

## **Doctoral Degree Programme**

### AREA OF STUDY

- Biomedical Sciences

INSTITUTE OF CHINESE MEDICAL SCIENCES

**Doctoral Degree Programme****Doctor of Philosophy**• **Biomedical Sciences**

<b>Disciplinary Courses</b>	<b>Credits</b>
Compulsory Courses:	
CMED8012 Research Ethics	--
CMED8013 Research Writing	1
CEMD8006 Seminars	--
CMED8005 Quality Research in Chinese Medicine	3
<b>Total Credits:</b>	<b>4</b>
Required Elective (Choose <b>one</b> of the following):	
CMED8001 Advanced Pharmacokinetics	3
CMED8002 Advanced Pharmaceuticals	
CMED8003 Functional Food Product Development in Chinese Medicine	
CMED8004 Healthcare Decision Analysis	
CMED8007 Chemistry of Natural Medicine	
CMED8008 Advanced Pharmaceutical Analysis	
CMED8009 Drug Discovery	
CMED8010 Advanced Pharmacology	
CMED8011 Advanced Topics in Medicinal Administration	
<b>Total Credits:</b>	<b>3</b>
For students admitted without a relevant Master's degree required to choose 2 Required Electives from the 9 courses listed above.	
<b>Doctoral Thesis</b>	<b>Credits</b>
CMED8999 Doctoral Thesis	18

## Master's Degree Programmes

### Master of Philosophy

- Chinese Medicinal Science

<b>Year I</b>	<b>Credits</b>
Compulsory Courses:	
CMED7001 Pharmacology and Safety Evaluation	3
CMED7002 Introduction to Research in Chinese Medicinal Science	3
CMED7008 Quality Control of Chinese Medicine	3
CMED7009 Development of Drugs and Health Products	3
Required Electives (Choose <b>four</b> of the following):	12
CMED7003 Medical Technology Management	
CMED7007 Biomedical Informatics	
CMED7010 Pharmaceutical Science	
CMED7011 Systems Biology	
CMED7012 Targets and Models for Drug Screen	
CMED7013 Emerging Materials in Clinical Medicine	
CMED7014 Advanced Natural Products Chemistry	
CMED7015 Progress in Contemporary Study of Chinese Medicine	
CMED7016 Application of Pharmacokinetics and Metabonomics in Drug Development	
CMED7017 Across the Gap between Science and Industry	
CMED7020 Computational Pharmacy	
<b>Total Credits:</b>	<b>24</b>

<b>Year II</b>	<b>Credits</b>
Thesis	12
<b>Total Credits:</b>	<b>36</b>

INSTITUTE OF CHINESE MEDICAL SCIENCES

**Master's Degree Programmes****Master of Philosophy**• **Medicinal Administration**

<b>Year I</b>	<b>Credits</b>
Compulsory Courses:	
CMED7003 Medical Technology Management	3
CMED7004 Social Medicine	3
CMED7005 International Business and Law for Medicine	3
CMED7006 Introduction to Research in Medical Administration	3
Required Electives (Choose <b>four</b> of the following):	12
CMED7007 Biomedical Informatics	
CMED7009 Development of Drugs and Health Products	
CMED7010 Pharmaceutical Science	
CMED7011 Systems Biology	
CMED7012 Targets and Models for Drug Screen	
CMED7018 Bio-Statistics	
CMED7019 Standardization and Quality Management of Chinese Medicine	
CMED7020 Computational Pharmacy	
CMED7021 Research Methodology	
<b>Total Credits:</b>	<b>24</b>

<b>Year II</b>	<b>Credits</b>
Thesis	12
<b>Total Credits:</b>	<b>36</b>

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## Course Description

### CMED7001 PHARMACOLOGY AND SAFETY EVALUATION

- Principles of Pharmacology.
- Mechanisms of some classes of drugs.
- Pharmacokinetics.
- In vitro and in vivo models for pharmacology research
- Experimental models for evaluating drugs used in the areas of cancer, cardiovascular diseases, immunology and endocrinology.
- Principle of safety evaluation.
- Experimental models for drug safety evaluation.
- Acute toxicity in drug safety evaluation, suchronic and chronic toxicity studies, genotoxicity, developmental and reproductive toxicity testing, carcinogenicity studies.
- Pharmacological studies and safety evaluation of Chinese medicine.

