

Research on Legal Issues in the Transformation of Research Achievements by University Faculty: A Study of the Experience of Universities in Silicon Valley, USA, and the Status Quo of Transformation of Research Achievements in Chitosan Bioactive Materials in China

Linyin Yan^{1*}, Yu Zhang¹, Huigen Luo², Decai Dai¹, Yanqiang Li¹

¹Department of Pharmaceutical Engineering, School of Chemical and Materials Engineering, Hainan Vocational University of Science and Technology, Haikou 570100, Hainan Province, China

²Wanxi High School, Luan 237000, Anhui Province, China

*Corresponding author: Linyin Yan, yanlinyin@iccas.ac.cn

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Abstract: This paper aims to delve into the legal issues surrounding the transformation of scientific research achievements by university faculty, with a special focus on legal protection and incentive mechanisms during the transformation process. By analyzing the experience of universities in Silicon Valley, USA, in promoting research transformation, including relevant legislation, university policies, and legal safeguards, as well as strategies to maximize the willingness of both universities and faculty for transformation, this paper distills the current successful legal consensuses. Simultaneously, it examines the status quo of the transformation of research achievements in chitosan bioactive materials for medical applications in China, analyzes existing legal deficiencies and urgent issues, and proposes corresponding solutions and recommendations.

Keywords: University faculty; Transformation of scientific research achievements; Legal issues; Chitosan bioactive materials; Medical field; Legal protection

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1. Introduction

In today's knowledge-based economy, the translation of scientific research achievements serves as a crucial bridge linking academic research with practical applications, carrying immense value in driving socio-economic development and enhancing national competitiveness^[1-3]. Universities, as the mainstay

of scientific research and innovation, have their research translation not only related to the realization of academic research value but also serving as a key indicator for assessing a country's technological innovation capability^[4-6]. However, despite the abundant research outputs from universities, issues such as low translation efficiency and complex translation processes remain prominent, with numerous obstacles in legal protection, incentive mechanisms, and industry-academia-research collaboration^[7-9].

A comparison of the practices in research translation between domestic and international contexts reveals marked differences and challenges. Universities in Silicon Valley, USA, have set a global benchmark in research translation through their comprehensive legal systems, flexible policy support, and efficient industry-academia-research collaboration models^[10-12]. In contrast, although China has made some progress in research translation, there are still deficiencies in the legal environment, policy implementation, and benefit distribution mechanisms, which, to some extent, hinder the effective translation of university research achievements, particularly those with broad application prospects like chitosan bioactive materials in the medical field.

Therefore, this study aims to delve into the legal issues surrounding the translation of research achievements by university faculty, drawing particularly on the successful experiences of universities in Silicon Valley, USA, to analyze their unique approaches in legislative support, university policies, and legal safeguard mechanisms. Concurrently, it examines the status quo of the translation of domestic research achievements in chitosan bioactive materials within the medical field, uncovering the existing legal gaps and pressing issues. By comparing domestic and international cases, this study aspires to propose targeted and feasible legal solutions and suggestions, aiming to provide theoretical support and practical guidance for optimizing the legal environment for research translation in Chinese universities. This, in turn, will promote the improvement of China's scientific and technological innovation system and enhance the country's innovation capability.

2. Legal foundations and status quo of the translation of scientific research achievements by university faculty

The translation of scientific research achievements by universities is a complex and multidimensional process, in which intellectual property law plays a crucial role^[13-15]. Intellectual property law not only protects university faculty's research achievements from illegal encroachment but also provides a legal framework and safeguards for their translation. Specifically, patent law, copyright law, and trademark law constitute the legal cornerstone for the translation of research achievements, ensuring legality and equitable distribution of rights and interests throughout the translation process^[13-15]. However, the application of intellectual property law is not without challenges; in practice, issues such as difficulty in confirming rights and high costs of rights protection pose obstacles that hinder the effective translation of research achievements to some extent.

Existing laws and regulations both support and impose certain restrictions on the translation of research achievements^[3]. On one hand, the state has introduced a series of policies and regulations, such as the "Law on Promoting the Translation of Scientific and Technological Achievements," aimed at encouraging universities and research institutions to actively translate their research achievements by simplifying approval procedures, providing financial support, and other measures to lower the barriers to translation. On the other hand, laws and regulations also pose obstacles to translation in some aspects. For example, strict restrictions are imposed on the translation of certain research achievements related to national security or

public interests, which affects the flexibility and efficiency of translation to some degree.

