Adopting US Postgraduate Education to Promote High-Quality Marine Pharmaceutical Postgraduates in China

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Abstract. Postgraduate education in Postgraduate education in the United States is a typical example of Western education: it is a comparatively distinctive and successful education model. From an analysis of development trends in US postgraduate education and the postgraduate education model there, this paper aims to help improve the quality of postgraduate education in China, particularly with respect to marine pharmacy. This study concludes that the way to achieve that is through increased investment in scientific research and improved collaboration.

Introduction

This “ocean century” is one in which the development of human society will as a whole turn to the oceans. The Communist Party of China has developed the strategy of rejuvenating the oceans, and it aims to advance China from a big to a powerful ocean power. In recent years, with the acceleration of marine development and wide application of modern biotechnology, the discovery of active natural products from marine organisms and development of new drugs have attracted widespread attention among researchers. Marine drug research has emerged as a new field with broad research results and market prospects [1].

Postgraduate education is the top tier of higher education. Reforming postgraduate education shows similarities in different countries: expanding and improving postgraduate education; promoting graduates trained both in academic fields and a wider range of professional fields; and education fostering high-quality professionals raising questions regarding broader social, economic, and environmental issues. Marine pharmaceutical colleges and universities shoulder the responsibility of training high-quality graduates for the rapid, sustainable development of China’s marine economy [2], [3]. This paper analyzes the characteristics and development trends in US postgraduate education; it also presents opinions on reforming postgraduate education in marine pharmacy in China.

Postgraduate Education in United States

From the turn of this century following changes in its domestic and the international situation, the United States summarized the development of postgraduate education there: it was believed that postgraduate education played a key role in leading social development and progress. Over the previous century, the economic and political prosperity of the United States had been rooted in its postgraduate education system. The major areas to maintaining national competitiveness were regarded as follows: maintaining the integrity of university specifications; considering high-quality graduate education as an essential component of US leadership in research and innovation as a driving force for the success of the entire higher education system; and improving postgraduate education in key areas[4][5](Figure 1). In the United States, postgraduate education has the following characteristics.
Figure 1. The characteristics of postgraduate education in USA.

**Emphasizing Innovation and Cooperation**

It is recognized that the future workforce must include trained graduates who will be knowledge creators and future reformers. Thus, those future leaders need to be technologically competitive; they also have to be good at dealing with the social and cultural problems of the global economic era. Accordingly, many US graduate schools often focus on graduate education and cooperation between business and political departments. There are many forms and levels of cooperation among graduate schools, businesses, and the government in the United States. In this regard, 1-year Master of Professional Sciences programs have been established there. For example, the master’s degree in data analysis at North Carolina State University provides graduates with strong analytic and problem-solving abilities. Many large businesses in North Carolina, such as banks, pharmaceutical companies, and information technology enterprises, apply advanced analytic techniques in their operations [6]. Thus, graduates with that degree are very popular.

**Improving the Cultivation of Enterprises**

Educational institutions in the United States believe that graduate-level entrepreneurship programs are favorable for the creation and innovation of knowledge, which is essential for the country’s continued economic prosperity. There are many successful examples of entrepreneurship programs for improving the quality of graduate education. The Institute of Enterprise Innovation of Georgia Technological University and the Center for Advanced Technological Development teach science, technology, and innovation to promote the competitive character of businesses. As an example, the university offers courses that help entrepreneurs build successful companies. Vivonetics is one such company. It is a nanotechnology enterprise founded by researchers at Georgia Technological University. The company has received federal funding to develop and commercialize molecular beacon technology for the detection and diagnosis of cancer and other diseases. This collaboration has stimulated scientific progress, helped new enterprises develop and improved people’s lives [7].

**Strengthening Social Practice**

Created in 1997, the Master of Professional Studies is a comparatively new graduate degree in the United States. With that degree course, students receive advanced training in science and mathematics while developing the practical skills valued by employers. The course covers emerging and interdisciplinary fields: it involves 2 years'academic training, and the professional training includes an internship and cross-training. Course graduates have mainly found employment in non-academic fields and generally do not publish academic papers. In the United States, there at present over 100 professional masters’ programs at 51 universities in 21 states. The professional master’s degree is a promising new creation to meet changing labor demands of industrial and commercial enterprises, non-profit departments, and government departments [8].
Optimizing and Improving Funding
Much US success has been achieved by investment in graduate education and research. Currently, graduate students receive grants through postgraduate education and research scholarships for their contributions to the country’s teaching and research institutions. Subsidies are also obtained through fellowship salaries and training scholarships established by federal or state governments for certain disciplines. A large proportion of graduate students are funded through the research projects of their professors. Graduate students constitute an important part of the scientific and engineering workforce in US research laboratories. Thus, this form of funding is a very important driver of research and innovation: the research assistant position provides graduate students with the opportunity to contribute to frontier areas; they are also able to obtain critical funding to complete their studies. The federal government has always been the main provider of funding for academic research and development and been the main supporter of graduate education. Other federal agencies and government ministries also have programs to provide funding for graduate students. These efforts help more people develop their potential through higher education, which can promote progress in the economy, society, health care, and civic matters[9].

