerships with international research institutions and universities, such as the University of California, Los Angeles, and the University of Oxford. The laboratory has also established a number of cooperative research projects with private companies, such as the China National Tobacco Corporation and the China National Medicine Corporation.

The laboratory has received a number of national and international awards, such as the National Science and Technology Progress Award, the Macao Science and Technology Achievement Award, and the Macao Science and Technology Innovation Award. The laboratory has also received a number of national and international project grants, such as the National Natural Science Foundation of China, the Chinese Academy of Sciences, and the Science and Technology Development Fund of Macao.

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There are more than 300 researchers and postgraduates in the laboratory, of whom 51 hold the positions as Assistant Professors or above, including Nobel laureates, academicians of the American Academy of Sciences, academicians of the Chinese Academy of Sciences and Chinese Academy of Engineering, Chair Professors, Professors, Distinguished Professors, Associate Professors and Assistant Professors and so on. Researchers who hold the positions as assistant professors or above are from well-known teaching and research institutions word wide and they are fluent English and Chinese bilinguals who possess prolific research experiences and international perspectives, forming a multi-disciplined, well-structured, and strong research team that integrates talents from a variety of related fields such as chemistry, biology and pharmacology.

The State Key Laboratory pays special attention to the integration of the most cutting-edge technologies in multidisciplinary areas, focusing on 2 research directions; the innovative technologies and methods for quality controls and optimization of herbal medicines and Chinese medicine compounds, as well as the key techniques and quality standards for the development of high quality new Chinese medicinal drugs. The four areas of research fields focused on are;

1. Technological innovations and basic research based on the complex characteristics of traditional Chinese medicine,
2. Preclinical and clinical study of high-value Chinese medicinal herbs,
3. Standardization and application of anti-cancer and anti-immune Chinese medicines,

Specific research directions include:

Discovery of new pharmacological effects in TCM, anti-influenza studies in Chinese herbal compounds’ superiority, multi-target treatment mechanism on diabetes and anti-inflammatory diseases, and to develop innovative research methods based on complex characteristics of TCM through the new perspectives of efflux transporter, mitochondrial division and interaction with intestinal microflora.

Combination quality assessment methods based on pharmacodynamics-pharmacokinetics-mass spectrometry, pharmacological effects of ginsenosides on intestinal microflora and prevention of ischemic heart disease, anti-cancer effects and mechanisms of novel ginsenosides, quality control evaluation of ginseng and other valuable herbal medicines with omics technology.

The discovery of new diagnostic markers and applied research in autoimmune diseases by new techniques such as glycolipidomics, screening of small molecules with anti-cancer and anti-inflammatory activities by molecular computational docking, new mechanism of anti-cancer and anti-inflammatory therapy, new animal models in anti-inflammatory immunity and research methods based on omics technology.

Identifying active components in Chinese medicine against brain degeneration, synthesizing anti-neuro-degenerative active small molecular compounds, investigation of the effect of pathogenic mutation of prion on its folding and aggregation mechanism, the binding site of TCM small molecules in islet amyloid protein; and biophysical research in Chinese medicine.
The laboratory has made some important scientific discoveries in the above-mentioned key areas, including:

- discovering a series of traditional Chinese medicine ingredients with novel structure and significant treatment efficacy;
- discovering the new activity and mechanism of various Chinese herbal ingredients;
- establishing a research platform based on innovative omics technology (proteomics, lipidomics, glycomics) to systematically reveal the target network of traditional Chinese medicines;
- discovering new anti-tumor drug resistance mechanism, new anti-inflammatory target and new oncogene;
- established a quality evaluation method based on multivariate analysis techniques, a more comprehensive and effective assessment of authenticity and quality of herbal medicines. Related research results have been published in mainstream academic journals such as Science, Nature, Nature Methods, Annals of Rheumatic Diseases, Analytical Chemistry, Organic Letters, Cell Death and Disease etc.

