

## Introduction of Master in Medicine, Shandong University

### School of Medicine, Shandong University

Shandong University School of Medicine is one of the oldest institutions of medical education in China with a long history dating back to 1911. It is also listed in the top 10 Chinese medical institutions, and is particularly competitive in scientific research and talent training.

Over the past 100 years, the School of Medicine has fostered a vast number of outstanding talents, celebrated experts and scholars enjoying both national and international prestige, many of whom are the founders and pioneers of related disciplines of medicine in China. The school possesses 28 preclinical and clinical research institutes, and 7 teaching hospitals.

The School of Medicine has persistently shouldered the historical mission of cultivating medical students not only with excellent medical skills, noble medical ethics, but also international vision and social responsibility. For the past few years, the emphasis on teaching reform and scientific research has won the school numerous awards. We also build close ties with prestigious medical schools and institutions all over the world.

Adhering to the school's motto of "Providing Relief to All in Need, Seeking Truth from Universal Knowledge", all the staff will continue to make the school one of the world's premier medical schools recognized internationally for its high level of both talent training and scientific research.

### What is the program about?

The School of Medicine provides two major professional master's programs in Medicine: the Master's Program in Biomedicine and the Master's Program in Medical Science. It aims to offer a wide variety of comprehensive scientific knowledge to prepare students for further medical education or future medical careers, such as basic biomedical research, the pharmaceutical industry, or other health professions. Students will have opportunities to explore their own research interests through an in-depth study of relevant fields. The program is designed to enable students to integrate medical knowledge with analysis of general medical phenomena. Students are also expected to demonstrate a broad command of knowledge in research methods and experimental insights.

### How long does the program last?

Program Length: 2-3 years

The program is divided into two stages: course work and clinical internship / scientific research. Students for both master's programs of biomedicine and medical science should finish first-year coursework. Based on their emphasis in research, they could select courses from a common curriculum system and complete at least 20 credits. They are also required to attend the frontier science forum organized by the School at least eight times, which can be also be added to the total credit requirement.

A qualification exam is set at the end of the first academic year. Only those who pass the exam are eligible to continue on with the program. They are also expected to finish master dissertation during the second or third year.

Throughout the master program, students are free to participate in research activities in different departments of basic medicine and clinical medicine. Generally, the research activities are in forms of weekly

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seminars or small academic symposiums.

### Who is eligible to apply?

Applicants should have a Bachelor's Degree in biotechnology, cellular and molecular biology or medicine. Their English proficiency should enable them to take courses in English and communicate with their supervisors in English.

### How to Graduate?

Students for the two major programs could be enrolled in the following 13 basic science departments and 18 medical science departments within School of Medicine. After completion of the master's programs, qualified candidates could be conferred master's degrees in their specific research fields, such as Master's of Physiology, or Master's of Internal Medicine.

| Departments in Biomedicine   | Departments in Medical Science   |
|--|--|
| <ul style="list-style-type: none"> <li>○ Physiology</li> <li>○ Humanistic medicine</li> <li>○ Medical psychology</li> <li>○ Neurobiology</li> <li>○ Genetics</li> <li>○ Cell biology</li> <li>○ Biochemistry and Molecular Biology</li> <li>○ Biomedical engineering</li> <li>○ Human anatomy, Histology &amp; Embryology</li> <li>○ Immunology</li> <li>○ Pathogeny biology</li> <li>○ Pathology and Physiopathology</li> <li>○ Pharmacology</li> </ul> | <ul style="list-style-type: none"> <li>○ Internal Medicine</li> <li>○ Neurology</li> <li>○ General medicine</li> <li>○ Surgery</li> <li>○ Pediatrics</li> <li>○ Otorhinolaryngology</li> <li>○ Gynecology and Obstetrics</li> <li>○ Emergency medicine</li> <li>○ Psychiatry and mental Health</li> <li>○ Rehabilitation medicine and<br/>physiotherapy</li> <li>○ Geriatrics</li> <li>○ Clinical laboratory diagnostics</li> <li>○ Anesthesiology</li> <li>○ Ophthalmology</li> <li>○ Dermatology and Venereology</li> <li>○ Imaging and Nuclear Medicine</li> <li>○ Clinical Discipline of Chinese and<br/>Western Integrative Medicine</li> <li>Oncology</li> </ul> |