Pre-requisite: None

### CMED7002 INTRODUCTION TO RESEARCH IN CHINESE MEDICINAL SCIENCE

- Harmless Chinese medicine and medicinal plants.
- Novel technology on the extraction, separation and purification of Chinese medicine.
- Novel dosage forms of Chinese medicine.
- Regulation and accreditation of the quality standard of Chinese medicine.
- Toxicity and adverse effects of Chinese medicine.
- Research, development and trends of the usage of Chinese medicine in clinical prevention, treatment and rehabilitation.

Pre-requisite: None

### CMED7003 MEDICAL TECHNOLOGY MANAGEMENT

- An introduction to:
  - Management.
  - Human resources management.
  - Financial control.
  - Costing study.
  - Audit system.
  - Organization development.
  - Centralization & Decentralization.
  - Marketing of pharmaceutical products.
  - Sales strategy of medical products.
- Quality control and surveillance of drugs and health products.
- International requirements on quality, safety and clinical trials of registered drugs.
- Good Guideline Practice (GGP)
- Good Agricultural Practice (GAP) of pollution-free Chinese medicine.
- Good Laboratory Practice (GLP) of non-clinical research.
- Good Clinical Practice (GCP).
- Good Manufacturing Practice (GMP).
- Good Supply Practice (GSP).
- Regulations of herbs and Chinese medicine in China, EU, US and East Asia.

Pre-requisite: None

### CMED7004 SOCIAL MEDICINE

- Theory and methods of social medicine research.
- Interactions between social economy, politics, culture and education.
- Principles and applications of economics on health delivery system.
- Social survey and its assessment.

- Medicine ethics.
- Human interactions and communication in medical practice.
- Analysis of psychological, behavioural and social factors of drug usage and abuse.
- Supply and demand of health services.
- Social responsibility of pharmacist.
- Marketing and regulation of drugs.
- Social welfare systems of China (Macao, Hong Kong, Taiwan) and other major western countries.
- Macro policy analysis and methodology.

Pre-requisite: None

### **CMED7005 INTERNATIONAL BUSINESS AND LAW FOR MEDICINE**

- An introduction to international business and trade.
- Introduction of health economics and pharmaceutical economics.
- Health Act & Regulation.
- Types of main international legal systems for medicine
- Regulations and international treaties for the control of medicine.
- Establishment and operation of multi-national, joint-venture pharmaceutical enterprises/companies.
- Legal settlement for business disputes.
- Medical patenting, trademarks and intellectual property.
- Legal rights and obligations of medical wholesalers.
- Censorships and responsibility of advertisements of medical products.
- Registration of Chinese medicine in European and US markets and its related laws.

Pre-requisite: None

### **CMED7006 INTRODUCTION TO RESEARCH IN MEDICAL ADMINISTRATION**

- Medical care and social security systems in Europe, US and China.
- Developmental strategies for medical health economy and medical technology industry.
- Development strategies for medical technology.
- Development and trends of research in surveillance and management of medicine, functional food, cosmetics and other health products in China and worldwide.

Pre-requisite: None

### **CMED7007 BIOMEDICAL INFORMATICS**

Informatics broadly covers the studies of natural and artificial domains for communication, interaction, data, and information, and relating them to the processes of defining, developing, managing, criticising, and refining knowledge. Biomedical informatics focuses on the theories, methodologies, and technologies of informatics that are related to processing biological and medical knowledge. This course mainly introduces important concepts (not trivial details), including those in basic informatics, medical informatics, bioinformatics, and Chinese medicine informatics. Later parts of this course will cover the recent advances in some integrative approaches such as systems biology, translational medicine, and evidence-based/led Chinese medicine.

Syllabus:

- Knowledge representations and computational reasoning
- Knowledge management
- Web, semantic Web, and multi-agents
- Practical software development
- Medical knowledge-based technologies
- Medical evidence reasoning
- Medical knowledge discovery
- Algorithms for biological sequences and structures

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- Prediction of protein structure and protein interactions
  - Analysing data from high-throughput experimentation
  - Systems biology and pathway modelling
  - Translational research in biomedicine
  - Medical research protocols
  - Evidence-based/led Chinese medicine

Pre-requisite: None

#### **CMED7008 QUALITY CONTROL OF CHINESE MEDICINE**

- Strategies of quality control for Chinese medicine.
- Optimization of marker for quality control of Chinese medicine.
- Samples preparation for quality control.
- New development for extraction, separation, and purification of major groups of active components.
- Application of modern biology on quality control of Chinese medicine.
- Chemical identification of major groups.
- Significant factors affecting the quality of Chinese medicine.
- Origin and species identification.
- Analysis of residual pesticides, heavy metals and arsenic salts.
- Contemporary analytical techniques in the quality control of Chinese medicine.
- Spectrophotometry, chromatography, mass spectrophotometry and their combined applications.