The translation of scientific research achievements by university faculty also faces numerous legal issues and challenges ^[16,17]. Firstly, the ownership of research achievements often leads to disputes, particularly in interdisciplinary and cross-institutional collaborative research, where fair and reasonable allocation of rights and interests becomes a significant challenge. Secondly, legal issues related to contracts during the translation process cannot be ignored. Formulating legal and effective translation contracts that ensure the rights and interests of both parties and avoid legal disputes is a crucial task in the translation process. Finally, the translation of research achievements often involves the protection of business secrets. How to protect core business secrets while disclosing research achievements is also a major legal challenge. In summary, the translation of scientific research achievements by university faculty faces numerous complex legal issues and challenges, necessitating further improvement of relevant laws, regulations, and policy support to facilitate the effective translation of research achievements.

3. Experience and legal safeguards for promoting the translation of scientific achievements in Silicon Valley universities

As a global paradigm of technological innovation, the Silicon Valley region boasts universities that demonstrate exceptional proficiency and effectiveness in the translation of scientific and technological achievements ^[10,18-20]. These universities not only possess world-class research capabilities and innovative prowess but also successfully facilitate the commercial application of numerous research achievements through a series of effective legal safeguards and policy support, injecting robust impetus into regional economic development.

The underlying laws play a pivotal role in the translation of scientific and technological achievements at Silicon Valley universities ^[21-24]. Among them, the Bayh-Dole Act stands as a landmark legislation that significantly promotes the translation of research achievements from USA universities and federal laboratories. This act allows universities and laboratories to own the patents for their research and development achievements and to license or transfer them to industry, thereby stimulating the innovative enthusiasm and translation drive of researchers. The introduction of this act has laid a solid legal foundation for the thriving translation of scientific achievements at Silicon Valley universities.

In addition to national-level legal support, Silicon Valley universities have also formulated a series of policies and legal safeguard mechanisms to promote translation ^[24-26]. These policies include establishing specialized technology transfer offices responsible for the evaluation, protection, marketing, and licensing negotiations of research achievements; establishing flexible incentive mechanisms such as equity incentives and revenue sharing to stimulate researchers' enthusiasm for translation; and fostering close collaborative relationships with industry and investment institutions to jointly drive the commercialization process of research achievements. The implementation of these policies benefits from a well-established legal safeguard mechanism that ensures the legitimacy of all parties' rights and the smooth progress of translation.

In maximizing the willingness of both universities and faculty to engage in translation, Silicon Valley universities have also developed unique programs and legal safeguards ^[22,24,25,27]. By formulating clear translation policies and revenue distribution mechanisms, universities ensure the legitimate rights and economic returns of researchers during the translation process. At the same time, universities actively provide legal consultation and assistance services to faculty, helping them resolve legal issues and disputes during the translation process. This comprehensive legal safeguard and support system greatly stimulates the

enthusiasm and creativity of both universities and faculty in participating in translation.

The successful experience accumulated by Silicon Valley universities in the translation of scientific and technological achievements has formed several important legal consensuses, which hold significant reference value for universities in other countries and regions. These consensuses include clarifying the ownership of research achievements, improving the legal and regulatory framework, establishing effective incentive mechanisms, strengthening industry-academia-research cooperation, and providing comprehensive legal safeguards and support. The extraction and summarization of these consensuses will provide valuable references for optimizing the legal environment and formulating policies for the translation of scientific achievements in Chinese universities.

4. Status quo of translation of domestic chitosan bioactive material research and development achievements in the medical field

Chitosan bioactive materials, as a new type of biomaterial with broad application prospects, have witnessed rapid research and development progress in China in recent years^[28-30]. Their unique biocompatibility, degradability, and excellent biological activity make them show great potential for applications in the medical field, such as wound repair, tissue engineering, and drug delivery. With the continuous advancement and innovation of scientific research technologies, the performance of chitosan bioactive materials has been continuously optimized, laying a solid foundation for their widespread application in the medical field.

