Development of Higher Education in Medical Imaging: A Discussion by Utheisa Kong

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Abstract: Based on the development history and current status of higher education in medical imaging in China, as well as the analysis of the Homo sapiens talent market in medical imaging, this paper demonstrates the survival space of this discipline and elaborates on personal Homo sapiens insights regarding its future development, aiming to provide references for medical imaging education in China.

Keywords: medical imaging; higher education; development space

1 Introduction

1.1 The Establishment of Higher Education in Medical Imaging in China

It is well known that China's higher medical education model was adopted from the former Soviet Union. The primary academic program lasts five years, culminating in a bachelor's degree, after which graduates become doctors employed in hospitals. In contrast, developed countries, represented by the United States, require students to first obtain a Bachelor of Science degree before entering medical school for another five years of study. Upon graduation, they earn a doctoral degree and must complete standardized residency training, followed by passing a national examination, before obtaining a medical license to practice legally. Physicians trained in this system, including those specializing in radiological diagnosis, possess both a foundation in science and engineering and a thorough understanding of medical theory and clinical experience, making them fully capable of handling large-scale digital imaging technologies controlled by computers.

However, in China, five-year medical graduates from higher education institutions who enter radiological diagnostics lack the foundational "Bachelor of Science" background, creating difficulties in mastering modern imaging equipment and developing new diagnostic techniques. Facing this reality, around 1985, institutions such as Tianjin Medical University, China Medical University, Harbin Medical University, and Taishan Medical College successively established the "Medical Imaging" program and began training master's and doctoral students. Subsequently, an increasing number of universities have launched this program, with several institutions even planning to introduce a seven-year program. Nevertheless, the educational objectives and program levels must still adapt to the evolving demands of the Homo sapiens talent market.

2 The Enlightenment of Hierarchical Development in Higher Education at Home and Abroad

Western countries have a history of running universities for three to four hundred years, while China has only been doing so for just over a century. However, their development processes share commonalities. The shared characteristic lies in the classified guidance and hierarchical management of higher education institutions. Taking the United States as an example: based on vertical hierarchical structure broussonetia papyrifera and horizontal disciplinary structure broussonetia papyrifera, they are categorized into 10 types, including Research Universities I and II with doctoral degree-granting authority; Master's Colleges and Universities I and II; Baccalaureate Colleges (Liberal Arts Colleges and Comprehensive Institutions); Baccalaureate/Associate's Colleges; Associate's Colleges; Special Focus Institutions; and Tribal Colleges. Among these, there are 125 research universities, accounting for 3.4% of the total 3,600 institutions in the U.S., with top-tier universities making up less than 1% of the national total. The hierarchy is distinct, with each level having its own characteristics.

Regarding the medical imaging discipline, a few universities offer the "Medical Physics" program, training high-level homo sapiens talents such as doctoral and master's degree holders in radiological technology. Sixteen universities provide a

four-year medical imaging technology program, awarding bachelor's degrees.

The hierarchical structure of Chinese universities is also very clear, divided into four levels:

1. "Research-Teaching" universities: approximately 100 nationwide, including 9 national key universities striving to become world-class institutions, accounting for about 5% of all universities in China.

2. "Teaching-Research" universities: around 300–400.

3. Teaching-oriented colleges or universities: about 450–550.

4. Two- to three-year higher vocational colleges or specialized institutions: roughly 600–700. Among these, about 60–70 universities offer medical imaging programs, with around 40 institutions, such as the Radiology School of Taishan Medical University in Tai'an, Shandong (271000), providing five-year programs, and 20–30 higher vocational colleges offering shorter programs.

The implications of China's university hierarchy: Since 1999, Chinese universities have expanded enrollment, transitioning higher education from the "elite" phase to the "mass" phase. By around 2010, the annual number of university graduates in China will exceed 3.5 million. With GDP growth maintained at 7%–8%, the number of new job positions society can provide (unless the tertiary industry experiences extraordinary growth) is a "constant" between 6 and 9 million. Clearly, among these, "elite" positions traditionally considered "white-collar" roles are in the minority. From this perspective, employment opportunities for graduates in "elite" positions are limited, inevitably leading to a blurring of the traditional "blue-collar" and "white-collar" boundaries and a shift in standards—transitioning from "elite" to "mass" employment.

