

# Construction of Molecular Biology and Experiment Case Library for Graduate Students

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**Abstract** Molecular Biology and Experiment is considered fundamental for graduate students specializing in aquaculture at Guangdong Ocean University. This discipline focuses on the examination of the structure and function of macromolecules, including proteins and nucleic acids. Moreover, it elucidates biological phenomena and principles at the molecular level, making it an essential foundational course for students pursuing various biology majors. As a foundational course for the basic application of aquaculture, Molecular Biology and Experiment requires guidance through numerous examples and cases. However, there are several challenges to address in developing the case library. Consequently, a case library has been established to meet the course requirements of Molecular Biology and Experiment for modern graduate students, with the central goal of reforming the educational model of higher education institutions and enhancing the effectiveness and quality of talent development. This strategy is designed to nurture highly skilled professionals who can address the current needs of the industry.

**Key words** Case library, Molecular biology and experiment, Aquaculture major

## 1 Introduction

With the advancement of China's reform and opening-up policies and the increasing pace of global economic integration, aquaculture is playing an increasingly significant role in the advancement of the social economy. For graduate students in this major, the primary aim of their education is the cultivation of practical competence. The extent of practice, whether high or low, is intricately linked to the assessment of the master's training quality. Consequently, it has emerged as a significant concern to be tackled in the instruction of aquaculture courses by adeptly merging theoretical knowledge with hands-on practice to elevate the practical ability of graduate students.

The case teaching method, an exploratory teaching mode based on practical experience, is ideal for practical courses. It focuses on solving practical problems in simulated real situations, allowing students to actively gain broader knowledge and a deeper understanding from typical cases. This teaching mode and talent training approach break through traditional book-centered teaching, making students the focal point of learning activities. It encourages independent, cooperative, research, and exploratory learning. The case teaching method is essential for developing highly skilled professionals globally<sup>[1]</sup>. While widely used in various fields, such as management, engineering, law, and medicine, it is still in the early stages of implementation in molecular biology

and experimental teaching for aquaculture graduate students.

Modern biology and experimental technology is an essential course for graduate students majoring in aquaculture. The course covers theoretical knowledge of molecular biology and practical experimental techniques, emphasizing practical application<sup>[2–3]</sup>. Hence, systematically summarizing and analyzing typical cases in modern biology, building a comprehensive teaching case library, and effectively using it in aquaculture graduate student courses are crucial for enhancing students' mastery of modern biology technologies and improving their experimental skills. This effort will enhance China's professional teaching case resources and help train skilled aquaculture professionals.

## 2 Significance and function of the construction of Molecular Biology and Experiment case library

**2.1 Inspiring students' enthusiasm** Traditional Molecular Biology and Experiment teaching often uses a one-way approach, leading students to passively accept abstract theoretical knowledge. This method can make complex molecular biology challenging and boring for students. This paper introduces specific biological cases, like *Vibrio* gene expression, to integrate theoretical knowledge with practical applications. Students become active participants who engage in critical thinking, summarizing, and problem-solving. This teaching method not only sparks students' interest and motivation but also enhances their independent problem-solving skills.

**2.2 Improving students' learning ability** The pedagogical approach of aquaculture molecular biology represents an innovative method that integrates theoretical principles with practical applications, encouraging students to explore aquatic organisms through the lens of molecular biology. Students are tasked with addressing

Received: April 15, 2024 Accepted: July 22, 2024

Supported by Degree and Graduate Student Education Reform Research Project of Guangdong Ocean University (202315, 202416).

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real-world challenges encountered in aquaculture by applying their theoretical knowledge. This instructional strategy aims to enhance students' problem-solving skills and critical thinking abilities. By prompting students to analyze, deliberate, and resolve issues within case studies, they can develop a propensity and capacity for independent thinking. Concurrently, students will experiment with novel approaches and concepts while tackling problems, thereby enhancing their learning aptitude and overall competencies.

**2.3 Accelerating the reform of education and teaching** The establishment of a case library holds significant importance in the field of aquaculture. It serves to emphasize the influential role of the course teaching resource library in education, training, and production guidance. Furthermore, it facilitates the development of a tailored teaching resource library that corresponds with the specific characteristics of the discipline. The creation of these resource libraries has been instrumental in advancing educators' educational concept, fostering innovative teaching approaches, enhancing teaching materials, and expediting educational reform. Moreover, it offers valuable insights for the establishment of similar course resource libraries.

**2.4 Realizing extensive sharing of teaching resources** The case library serves not only as a valuable resource for teaching purposes but also offers a useful reference for the development of other course resource libraries. By creating a comprehensive network sharing platform, the case library can offer its services to individuals in the aquaculture sector nationwide, presenting a broad spectrum of potential applications.

**2.5 Improving teacher's teaching level** The establishment of a Molecular Biology and Experiment case library necessitates educators within the course group to delve into the developmental concept of the course resource library and integrate this notion into their teaching methodologies. This ongoing process of learning and practical application serves to enhance the professional skills and knowledge base of educators, thereby fostering the development of a proficient teaching team. Furthermore, educators within the course group must consistently enhance and refine the case materials within the library to align with the evolving demands of education and societal progress. This continual cycle of learning and practical application enhances the overall quality and instructional standards of educators, thereby positively impacting the cultivation of exceptional talents.