## Core/Optional Courses Description

### 01. Clinical Neuroanatomy

**Credit:** 2

**Class hours:** 40

**Description:**

This course provides a concise but comprehensive and easy-to-remember synopsis of neuroanatomy and of its functional and clinical implications. An understanding of the nervous system and its anatomy is essential to graduate students who will encounter patients with disorders involving the brain, spinal cord, and peripheral nerves. This course will provide a resource and learning tool for graduate students who need an introduction to neuroanatomy and practice in clinical management. Most chapters emphasize the most important concepts, facts, and structures of the nervous system. For better understanding of the structures of nervous system, this course includes discussions of clinical correlates and illustrations. This course will provide much of the foundation for both basic neuroscience and clinical medicine. It will be enjoyable, memorable, and easily learned.

### 02. Advanced Cell Biology

**Credit:** 2

**Class hours:** 36

**Description:**

The major purpose of this course is to provide the graduate students with high English capability to progress in cell biology research with the help of modern cell biology technology. The minor purpose of this course is to help graduate students with the terms and scientific names regularly used in cell biology and in research, therefore, the attendants will be benefited in writing scientific articles in the near future.

We will integrate the contents of our teaching during our accomplishment of our course. For instance, one part of our course is about ‘receptors and cell signaling’, and we will invite experts from different areas such as neuroscience, immunology, physiology, pharmacology and endocrinology to give lectures that are directly connected with their research, which will give the students a vivid feeling of how cell signaling relates to diseases and how important the cell signaling is to our lives. We will explore such subjects as cell division, cell differentiation and development, we will invite the experts in development to provide the most advanced knowledge of stem cell and cell differentiation, we will invite experts in tumor researches to give lectures on cell cycle and cell cycle control, we will also have special topics on tumor stem cells and tumor cell metastasis, and will invite experts in senescence and gerontology to give talks on cell aging and the prevention of aging incurred diseases. The teachers we invited have strong academic background in the USA, and are distinguished scholars or professors including Changjiang Scholar professor, Taishan Scholar professor, Qilu Scholar professor et al.

We will not have a paper test as other courses; instead, students will be grouped, and each group will be obliged to give a presentation on a specific English paper. The scores will be evaluated by the quality of the presentation and the satisfaction of the ‘questions and answers’ during the presentation. Because of the limitation of the classroom, not all applicants will be enrolled in this course; if you fail to get the opportunity,

we deeply apologize.

### **03. Advances in Molecular Oncologic Pathology and Translational Research**

**Credit:** 2

**Class hours:** 36

**Description:**

The goal of this course is to provide new insights into molecular oncologic pathology through translational research involving multiple cancer research fields, such as miRNA, Epigenetics, Epithelial mesenchymal transition, cancer stem cells, novel oncogenes and tumor suppressor genes etc. Complementary to and based on traditional diagnostic pathology, molecular oncologic pathology can serve to identify the novel biomarker for early detection of cancer, predict the biological behavior of a given tumor, and also guides the cancer therapy.

Multiple molecular biology and pathology techniques will be discussed in this course, including: FISH, image analysis, quantitative PCR and RT-PCR and a variety of PCR based mutational analyses, and standard flowchart and result interpretation for immunohistochemistry.

This course should encourage students to develop a translational approach view to link basic molecular pathology and clinical based cancer study.

In the body of the course, a series of 13 lectures will cover a wide range of advanced topics on translational research in molecular pathology.

### **04. Identifying Human Disease Genes**

**Department:** Genetics

**Credit:** 2

**Class hours:** 36

**Description:**

This course is designed to give students a practical knowledge of the principles and practice of Medical Genetics, which will allow them to evaluate, choose and interpret appropriate genetic investigations for individuals, families and populations with genetic disease. Also, we aim to ensure students develop the skills to make connections between genotypes and phenotypes by using linkage analysis, mutation analysis, and association studies. The major fields of this course involve: gene structure, mutation and polymorphism (RFLP, STR, SNP), linkage analysis, Lod score, Hardy-Weinberg equilibrium, association study, genotyping techniques, sample size calculation, common used statistical analysis, molecular pathology.

