Teaching Reform and Exploration of Basic Molecular Biology and Experimental Technology

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Abstract. As a basic subject to explore the nature of life phenomena at the molecular level, molecular biology has been widely used in biomedical sciences, as well as in the fields of life sciences. In this study, aim to improve the teaching quality and cultivate high-quality biological innovative talents, the teaching reform from the aspects of teaching content, teaching mode and curriculum assessment methods were explored.

Introduction

Molecular biology is the science of studying the morphology, structural characteristics, importance, regularity and interrelationship of biological macromolecules such as nucleic acids and proteins. As a basic subject to explore the nature of life phenomena at the molecular level, its cross-infiltration of molecular biology with biochemistry, genetics and cell biology has strongly promoted the development of life sciences [1]. With the continuous development and improvement of molecular biology, its related theoretical knowledge and scientific research techniques have been widely used in biomedical sciences, as well as in the fields of life sciences such as agriculture, forestry, animal husbandry and fishery, which laid the foundation for the rapid development of these disciplines.

The main topics of Basic Molecular Biology and Experimental Technology include chromosome and DNA, transcription, translation, modern molecular biology research methods and techniques, prokaryotic gene expression and regulation, eukaryotic gene expression and regulation, genomics and comparative genomics, and genetic engineering principles. The focus is on DNA replication, transcription and translation, prokaryotic gene expression and regulation, eukaryotic gene expression and regulation and genomics. The basic principles of genetic engineering technology, focusing on the basic concepts and basic theories of molecular biology, while striving to reflect the latest advances in molecular biology. Especially the structure, expression and regulation of eukaryotic genes. The experimental contents include basic operations of molecular biology experiments, genomic DNA extraction and purity, DNA detection by agarose gel electrophoresis, amplification of DNA fragments by polymerase chain reaction (PCR), preparation and transformation of \textit{E. coli} competent cells, plasmid DNA extraction and identification [2].

Through the way of multimedia teaching, the basic concepts, basic principles and methods of molecular biology are emphasized, and the basic experimental operation skills of molecular biology are mastered in combination with experimental teaching. At the same time, various teaching methods, such as uninterrupted questioning, class discussion, flipped classroom, heuristic teaching, and seminar-based teaching are used in the class to improve the teaching quality of molecular biology course.

Based on the characteristics of Basic Molecular Biology and Experimental Technology and the teaching experience in recent years, the teaching reform from the aspects of teaching content, teaching mode and curriculum assessment methods were explored in this paper, in order to improve the teaching quality and cultivate high-quality biological innovative talents.
Reform of Teaching Contents

In the course content of chromosomes and DNA, RNA transcription, genetic code, protein synthesis contains many basic concepts and principles, which require students to have solid basic knowledge to be able to integrate and apply what they have learned. Therefore, in the process of teaching, the central rule is used as the entry point to expand the key points, and the concepts of the most basic concepts such as DNA and RNA can be discussed as little as possible, and students can ask questions in class if there is any problem. In terms of molecular technology, students are required to be familiar with nucleic acid gel electrophoresis, molecular hybridization, bacterial transformation, gene amplification, gene cloning, gene site-directed mutagenesis, protein interaction and other technologies, and students must master the basic operations of these techniques through molecular biology experiments.

Molecular biology is not only the most rapid and dynamic field in the natural sciences, but also the leading discipline of this century. In the introduction, highlight the development of molecular biology and genetic engineering, and the contribution to human society in the 21st century [3]. The arrangement of the course content should follow the principle of progress from shallow to deep, and each part of molecular biology should be closely connected and coherent, and the understanding of the content of the previous chapter lays a foundation for later learning, and thus to stimulate students' enthusiasm.

Exploration of Teaching Mode

At present, the teaching method of molecular biology is mainly based on multimedia, which contains large amount of information, and causes students to be unable to understand in a timely manner. Meanwhile, the same teaching model can make students feel tired and reduce their interest in learning. Therefore, the practice link is added in the teaching process, including uninterrupted questioning, class discussion, flipped classroom, heuristic teaching, seminar-style teaching. Each class leaves 40% of the time to communicate freely with students, and selects various teaching modes to interact with students according to different teaching contents to stimulate students' learning motivation and cultivate students' habit of active learning, so that teachers and students can promote each other.

In most colleges, the method of curriculum assessment of molecular biology is written examinations, and the questions focus on the memorization and memory of concepts, principles and mechanisms, but lack of some subjective questions of self-consultation type, and the overall evaluation results mainly depend on the final exam results. Such an assessment method is not conducive to the mastery of knowledge. Therefore, after each lesson is taught, the corresponding exercises are arranged to deepen and consolidate the content of the lectures. The grades of the courses are assessed by the percentage system, and the usual grades account for 50-70% (mainly attendance, classroom discipline, homework, questioning, discussion, flipped classroom), and the final exams account for 30-50%, which can comprehensively examine the students' mastery of knowledge.

Increasing Practical Teaching Hours

There are many contents in the principles of molecular biology and genetic engineering, and there are more classes in theoretical teaching and relatively few hours of practical teaching. Teachers use more hours to teach in the classroom so that students can better understand the basic concepts, regulation laws, and technical principles. While relying solely on the lectures in the classroom, students can't fully grasp the main content of the course. Therefore, it is necessary to increase the amount of practical teaching hours to 40% of the total hours. In the practical teaching class, teachers no longer focus on explaining the content of the course, but mainly on the learning activities of the students. Practical teaching can make students master the basic principles, technical operations and experimental procedures of molecular biology and genetic engineering principles through specific experimental operations. Students could deepen their understanding of the
principles of molecular biology and genetic engineering, and cultivate students' ability to conduct scientific experiments and innovative thinking independently, laying a solid foundation for follow-up study and research [4].

**Mobilizing Students' Interest**

It is very difficult for students to understand the basic concepts, regulation mechanism and fundamental of technical operation due to a wide range of content of molecular biology. Therefore, some effective measures need to be taken to stimulate students' interest in learning. First, increasing the fun of teaching. In the teaching process, often introduce some real-life examples, such as the relationship between disease and genes, the environmental safety of genetically modified organisms, the safety of genetically modified foods, the diversity of life worlds and the consistency of life essence. These examples contain knowledge of the principles of molecular biology and genetic engineering. Second, improving the teaching ability and allowing students to continuously acquire new knowledge and successfully apply it to practice, and students will feel interested and the teaching effect will be better. Third, communicating with students frequently. Teachers should try to understand the interests of students and help students understand the practical significance and future development of learning molecular biology and genetic engineering principles. And fourth, establishing the correct concept of students. Some students may think that this course is not very useful for their own work in the future which leads to poor teaching effect. Therefore, teachers should follow the guidance and encouragement in the teaching process to help students establish correct learning concepts.

**Summary**

Molecular biology is a basic subject to explore the nature of life phenomena at the molecular level, which has been widely used in biomedical sciences, as well as in the fields of life sciences. According to the characteristics of Basic Molecular Biology and Experimental Technology and the teaching experience in recent years, the teaching reform about teaching content, teaching mode and curriculum assessment methods were explored to improve the teaching quality and cultivate high-quality biological innovative talents.

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