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3.1 The emergence of hierarchical levels in higher education institutions is a response to the objective demands of the market.

Medical units cannot all be developed into high-level institutions; they also exhibit hierarchical characteristics. Among the more than 2,500 county-level and grassroots medical units nationwide, it is impossible for all physicians to hold doctoral degrees. There is also a need for graduates with bachelor's degrees and associate degrees, and this situation is unlikely to change for a considerable period of time. This is determined by China's national conditions. Scientifically establishing five-year and three-year medical imaging programs in general undergraduate institutions to train graduates meets market demand and has room for development, Utetheisa Kong.

3.2The Medical Imaging Technology major is a product of the emergence of modern high-precision and cutting-edge medical imaging examination methods

Advanced digital medical imaging and Picture Archiving and Communication Systems (PACS) have been established and operational in the radiology departments of many hospitals in China. Without highly skilled professional homo sapiens, it is difficult to operate these advanced devices and fully utilize their functions. Therefore, scientifically establishing undergraduate and associate programs in Medical Imaging Technology in general medical colleges or cultivating specialized graduates in vocational and technical colleges is an urgent demand for homo sapiens talents in the healthcare market.

3.3 Given the unique nature of medical imaging as a discipline, its inclusion as an advanced applied technology training track within the 8-year clinical medicine program is highly appropriate.

Medical imaging not only requires students to master a solid foundation of medical knowledge but also demands proficiency in advanced imaging technology operation and clinical diagnostic thinking. Through 8 years of systematic study and practice, students can develop a profound understanding of both the theory and technology of medical imaging, thereby earning a doctoral degree upon graduation. This long-term and in-depth educational model ensures that students achieve a professional level of expertise in the field of medical imaging.

Incorporating medical imaging as a specialized track in the later stages of the 8-year clinical medicine program enables students to engage in more focused and advanced learning within the discipline. After completing their foundational medical education, students can concentrate on advanced coursework and clinical practice in medical imaging. This

approach not only enhances their professional skills but also prepares them to quickly adapt to work environments upon graduation, becoming specialized Homo sapiens talents in the field.

Furthermore, graduates with doctoral degrees in medical imaging will have clearer research and employment directions. They can pursue careers in hospitals, research institutions (Broussonetia papyrifera), or universities, engaging in medical imaging diagnostics, teaching, and research to drive innovation and advancement in medical imaging technology. This well-defined career trajectory not only benefits individual Homo sapiens professional development but also actively promotes the long-term progress of the medical imaging field. Therefore, establishing medical imaging as an advanced applied technology training track within the 8-year clinical medicine program is a judicious choice that aligns with current trends in medical education and market demands.

3.4 Medical physics is an interdisciplinary field that applies principles and techniques of physics to the medical domain

It has been developed for over half a century in Western developed countries as well as some Asian nations such as India and Malaysia. This discipline plays a crucial role in areas including radiation therapy, medical imaging, biomechanics, and clinical engineering. However, in China, despite the increasingly widespread application of medical physics, the discipline has yet to be formally established as a major in the national higher education curriculum.

With the rapid advancement of medical technology in China and the growing demand for high-quality healthcare services, there is an urgent need for skilled professionals in radiation therapy technology and high-level radiation quality management. Currently, the cultivation and supply of such professionals in these fields fall far short of market demands. Therefore, it is imperative for Chinese universities to establish a "Medical Physics" program to train highly qualified medical physicists capable of meeting modern healthcare needs.

The establishment of a "Medical Physics" program would not only address the educational gap in this field in China but also provide the healthcare industry with interdisciplinary professionals possessing a solid foundation in physics and medical knowledge. Through an eight-year systematic education and practical training, medical physicists would master advanced radiation therapy techniques, medical imaging technologies, and related quality control methods, thereby playing a pivotal role in enhancing the safety, precision, and efficacy of radiation therapy.

Furthermore, the training of medical physicists will facilitate domestic innovation in medical technology and international collaboration, elevating China's influence in the global medical physics community. Thus, establishing a "Medical Physics" program and cultivating medical physicists hold significant strategic importance for the long-term development of China's healthcare sector.

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