Pre-requisite: None

#### **CMED7009 DEVELOPMENT OF DRUGS AND HEALTH PRODUCTS**

- Introduction of international herbs, Chinese medicine and its health products.
- Precursor compounds.
- Principle and methods of drug design.
- Drug forms and process control.
- Screening of bioactive ingredients.
- Investigation of cellular and molecular mechanisms.
- Pharmacokinetics.
- Toxicology and drug dependence.
- Integrated clinical evaluation.
- Development of Chinese medicine, health products and cosmetics.
- Functions and safety assessment of health products and cosmetics.
- Development of simulation design on new drugs and health products.

Pre-requisite: None

#### **CMED7010 PHARMACEUTICAL SCIENCE**

- Optimal design of drug preparation.
- Novel medical subsidiary materials.
- Stability of drug preparation.
- Different types of preparations: slow-release and controlled-release preparations, targeted preparations, important and new types of Chinese medicine preparations, biotechnological preparations, etc.
- Manufacturing techniques and instruments used in drug preparation.
- Techniques and their applications in Chinese medicine preparations: inclusion technique, solid dispersion, micro-cyst, liposome, etc.

Pre-requisite: None

#### **CMED7011 SYSTEMS BIOLOGY**

- Principles of system biology.
- Gene expression, regulation and molecular cloning.

- Genomics (that is, organismal DNA sequence) and its application.
- Epigenetics (that is, DNA methylation, histone acetylation and deacetylation, etc.) and its application.
- Proteomics (that is, whole proteins and peptides from organismal, tissue, or cell level) and its application.
- Metabolomics (that is, organismal, tissue, or cell level measurements of all small-molecules) and its application.
- Application of system biology for studying Chinese medicine.

Pre-requisite: None

#### **CMED7012 TARGETS AND MODELS FOR DRUG SCREEN**

- Principles of targets, models and drug screen.
- Drug screen for the samples from different sources.
- High-throughput drug screen.
- High-content drug screen.
- Targets and models for anti-cancer compounds screen.
- Targets and models for anti-microorganism compounds screen.
- Targets and models for neuro-protective compounds screen.
- Targets and models for immune-regulation compounds screen.
- Targets and models for screening compounds for treatment of cardiovascular diseases.
- Screen biological active compounds from Chinese medicine.

Pre-requisite: None

#### **CMED7013 EMERGING MATERIALS IN CLINICAL MEDICINE**

This course aims to provide students a broad understanding of cutting-edge development in biomedical materials, devices and implants, and their emerging applications in clinical medicine. This course will introduce successful stories from bench to bedside (and beyond), discuss exciting breakthroughs in nanomedicine, tissue engineering, cancer therapy and regenerative medicine, as well as outline important regulatory and marketing challenges for these inventions.

Pre-requisite: None

#### **CMED7014 ADVANCED NATURAL PRODUCTS CHEMISTRY**

This course introduces and reviews the basic concepts of natural products chemistry, focusing on modern extraction and purification methods, and advanced spectroscopic methods. Biogenesis pathways of common natural products, as well as the biological activities and pharmaceutical importance of natural products will also be discussed. The course includes lectures and group discussion.

Pre-requisite: None

#### **CMED7015 PROGRESS IN CONTEMPORARY STUDY OF CHINESE MEDICINE**

The objective of this course is to provide an overview of progress in contemporary study of Chinese medicine. The course will consist of a series of lectures based on the specific disciplines of Chinese medicine research, focusing on immunopharmacology, tumor pharmacology, cardiovascular pharmacology, toxicology, chemistry and medicinal pharmacy, etc. The academic staff in ICMS or guest speakers will be recruited to provide lectures in their areas of expertise, and each is responsible for respective course objectives. This course will also have a journal club component, which will enable students to read and present a scientific journal article related to the course.