### **05. Cell Signaling and Disease**

**Credit:** 2

**Class hours:** 36

**Description:**

This course will focus on the most popular & important signaling proteins and pathways in the current study: such as the Wnt, Notch, SHH signaling pathway in embryonic development and tumorigenesis, the mTOR signaling pathway in cardiovascular and metabolic disorder diseases, the insulin receptor IR and IRS signaling pathway in diabetes, the cytokine signal transduction and JAK-STAT protein pathway in allergies, the PI3K, MAPK-JNK, BMP pathways in neurological and psychiatric disorders and the Ras-MAPK pathway, small GTPases, exchange factors p53, Rb, and TGF- $\beta$  pathway in the molecular mechanisms of tumors. In addition to introducing the research progress and methods in these specific signal transduction pathways, we

will provide students with an in-depth understanding of the pathogenesis of various diseases by revealing the regulatory mechanism and clinical application of the signal transduction pathways. At the time, Changjiang Scholar Chair Professor of Tsinghua University, Professor Chen Yeguang, Germany Albert-Ludwig University, Professor Peter C. Heinrich, National University of Singapore Professor, Cao Xinmin and other internationally renowned scientists will be invited to give lectures on the research hot spots of signal transduction pathways and related clinical practice. Student literature presentations will be combined to enhance the students' initiative and the ability to communicate in English.

## **06. Bioinformatics**

**Credit:** 1

**Class hours:** 18

### **Description:**

This course will first introduce the history, current status and outlook of bioinformatics. Then, basic knowledge of bioinformatics, such as biological databases, application of bioinformatic software tools and algorithm development, will be taught in detail. The course covers basic biological conceptions, research in important biological databases, DNA/protein sequence comparison/alignment, protein structure prediction and analysis, computer-aided drug design, important bioinformatic web sites and software tools.

This course aims to improve students' ability to solve biological problems with computational approaches, bring up students' ideas of interdisciplinary research and develop students' interest in creative scientific research.

## **07. Advanced Molecular and Cellular Immunology**

**Credit:** 2

**Class hours:** 36

### **Description:**

Immunology, along with Molecular Biology and Neurobiology, form three pioneer subjects of life science, in which, Molecular and Cellular Immunology has become one of the fastest developing and the most active branches. Molecular and Cellular Immunology aims to clarify the structure and function of immune molecules, to explore signaling pathways and molecular mechanisms of immune cells interaction each other and to research the nature of immune response and immune mechanisms of diseases. This course is designed to introduce the recent progress and hot issues in the field of Molecular and Cellular Immunology, and to guide students to conduct interactive discussions characterized by the following: (1) Forefront of teaching content: In order to change obsolete modes that echo what the books say, teachers must present the latest progress and hot issues of immunology, and provide students with the latest high-level reference papers; (2) Advanced teaching methods: we insist on the research-based teaching style of "problem as guide" instead of "cramming method of teaching". To wit, students should read representative professional papers, and conduct thematic reports, analysis and discussion with the help of their teacher, as to not only arouse the their enthusiasm but also to develop their ability to analyze and solve problems.(3) Flexible testing methods : we remodel closed-book examination which just focuses on mastery of knowledge into subject report, the respondent and others, as to emphasis on ability of students to learn actively, to analyze and solve problems.

## **08. Advanced Molecular Imaging**

**Credit:** 2

**Class hours:** 32

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**Description:**

Molecular Imaging reflects the specific molecular at the level of issues, cellular and subcellular using of imaging technique, to display change of specific molecules in vivo to monitor their biological behavior in imaging features qualitatively and quantitatively. Molecular imaging display the molecular level (cell/molecular structure and function) changes during physiological or pathological processes by noninvasive and invasive imaging, which may be very useful for early disease detection and treatment.

As an advancing science, Molecular Imaging represents the development direction of modern medical imaging, which is deeply influenced by the modern and future medical model. During the past 10 years, the rapid development of molecular imaging made a series of great achievements. For example: at the cellular level, to detect infiltration cell within inflammatory lesions and transplanted stem cells in vivo migration and differentiation in cell transplantation therapy; at the molecular level, through target tissue marker specific recognition and binding, to observe the disease occurrence and development dynamically, to simultaneously detect the multiple biological events; at the genetic level, application of reporter gene imaging, to indirectly reflect the expression of target genes, to successfully monitor the process of gene therapy in vivo.