Emphasis on Interdisciplinary Disciplines
Toward developing knowledge and identifying the operating mechanisms of modern society, it is difficult for researchers to focus on a single subject. Accordingly, interdisciplinary postgraduate education offers an opportunity to address social problems through finding innovative solutions. More and more universities around the world find themselves dealing with businesses and federal agencies. Interdisciplinary postgraduate education often develops in concert with the tangible outcomes of such partnerships. This kind of collaboration results in special research institutes set up within universities.

Thinking and Enlightenment in China
Currently, China’s human resources in the area of marine development are insufficient in terms of numbers and general structure; that is especially true of marine drug research. Statistics show that the supply ratio of undergraduates and master’s and doctoral graduates in marine specialties in China to be 1:1.3:23. Those figures are clearly from those of better energy-level structure (1:6:14). In marine drug research in China, the proportion of engaged technicians is far behind that in developed countries. Compared with US postgraduate education in marine medicine, that in China needs to be improved with respect to several factors (Figure 2) [10].

![Figure 2. Characteristics of postgraduate education in China.](image-url)

Combining Basic Knowledge with Innovative Ability
China is a large country with an ocean coastline and abundant marine resources; however, the level of its marine research and development is relatively low. In contrast to the advanced levels overseas, China’s marine education, development, and research fall far below its requirements. The rapid, sustainable development of China’s marine economy demands the training of skilled postgraduates in marine research. However, the quality of the country’s graduate students in marine
medicine is uneven; those students include interdisciplinary graduate students. In recent years, many marine graduate training units have suffered considerably. Accordingly, developing basic knowledge has been identified as the basic problem with respect to training. In this regard, the establishment of Wanzhang High Building Rises on Flat Ground is particularly important. Innovation is the cornerstone of continuous development and social renovation. Without innovation, there can be no development. Marine resources are complex, diverse, and profound. Marine drug research involves a difficult process of exploration. Only by promoting an innovative, bold exploratory ability among graduate students toward developing rare, unusual pharmacodynamic drugs will it be possible to provide benefits for humankind.

**Improving Education and Training in Interdisciplinary Disciplines**

The essence of postgraduate marine education is to use the unique resources of marine organisms to research, develop, and produce marine drugs. The research field of marine drugs has become one of the most attractive and vital frontier disciplines in modern medical science. The study of marine pharmaceuticals constitutes a strong academic course. Because of the complexity of the medicinal nature of marine organisms, comprehensive development should be considered in the education of postgraduates in marine pharmaceuticals. Such courses should include parallel studies of basic academic content and related professional content. Commercial enterprises need to be involved in the practical content of those courses toward improving cross-disciplinary training and education. To make a greater social contribution, the courses should include a comprehensive knowledge system, incorporating strong scientific research and exploration for developing marine drugs.

A key factor in the quality of postgraduate training is insufficient investment in scientific research funding. In the area of marine pharmaceuticals, research funding in China comes from a single source, which is the Ocean University.

**Increasing Input of Training Funds**

The Ministry of Education provides research funding for postgraduates only at master’s and doctoral degree levels, and the amount is very small. Postgraduates are the leading conductors of a country’s scientific research—especially basic-applied research. Research into marine medicine is one conductors of a country’s scientific research—especially basic-applied research. Research into marine medicine is one such case. According to statistics of the Ministry of Science and Technology, the output rate of high-grade papers and patents is much higher in Chinese universities than in scientific research institutions; the output of patents is strongly correlated with the growth in university funding. Institutions of higher learning are also the main producers of international and domestic academic papers, and graduate students are a major force in scientific research. Students should be encouraged to start businesses, transform their scientific research into commercial production, and play a leading role in the social development of higher education. Increasing postgraduate enrollment has to keep pace with increased research funding in institutions of higher learning. Only by linking the rate of postgraduate enrollment in colleges and universities with research funding in China can the quality of postgraduate education be improved.

**Emphasizing and Improving Enterprise Collaboration**

Marine drug research is a relatively new field, and education in this area is currently insufficient in China. The education system in China is different from that in Europe and the United States. There are few independent research institutions in China’s enterprises and government departments. Those research institutions recruit only a small number of graduate students. Few government departments have joint research institutions in universities. Further, students seldom go to enterprises to gain work experience, and many students lack social experience. Thus, the knowledge obtained from books cannot be applied to society at large. Accordingly, it is necessary to establish cooperative research institutions at the Ocean University involving government and enterprise departments. Such collaboration would help develop social practice ability among graduate students; it would also train them in applying knowledge to practice. This action would result in
high efficiency and be beneficial for both the enterprises and society. It would effectively avoid the inefficient use of scientific research in colleges and universities and make a key social contribution.

**Conclusion**

The United States of postgraduate education is a successful education model. From an analysis of development trends postgraduate education and the postgraduate education model in US, this paper aims to help improve the quality of postgraduate education in China, particularly with respect to marine pharmacy. This study concludes that the way to achieve that is through increased investment in scientific research and improved collaboration.

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