The laboratory has received multiple academic awards which include:

- 2012 National Science and Technology Progress Award (Second Prize),
- Macau SAR Science and Technology Award
  (2014 Special Award & Natural Science Award (Second Prize))
  (2016 Natural Science Award (First Prize) & Technical Invention Award (Second Prize) & Science and Technology Progress Award (Third Prize))
  (2018 Natural Science Award (Second Prize))
  (2012, 2014, 2016, 2018 Graduate Technology R&D Award),
- National Ministry of Education Academic Research Outstanding Achievement Award for Colleges and Universities - 2014 Natural Science Award (First Prize),
- 2017 National Innovation Award Winner,
- The 12th annual China Pharmaceutical Association Science and Technology Award - Science and Technology Award (Second Prize)
- 2017 Guangdong Provincial Science and Technology Award (First Prize),
- 2017 Sichuan Provincial Science and Technology Progress Award (First Prize).

In addition, one researcher was selected as the Chang-Jiang Scholar Chair Professor by the State Ministry of Education of PRC in 2014. Another researcher was granted the National Natural Science Foundation of China - Overseas and Hong Kong•Macao Scholar Collaborative Research Fund.
In recent years, the State Key Laboratory has been actively conducting exchanges and cooperation events, and has established joint laboratories or research centers with 17 well-known teaching and research institutions, regularly co-organizing academic conferences and seminars with the Macao Science and Technology Development Fund and “Cross-Straits Scientific Collaboration Center for Chinese Medicine”. The laboratory is also committed to promoting the international standardization of Chinese medicine and expanding the development of high-technological services with the founding of "Macau Centre for International Standard of Chinese Medicines". It has promoted the establishment of international standards for Chinese medicine, and has been responsible for the operation of the Chinese Herbal Medicine Working Group (WG1) of the Chinese Medicine Technical Committee (TC249) within the International Standard Organization (ISO);

The laboratory has obtained Australian NATA/ISO17025 certification, which can provide testing services in Chinese medicine and food products that conform to international ISO standards for scientific research institutions and enterprises across the cross strait.

In response to the laboratory’s development goals and major research areas, the laboratory currently consists of 8 research laboratories and research centers:

- Laboratory for Quality Assessment and Control of Chinese Medicines,
- Laboratory for Bioorganic and Chinese Materia Medica Chemistry,
- Laboratory for Bioassay and Molecular Pharmacology of Chinese Medicines,
- Laboratory for New Formulation Technology of Chinese Medicinal Preparations,
- Center for Omics Technology and Innovative Drug Research,
- Macau Center for MS and NMR Analysis,
- Center for Safety and Quality Assurance of Chinese Medicines and Foods,
- Center for Quality and Safety Information of Chinese Medicines.

“Dr. Neher’s Biophysics Laboratory for Chinese Medicine” a Nobel laureate workstation has also been established.
The laboratory is equipped with a series of advanced, sophisticated, high-end laboratory instruments and processing systems, including a set of all types of liquid/mass spectrometry and gas/mass spectrometers, and a series of the most advanced chemical analysis and systems biology techniques, and research equipment required for the evaluation of the overall animal cell-molecule drug biological activity, such as LC-SPE-NMR (600 MHz) (Bruker), PacBio Third generation sequencer, Computer-aided drug design for large-scale computer clusters, Time-of-Flight Secondary Ion Mass Spectrometer × 2D nano-LC-MALDI TOF-TOF System (Bruker), Agilent 1290 UHPLC with 6490 Triple Quadrupole Mass System, Agilent 1290 UHPLC with 6550 TOF MS System, Agilent 1290 UHPLC with 6230 TOF MS System, Agilent 2D-LC Chip with 6490 Triple Quadrupole System, DeltaVision Live-Cell Imaging System, BD FACScan flow Cytometer, GE Healthcare DlGE System, etc., the total value of equipment exceeds 250 million Patacas.

**Chemical Analysis Technologies**

- Isolation and structure elucidation of natural compounds technology.
- Traditional Chinese medicine gene barcode identification technology.
- Subcellular and molecular microscopic visualization technology.
- Bioorganic chemistry technology.
- Glucose/Glycopeptidomics analysis technology.
- Lipidomics analysis technology.
- Proteomics analysis technology.
- Stem cell analysis technology.
- Chinese medicine nano preparations technology.
- Microfluidic chip casting and research.
- Single cell research.
- Nanomaterial-based targeted delivery technology for anti-tumor drugs.
- Drug screening & design and pharmaceutical data analysis.

**Chinese Medicine Ingredients Intracellular Pharmacokinetics Research Technologies**