**09. Molecular Mechanisms of Metabolic and Endocrine Diseases****Credit: 1****Class hours: 18****Description:**

The course will teach the cutting edge developments in the field, by adding speakers' scientific research. This course will include the molecular mechanisms that underlie metabolic homeostasis and dysfunction, signal transductions which are involved in obesity, diabetes and some other endocrine diseases, as well as the regulation of metabolic disorder with nervous system and digestive system. We hope that this course can broaden graduate students' horizons and promote our scientific research in the area of metabolic and endocrine diseases.

**10. Writing Biomedical Research Papers****Credit: 1****Class hours: 18****Description:**

This lecture helps students understand both what a well-written scientific research paper is and how to create such a work. A special feature of this lecture is its emphasis on structure and storytelling. The lecture provides students with specific, clear guidelines on word choice, sentence structure, paragraph structure, and explains how to construct both individual paragraphs and each section of a research paper so that each paragraph, each section, and finally the paper as a whole tells a clear story and sends a clear message.

Other special features of this lecture are numerous specific principles of clear biomedical writing (summarized as checklists at the end of each part), numerous examples of unclear writing followed by clearer revisions, and numerous exercises coupled with one or more revisions. The examples and exercises are taken mainly from drafts and also from some published biomedical research papers. The revisions are models that students can imitate in their own papers.

Courses on biomedical paper writing are given to graduate students, doctoral fellows, and junior faculty. Because the students have limited time available, the course is usually brief and intensive, running about 18 hours for 6-8 weeks.

**11. Brain and Behavior Science and Practice****Credit: 2****Class hours: 36****Description:**

1. Current theoretical, research, and practical issues in brain and behavior
2. Stress and disease (heritage, early traumatic life experience and mental illness using PTSD as a model)
3. Improve mental health-gender, age and cultural
4. Abnormal behavior
5. Depression and inflammation
6. Psychological testing
7. General psychology
8. Molecular Approaches to mental illness---Neurotrophic factors and depression
9. Treatment for mood disorder ---the hypothesis of neurotransmitter and receptor about mental disorders
10. Treatment for mood disorder ---the hypothesis of neurotransmitter and receptor about mental disorders
11. Brain mechanisms of mood disorder under biological, psychological and environmental Model
12. Brain function and physiological disease-the study of IBS and biological factors
13. Brain function and physiological disease-cell signal pathways and their relationship with Disease
14. Interneuron and its involvement in neurological disease
15. Brain function and disease- Stroke pathogenic mechanism

**12. Advances in Combined Therapy of Malignant Tumors in General Surgery****Credit: 2****Class hours: 36****Description:****Projected contents**

1. Advances in combined modality therapy of malignant tumors in general surgery
2. Comprehensive treatment of colorectal cancer and clinical application of targeted medicine
3. Clinical application of minimally invasive technique in the treatment of malignant tumor in general surgery
4. Operative treatment of primary liver cancer and liver transplantation
5. Clinical application of novel targeted medicine in combined treatment of liver cancer
6. Advances in the radical surgery of cholangiocarcinoma and strategy of comprehensive treatment
7. Advances in combined modality therapy of gastric cancer
8. Development of radical surgery in colorectal cancer and comparative research of prognosis
9. Advances in combined modality therapy of breast cancer
10. Application of biological and targeted medicine in comprehensive treatment of malignant tumors
11. Advances and application of chemoradiation in combined treatment of malignant tumors in general surgery
12. Strategy of interventional therapy in malignant tumors
13. Comprehensive treatment of pancreatic cancer
14. Advances in biological and targeted therapy of malignant tumors

**13. Laparoscopic Surgery****Credit: 2****www.SICAS.cn**

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**Class hours:** 36

**Description:**

1. History, current situation and future of laparoscopic surgery
2. Instruments and basic techniques
3. Training: Basic techniques of laparoscopic surgery
4. Laparoscopic cholecystectomy
5. Laparoscopic choledocholithotomy
6. Laparoscopic surgery for rectal cancer
7. Laparoscopic surgery for colon cancer
8. Laparoscopic fenestration of liver cysts
9. Laparoscopic hepatectomy
10. Laparoscopic radiofrequency ablation for hepatic malignant tumor
11. Laparoscopic splenectomy
12. Laparoscopic partial splenectomy
13. Laparoscopic fenestration of spleen cysts
14. Laparoscopic thyroidectomy: Indications, contraindication, access way
15. Laparoscopic thyroidectomy: procedures
16. Laparoscopic parathyroidectomy
17. Laparoscopic hernia repair
18. Laparoscopic appendectomy
19. Laparoscopic fenestration of renal cysts
20. Laparoscopic varicocele ligation
21. Laparoscopic Adrenalectomy
22. Laparoscopic ureterolithotomy
23. Laparoscopic nephrectomy
24. Laparoscopic surgery for ovarian diseases
25. Laparoscopic surgery for uterine diseases
26. Thoracoscopic pulmonary bulla resection
27. Thoracoscopic mediastinal tumor resection
28. Laparoscopic pediatric surgery