### 3 Status quo and challenges of the construction of Molecular Biology and Experiment case library

Molecular Biology and Experiment is essential for graduate students specializing in aquaculture. It aims to investigate the structure and function of biological molecules like proteins and nucleic acids, thus elucidating life phenomena and biological principles. This course holds significant importance as a fundamental professional course for biology students. The teaching of Molecular Biology and Experiment should integrate abundant examples and cases. However, the development of a case library encounters

several challenges. Firstly, the course content is highly theoretical and abstract, lacking specific illustrative examples. Consequently, students find it challenging to comprehend the key knowledge points, leading to a perception that the subject is disconnected from real-life applications. This cognitive disparity results in low class engagement and a lack of motivation for learning.

Secondly, the rapid advancement of molecular biology and the continuous evolution of technical methodologies have led to a growing need for experimental teaching equipment. However, due to the influence of conventional academic graduate teaching paradigms, the resources allocated to experimental teaching equipment in aquaculture graduate student training programs are limited. Moreover, molecular biology experiments are time-consuming, and the scarcity of relevant courses further complicates case-based teaching. Furthermore, educators in higher education institutions have not yet fully recognized the significance of case teaching in Molecular Biology and Experiment. As a result, the development of case libraries has been sluggish and inadequate.

Thirdly, the teaching cases in Molecular Biology and Experiment course are primarily sourced from production practice, clinical practice, newspapers, magazines, and other relevant channels. Nevertheless, inadequate teaching experience among instructors may lead to inappropriate selection, processing, and presentation of cases. This can manifest in cases with complex backgrounds and a wide array of issues, which may overwhelm students due to their limited knowledge base and clinical exposure. Consequently, the development of a comprehensive case library that is both rich and practical, aligning with students' cognitive abilities, emerges as a critical objective in the teaching of Molecular Biology and Experiment course.

### 4 Building practice of case library

**4.1 Purpose** The characteristics of professional education for graduate students in aquaculture are thoroughly examined through extensive research. A case library has been established to meet the course requirements of Molecular Biology and Experiment for modern graduate students, with the central goal of reforming the educational model of higher education institutions and enhancing the effectiveness and quality of talent development. This strategy is designed to nurture highly skilled professionals who can address the current needs of the industry.

**4.2 Main task** (i) The feasibility and positioning analysis of the case library; (ii) the composition, content and structural analysis of the case library; (iii) the sharing and management mechanism of the case library.

**4.3 Implementation plan** The survey provides a comprehensive insight into the attributes and needs of professional education in aquaculture, outlining the fundamental objectives of nurturing skilled individuals that align with current requirements. Centered around Molecular Biology and Experiment course, the survey systematically devises and organizes the contents, resolutions, and structure of a case library tailored to regional features. It advocates

for the exploration of innovative teaching approaches and methodologies that seamlessly incorporate modern information technology to enhance the evolution and enhancement of the educational framework in higher education institutions. This, in turn, aims to enhance the quality and efficacy of personnel development.

**4.4 Implementation plan** (i) Teaching objective of Molecular Biology and Experiment and positioning analysis of the case library. The team members engage in discussions to elucidate the teaching mode and positioning strategy of the case library in alignment with local industry characteristics and talent demands, based on the teaching objectives of Molecular Biology and Experiment. (ii) Acquisition, organization, and evaluation of local characteristic teaching resources. A comprehensive survey, systematic collection, classification, and in-depth analysis of local teaching resources relevant to the Molecular Biology and Experiment course will offer substantial material support for the design and development of the characteristic case library. (iii) Development, strategic planning, and content analysis of the characteristic case library. By adhering to the course outline of Molecular Biology and Experiment, the effective integration of teaching materials and local teaching resources that reflect local teaching resource characteristics is explored to create a teaching case with regional attributes. (iv) Dissemination and management mechanism of the case library. The creation of a script and operational plan for the case library is essential for studying the sharing and management mechanisms, ensuring the efficient utilization and broad dissemination of the case library.

#### 4.5 Implementation effect, application and promotion value of the case

**4.5.1 Implementation effect.** After two years of meticulous development, a total of 44 Molecular Biology and Experimental teaching cases have been finalized, with four cases thoughtfully crafted for each section.

**4.5.2 Application and promotion value.** The establishment of the Molecular Biology and Experiment case library serves as a valuable reference for developing aquaculture professional teaching resource libraries. It offers scientific guidance and practical examples for creating similar resources in other courses. The teaching

resource library created will be accessible across the province and potentially nationwide, offering high-quality educational materials to various regions and educational institutions. Teachers within the course groups have not only familiarized themselves with the development principles of the resource library but have also implemented them during the construction phase of Molecular Biology and Experiment. This integration has enhanced the teaching proficiency of educators and the overall development of the professional teaching team.

## 5 Conclusions

The training of aquaculture students plays a crucial role in developing advanced aquaculture professionals with essential skills such as independent thinking, scientific decision-making, and clinical practice abilities. This training aligns with the objective of nurturing "high-level and applied" fishery talents in China. Case teaching, recognized as an effective teaching approach, is instrumental in achieving this objective. However, the development of a case library for the Molecular Biology and Experiment course is still in its early stages, lacking well-established samples for reference. This research endeavors to establish a case library for Molecular Biology and Experiment to offer new insights for creating similar cases. Nevertheless, it is acknowledged that there are areas for improvement in the current case library. Collaboration with additional universities and enterprises is anticipated to enhance the quality and practicality of Molecular Biology and Experiment teaching, thereby fostering the growth of exceptional high-level applied talents in the aquaculture sector in China.

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