Pre-requisite: None

#### **CMED7016 APPLICATION OF PHARMACOKINETICS AND METABONOMICS IN DRUG DEVELOPMENT**

This course aims to equip students with practical working knowledge of pharmacokinetics and metabolomics and its application to lead identification and target validation in drug discovery and development. Properties that affect pharmacokinetics, pharmacodynamics, and toxicity are



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discussed (i.e., physicochemical, interactions with human body). Cutting-edge models and technique platforms as well as comprehensive strategies are introduced. Cases examples from the literature illustrate successful lead selection and optimization using pharmacokinetics and metabonomics approaches in drug development.

Pre-requisite: None

### **CMED7017 ACROSS THE GAP BETWEEN SCIENCE AND INDUSTRY**

There is a big gap between science and industry. This course tries to help student get across this gap by introducing necessary knowledge and skills in the industry. The course covers a wide range of information including: over all view of business of Chinese medical science, a glance of big Pharms, the organization of global company, product development strategies, project management, business communication skills, leadership and team work, knowledge transfer issues, introduction of generic drugs and the GXP in drug development. The course will be useful for those who want to move to industry after graduation also for those who want to develop health related products in the university.

Pre-requisite: None

### **CMED7018 BIO-STATISTICS**

This course is designed for master students to understand the basic bio-statics theory and skills. Also the course will teach students how to use the most advanced bio-statics softwares.

Pre-requisite: None

### **CMED7019 STANDARDIZATION AND QUALITY MANAGEMENT OF CHINESE MEDICINE**

In 'Standardization and Quality Management of Chinese Medicine' course, some basic concepts and theories of standardization will be introduced. The topics include standard substance, uniformity stability, precision, ISO, Total Quality Management (TQM), Six Sigma (  $6\sigma$  ), Lean Manufacturing and Lab certification. Moreover, some cases will also be introduced to show how to design the quality of traditional Chinese medicine or new drugs.

Pre-requisite: None

### **CMED7020 COMPUTATIONAL PHARMACY**

The course introduces computer application to pharmacy, including expert and knowledge-based systems, artificial intelligence, online pharmacy and medical databases, molecular modeling and computer-aided drug design, computational pharmaceuticals and bioinformatics. In computer laboratory, students will acquire initial skills of molecular modeling. They will also practice in searching online databases. The course will build a bridge between computer science and pharmacy for students.

Pre-requisite: None

### **CMED7021 RESEARCH METHODOLOGY**

This course aims to help students to master the main research methods for their thesis projects, including qualitative methodology, case study, web content analysis, qualitative data analysis, network visualization and analysis, correlation analysis, multiple regression, etc. Moreover, students will learn how to write and publish academic papers in major journals.

Pre-requisite: None

### **CMED8001 ADVANCED PHARMACOKINETICS**

The principal objective of the course is to provide the students an in-depth insight into the basic processes that governs the disposition of drugs and other xenobiotics by the human body and the correlation with efficacy and toxicity. The course focuses on the application of the principles of pharmacokinetics solving problems in new drug discovery and development and the development of the herbal medicine products. Real-world cases will be reviewed and formal readings and discussions will occur throughout the course to foster critical thinking and independent learning.

Pre-requisite: Participants need to have knowledge in biological sciences, pharmaceutical sciences, mathematics

**CMED8002 ADVANCED PHARMACEUTICS**

This course introduces the recent progress in the interdisciplinary field of pharmaceutical sciences, with particular emphases on drug delivery systems, nanoscale formulations as well as gene/cell therapy. It enables students to understand how these new theories and technologies can improve drug safety, enhance therapeutic efficacy and translate into new therapeutic modalities.

Pre-requisite: None

**CMED8003 FUNCTIONAL FOOD PRODUCT DEVELOPMENT IN CHINESE MEDICINE**

This course will introduce students to the essential concept and development procedure of functional food in Chinese Medicine (CM). It includes basic knowledge of medicine - food dual purpose CM, functional ingredients in CM, pharmacological activity evaluation and safety evaluation. These lectures will also cover in moderate detail the new technologies and methodologies for the development of functional food from CM. Moreover, this course will introduce selected topics of functional food from other natural products, including functional fatty acids, mushroom, soy extracts, grape, etc. In addition, functional food regulations in China, USA and Europe will be briefly introduced.

Pre-requisite: None

**CMED8004 HEALTHCARE DECISION ANALYSIS**

This course aims to equip research students with the knowledge and skills to conduct evaluation research into the healthcare issues that require evidence-based reasoning and data analytics. Major healthcare cases related to complex diseases will be studied through interactive study and project-based research.

Pre-requisite: Before taking this course, the students should prepare themselves with a working knowledge of basic multivariate statistics and pathophysiology. Some knowledge of statistical software or data mining packages based on R or Python would be an advantage.