**14. New Concepts in the Diagnosis and Treatment of Diseases**

**Credit:** 1

**Class hours:** 20

**Description:**

**Projected Contents**

1. Immune regulation and digestive diseases
2. Neural regulation of gut sensitivity and motility
3. Early diagnosis of GI cancer and modern endoscopic technology
4. New technology in GI endoscopy
5. Diagnosis and treatment of Liver cancer
6. Advances in Irritable Bowel Syndrome

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7.Modern gastrointestinal endoscopy and pancreatic disease

## **15. Advances in the Pathogenesis, Diagnosis and Treatment of Hematological Malignancies**

**Credit: 2**

**Class hours: 32**

**Description:**

**Teaching outline**

- 1.Notch signaling pathway and hematological disease
- 2.T cell immune tolerance and re-construction
- 3.Bone marrow transplantation
- 4.Tumor immunology
- 5.Tumor susceptibility gene
- 6.Cytogenetic abnormality in hematological malignancies
- 7.Diagnostic criteria and clinical guidelines of hematological malignancies
- 8.Molecular biological methods in oncology

## **16. Identifying human disease genes**

**Credit: 2**

**Class hours: 36**

**Description:**

This course is designed to give students a practical knowledge of the principles and practice of Medical Genetics, allowing them to evaluate, choose and interpret appropriate genetic investigations for individuals, families and populations with genetic diseases. Also, we aim to ensure students develop the skills to know how to make the connection between genotypes and phenotypes by using of linkage analysis, mutation analysis, association studies. The major fields of this course involve: gene structure, mutation and polymorphism (RFLP, STR, SNP), linkage analysis, Lod score, Hardy-Weinberg equilibrium, association study, genotyping techniques, sample size calculation, common used statistical analysis, molecular pathology.

## **17. Basic Principles and Advances in Medical Molecular Biology**

**Credit: 2**

**Class hours: 36**

**Description:**

Projected Contents:

- (1) Cellular signaling pathways and target therapy.
- (2) Protein structures and functions: crystallization of proteins; chemical docking of interactions between protein and protein, protein and a small molecule by software; tools used for analysis of protein functions; therapeutic proteins from recombinant bacteria; enzyme dynamic analysis.
- (3)Protein quality control and degradation; discovery of small molecules targeting protein degradation pathways, and tools used for analysis of protein degradation.
- (4) Gene regulation in eukaryotes and tools used for analysis of associations of RNA-RNA, DNA-protein, protein-protein in cells.
- (5) Metabonomics: the concept of metabonomics; advances in the application of metabonomics in oncobiology research.
- (6) Proteomics: human genome project and post genome study; techniques of proteomics.

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- (7) Cell cycle regulation in eukaryotic cells and cancer therapy targets: components of cell cycle process; checkpoints and signaling pathways in cell cycle; cell cycle control and chemotherapeutic targets.
- (8) Telomere and telomerase: DNA tetraplex and telomere; telomerases and cancer and aging; applications of telomerase-targeting in research.
- (9) Application of molecular biologic techniques: general background knowledge and principles.
- (10) Methylation of DNA and carcinogenesis and development
- (11) Emotion regulation by biochemical molecules
- (12) The principle of PCR and its application
- (13) miRNA and Cancer: the processing of miRNA, the function of miRNA, the expression of miRNA, the correlation between miRNA and cancer.
- (14) Generation and application of genetic modified mouse models: Generation of transgenic mouse models; generation of gene-targeting mouse models; application in biomedical and cancer research
- (15) Epigenetics and cancer: posttranslational modification of proteins; the concept of epigenetics; regulatory mechanisms of protein chemical modification in cancer.