MINI REVIEW

Expanding nanomedicine industry through pharmacy education

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ABSTRACT

A vast range of different active pharmaceutical components and medication formulations are present in the developing field of nanomedicine. Their creation gives nanomedicines special properties that enhance pharmacokinetics and pharmacodynamics. They are created utilizing manufacturing methods that are biotechnology or traditional. They are physically very dissimilar from conventional small-molecule medications. The multidisciplinary team of scientists working on their research and clinical use includes pharmacists, who play a significant role. As a result, their education should enable them to comprehend the challenges involved in the development and assessment of nanomedicines. Therefore, additional exposure to this rapidly growing class of treatments should be provided to trainees, post-doctoral researchers, and student pharmacists.

Key Words: *Nanomedicine; Pharmacy; pharmacist; Nanoparticles*

INTRODUCTION

In the late 1990s, nanotechnology and nanomaterial science rapidly advanced, establishing the field of nanomedicine as a stand-alone scientific discipline [1]. For instance, over half of the nanomedicines that are currently licenced in the United States were approved within the last ten years, demonstrating the explosive expansion of these novel pharmacological therapies [2]. Nanomedicines are specifically created to bypass biologic barriers and exhibit customised pharmacokinetic and pharmacodynamic profiles to improve safety and therapeutic efficacy [3]. This is in contrast to their small-molecule parent medications. The science of nanomedicines still faces numerous obstacles and knowledge gaps, including how to define these substances most effectively, assess their intricate pharmacokinetic and biodistribution profiles, and contrast their cost-benefit analyses with those of small-molecule medications [4].

The healthcare practitioners who play the most important roles in both are pharmacists.

Using nanomedicines involves making both clinical and administrative judgments. Regarding the fundamental ideas that underlie the intricate class of nanomedicines, they are also the healthcare professionals with the best training. The development of nanomedicines is still ongoing. An innovative, forward-looking strategy should be used to include nanomedicine content in pharmacy curricula, pharmacy administration, and pharmacy education.

COVERAGE OF NANOMEDICINE THROUGH PHARMACY EDUCATION

One of the areas of medication development that is quickly evolving is engineered nanomaterials that has the ability to overcome a variety of biological constraints.

The market for pharmaceuticals is expected to develop tremendously. There is a rising trend in the creation of nanomedicines for use in treating complex diseases in clinical settings immunotherapy- and genome-related conditions.

Current and future pharmacists need to be better familiarized and equipped with essential knowledge of nanotechnology to engage in the developing demands and challenges in their professional practices and research enterprises [5]. Fundamentally, the current educational reform within professional pharmacy programs is focused on the integration of fundamental science and clinical science education to ensure that students and trainees can apply concepts bidirectionally from bench to bedside (and back). There is a relative dearth of information regarding the rate and extent to which programs cover the medical application of nanotechnology in current pharmacy and pharmaceutical sciences curricula.

A GLOBAL SNAPSHOT OF OPPORTUNITIES TO INCORPORATE NANOMEDICINE EDUCATIONAL CONTENT

1. **Studies in pharmacy in the United Kingdom**

   In Liverpool, pharmacy education has been offered since 1849 . One of the UK's oldest institutions for pharmacy study is Liverpool John Moores University. With participation from all significant stakeholders, the current four-year MPharm programme was created as a spiralling integrated curriculum [6]. As a result, scientific knowledge and abilities continue to advance while becoming more complex. The lectures, laboratory exercises, and workshops that make up the core of the MPharm program's delivery cover formulation techniques for nanomedicines utilising examples of commercially available liposomal formulations.

2. **Studies of pharmaceutical sciences in the United States**

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US Pharm D programmes have been primarily expanding their experiential and clinical curricular components—at both the introductory and advanced level—focusing on effective and safe medication utilization—since the Doctor of Pharmacy degree became a requirement for being licenced to practise pharmacy in the United States. As a result, pharmacy programmes have been created largely to educate graduates to enter the workforce, with students focusing the majority of their coursework on providing direct patient care and achieving clinical outcomes[7].

3. Studies of pharmaceutical sciences in the china

The majority of Chinese colleges and universities do not now offer separate courses in nanomedicine, but several have included concepts in related courses (e.g., pharmaceutics, advances in medicine). Many colleges and institutions offer courses on peptides, small molecules, and liposomes. For instance, the Beijing Key Laboratory of Peptide and Small-Molecule Drugs is located in the School of Pharmacy at Capital Medical University [8]. Some pharmacy students will use elective courses to assist them finish a graduation project while pursuing their master's and doctoral degrees. One of these courses, Liposome Preparation and Verification of Efficacy, examines novel techniques of administration to enhance the therapeutic effect or lessen unfavourable drug effects[9,10].

CONCLUSION

Strong foundations in the pharmaceutical sciences, together with the knowledge and skills required to understand the physiological, preclinical, and clinical aspects of drug development, have defined pharmacy education for generations. The gaps between those fields have widened in relation to nanomedicine, necessitating interdisciplinary study and methods of instruction. As a result, newly developed integrated curricula offer a chance to close significant gaps in the education of both aspiring pharmacists and research scientists.

The nanomedicine domain is expanding at a rapid rate. Because of the complexity of this class of drugs, pharmacists represent the discipline with the best aptitude to integrate pharmaceutical science, the regulatory evaluation, and clinical data to lead decision-making for patient care. Given the application of nanomedicines to a wide and diverse array of disease states, Doctor of Pharmacy curricula should be forward-thinking in their approach to including and expanding the coverage of nanomedicines. Given the density of material in pharmacy programs, innovative techniques such as co-curricular electives, student organization initiatives, and certificate programs can effectively provide didactic education on key nanomedicine concepts.

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