**CMED8005 QUALITY RESEARCH IN CHINESE MEDICINE**

This subject introduces the novel strategies, new methodologies and state-of-the-art techniques for quality research of Chinese medicines. Strategy of systematic evaluation, advanced instruments and analytical techniques including sample preparation and detection will be emphasized in the course.

Pre-requisite: None

**CMED8006 SEMINARS**

The Seminar is a graduate level course designed to give students an opportunity to hear from and interact with experts in their fields of study. ICMS will invite the leading local, national, and international scientists to speak about the latest advances in Biomedical Sciences. Graduate students also present talks about their own research. This experience gives the students practice speaking to the others and allows for the exchange of ideas as they conduct their thesis research.

Pre-requisite: None

**CMED8007 CHEMISTRY OF NATURAL MEDICINE**

This course is intended to provide an extensive understanding of chemistry of natural medicine and the cutting-edge techniques in discovering and developing natural medicines. Especially, the isolation, structural elucidation, classification, bioactivities and toxicities of natural medicines and related topics will be discussed in this course.

Pre-requisite: None

**CMED8008 ADVANCED PHARMACEUTICAL ANALYSIS**

The principal objective of the course is to provide the students an in-depth insight into the advanced development in strategies and practices in pharmaceutical analysis. The course focuses on the new methodologies and state of the art techniques for including sample preparation, instrumental analysis and data processing for pharmaceutical analysis. Real-world

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cases will be reviewed and formal readings and discussions will occur throughout the course to foster critical thinking and independent learning.

Pre-requisite: Participants need to have knowledge in analytical chemistry, pharmaceutical sciences, pharmaceutical analysis

### **CMED8009 DRUG DISCOVERY**

This course will introduce students to the essential concepts and principles of drug discovery. It covers the latest and most outstanding developments on the medicinal chemistry and pharmacology of molecular drug targets, e.g. disease specific proteins, receptors, enzymes, and genes. This course also includes descriptions of current techniques in isolation and structural elucidation, screening techniques and high-capacity instrumentation for increased productivity in the development and discovery of new drugs.

Pre-requisite: None

### **CMED8010 ADVANCED PHARMACOLOGY**

This course will introduce students to the essential concepts and principles of pharmacology. It includes descriptions of type of receptor, agonist and antagonist activities, analysis of agonist-effect relationships and the intracellular signaling pathways and transcriptional regulation at molecular level by which endogenous and exogenously applied compounds elicit effects. Also, this course will introduce some new research strategies recently developed in pharmacology such as systems pharmacology, network pharmacology. Lastly, this course will emphasize the hot topics of biology such as autophagy, hormesis, epithelial-mesenchymal transition, etc., which could be integrated into pharmacological study of Chinese medicine research.

Pre-requisite: None

### **CMED8011 ADVANCED TOPICS IN MEDICINAL ADMINISTRATION**

This course will introduce various advanced topics in medicinal administration to PhD students, including pharmaceutical care at community pharmacy, pharmaceutical innovation system, basic theories of standardization and quality management (ISO 9001), total quality management (TQM) and relevant case study, data and visualization of data, e-learning in pharmacy education, ICT in pharmaceutical industry, and drug registration and patent linkage. Once completing this course successfully, students can have a wide understanding of cutting-edge theories and methods in medicinal administration, which is crucial to integrate multidisciplinary resources to develop PhD study.

Pre-requisite: None

### **CMED8012 RESEARCH ETHICS**

The on-line course provides students with an understanding of the following issues:

- the need for research ethics and the responsibility of the researcher (the student)
- the most common types of academic dishonesty (such as fabrication and plagiarism)
- how to avoid committing acts of academic dishonesty (such as through using citations and references)
- how the University deals with students who have been proven to have committed acts of academic dishonesty (The University's 'Rules on Handling Student Academic Dishonesty' will be outlined)

Pre-requisite: None

### **CMED8013 RESEARCH WRITING**

The course focuses on helping students to make academic presentations whether verbally (as in a conference) or in writing (as in a paper). Topics include:

- how to write a research proposal
- how to structure a presentation (on paper and in powerpoint)
- tenses used in various parts of a paper presentation
- how to structure clear and logical paragraphs

- how to be concise
- how to avoid ambiguity and different writing styles (for example, conventions for use of numbers, abbreviations, etc.)

Pre-requisite: None