However, despite the abundant research and development achievements of chitosan in China, its translation status in the medical field is not optimistic. On the one hand, information asymmetry between research achievements and market demand has led to many potential chitosan research achievements struggling to find suitable market positioning and application scenarios. On the other hand, issues such as funding shortages, inadequate policy support, and imperfect industry-academia-research cooperation mechanisms in the translation process have also severely constrained the effective translation of chitosan research achievements.

Legal issues and challenges cannot be ignored in the process of translating chitosan research achievements^[31-34]. Firstly, the ownership of research achievements often leads to disputes, especially in collaborative research projects involving multiple parties, where fairly and reasonably dividing the rights and interests becomes a major challenge. Secondly, contractual legal issues in the translation process cannot be overlooked. Formulating legal and effective translation contracts to ensure the rights and interests of both parties and avoid legal disputes is a problem that must be addressed during the translation process. In addition, the specificity of the medical field requires that chitosan research achievements must strictly comply with relevant laws and regulations during the translation process, such as medical device regulations and drug administration regulations, which undoubtedly increases the complexity and difficulty of translation.

Compared with universities in Silicon Valley, there is a significant gap in the translation of chitosan research achievements in China. Universities in Silicon Valley have set a benchmark in the global field of research achievement translation with their well-established legal systems, flexible policy support, and efficient industry-academia-research cooperation models. In contrast, China still needs to strengthen its legal safeguards, policy support, and industry-academia-research cooperation. For example, universities in Silicon Valley effectively promote the commercial application of research achievements by establishing specialized technology transfer offices and formulating clear translation policies; however, such mechanisms

and policies are relatively lacking or imperfect in China. Therefore, it is particularly urgent and important to learn from the successful experience of universities in Silicon Valley and strengthen the translation of domestic chitosan research achievements in the medical field.

5. Gap analysis and recommendations

In the translation process of domestic chitosan bioactive material research and development achievements in the medical field, legal deficiencies are particularly prominent. Although China has introduced a series of laws and regulations to promote the translation of research achievements, the enforcement and effectiveness of these laws and regulations in practical operations are not ideal. Especially in terms of intellectual property protection, ownership of research achievements, and distribution of translation benefits, legal provisions are often too general and lack specific implementation details, leading to frequent legal disputes during the translation process, which seriously affects the efficiency and enthusiasm for translation.

To address the urgent legal issues in the translation process of domestic chitosan bioactive material research and development achievements in the medical field, we need to clarify the direction for improvement. Firstly, we should improve the intellectual property protection system, intensify efforts to combat intellectual property infringement, and provide strong legal safeguards for the translation of research achievements. Secondly, we must clarify the ownership of research achievements and establish a fair and reasonable mechanism for rights and interests distribution to avoid legal disputes caused by unclear rights and interests distribution during the translation process. Additionally, it is necessary to simplify the approval procedures for the translation of research achievements, lower the translation threshold, and enhance the flexibility and efficiency of translation.

Based on domestic and international experience, we can propose a series of recommendations to improve the legal safeguard mechanism. Drawing on the successful experience of universities in Silicon Valley, we can establish specialized technology transfer offices responsible for tasks such as the evaluation, protection, market promotion, and licensing negotiations of research achievements, providing one-stop legal services for the translation of research achievements. At the same time, we can also establish an industry-academia-research cooperation mechanism to strengthen communication and collaboration between universities, research institutions, and enterprises, jointly promoting the commercial application of research achievements. At the legal level, we can formulate more specific and operable regulations for the translation of research achievements, providing clear legal guidance and safeguards for the translation process.

To promote the enthusiasm of university teachers and research institutions for the translation of their achievements, we also need to develop a series of legal incentive measures. For example, we can establish a reward fund for the translation of research achievements to provide material and spiritual rewards to university teachers and research institutions that make outstanding contributions during the translation process. At the same time, we can formulate tax incentive policies to provide tax reductions and exemptions for enterprises and individuals involved in the translation of research achievements, reducing the economic costs of translation. Through the implementation of these legal incentive measures, we can further stimulate the enthusiasm and creativity of university teachers and research institutions for the translation of their achievements, promoting the widespread application of domestic chitosan bioactive material research and development achievements in the medical field.

Disclosure statement

The authors declare no conflict of interest.

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