

Exploration and Practice of Ideological and Political Teaching Construction for Biochemistry Course in Agricultural Colleges and Universities

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Abstract Biochemistry is a fundamental core course in disciplines such as agriculture, forestry, medicine, animal husbandry, veterinary medicine, and food science. By prioritizing "educating people" in the teaching process of this professional course, we can unearth diverse ideological and political elements related to agricultural production practices within the curriculum knowledge system and the forefront of discipline development. Exploring various teaching methods and utilizing diverse teaching tools are effective strategies to achieve ideological and political education that silently influences students in the field of biochemistry. The goal is to nurture students' strong ideals and beliefs, fostering a deep connection to the sentiments of "agriculture, rural areas and farmers in a great nation." This approach aims to instill a sense of responsibility towards strengthening agriculture, shaping students into individuals from South China Agricultural University who possess lofty aspirations and the courage to shoulder responsibility in the new era.

Key words Biochemistry; Curriculum ideology and politics; "Agriculture, rural areas and farmers in a great nation"; Rural revitalization; Exploration and practical application

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At the national conference on ideological and political work in colleges and universities, General Secretary Xi Jinping put forward that "strengthening moral education and cultivating people should be the central link, and ideological and political work should be conducted throughout the whole process of education and teaching, so as to realize the whole process and all-round education". Meanwhile, he pointed out that "all kinds of courses and ideological and political theory courses go in the same direction, forming a synergistic effect"^[1-2]. *Guiding Outline of Curriculum Ideological and Political Construction in Colleges and Universities* issued by the Ministry of Education clearly points out that it is necessary to comprehensively promote construction of curriculum ideology and politics, guide values into knowledge imparting and ability training, and help students cultivate and shape a correct outlook on world, life and values. In the new era of strengthening ideological and political education, it is required to take "educating people" as the core in the teaching process of professional courses, and establish a systematic and three-dimensional curriculum ideological and political system, which gives full play to the educational function of professional courses and make professional education and ideological and political education go hand in hand and complement each other^[3]. Therefore, it is necessary to integrate the new concept of ideological and political teaching into the teaching process of biochemistry in agricultural universities. Our South

China Agricultural University is a university with the characteristics and advantages of agriculture, and it is necessary to strengthen the education of ecological civilization in teaching and guide students to establish and practice the concept of lucid waters and lush mountains are invaluable assets; and attention should be paid to cultivating students' feelings of "agriculture, rural areas and farmers in a great nation" and guiding students to take it as their responsibility to strengthen agriculture and promote agriculture. As a basic course for all majors in agricultural colleges and universities, biochemistry course must tap more ideological and political elements from the teaching of biochemistry course, especially teaching cases of biochemical theory and new technologies closely related to the practical application of agricultural production, enhance students' sense of mission and responsibility in serving the modernization of agriculture and rural areas, and cultivate innovative talents for promoting rural revitalization.

Importance of Ideological and Political Teaching for Biochemistry Course in Agricultural Colleges and Universities

Basis of ideological and political teaching with agricultural characteristics for biochemistry course

The biochemistry course of South China Agricultural University was founded in 1983. Carrying out the ideological and political construction and practice with biochemistry course as a carrier has following characteristics and advantages: ① the course has a wide teaching range. Nearly 4 000 students from more than 30 majors such as biology, agriculture, forestry, medicine, animal husbandry and veterinary food take biochemistry course every year, which provides support for the cultivation of outstanding biological talents in agriculture, forestry, medicine, animal husbandry,

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veterinary food and other majors of South China Agricultural University. ② The course is taught early. As a professional basic course, it is usually started in the second or third semester of college life. The ideological and political education in the biochemistry course can guide students to establish the professional concept of strengthening agriculture and promoting agriculture from the fields of agriculture, forestry, medicine, animal husbandry, veterinary medicine, and food as early as possible, and it can help students establish a correct outlook on life, world, and values, and cultivate students' feelings of "agriculture, rural areas and farmers in a great nation", and social responsibility to serve rural revitalization. ③ The course is rich in content and diversified in ideological and political elements. The biochemistry course consists of theoretical lessons and experimental lessons, and the teaching content is not only close to the frontier field of life science, but also closely linked with the practical application of agricultural production, so the agricultural characteristic ideological and political elements of the course are rich and diversified. ④ The teaching materials of the course are excellent. Biochemistry (4th edition) is a textbook planned by the Ministry of Agriculture and Rural Affairs in the 13th Five-Year Plan and the 14th Five-Year Plan for of General Higher Education. It was edited by Wu Guanghong, the chief editor of our department, and other teachers. The textbook won the National Excellent Textbook Award for Agricultural Education (2017 and 2023), and it was used by more than 20 universities and agriculture-related vocational colleges in China. ⑤ The effect of online and offline mixed teaching has a wide range of radiation. Biochemistry massive open online course (MOOC) has implemented online and offline mixed teaching in the public platform of Wisdom Tree Online Education in 2019, and is also an online open course alliance of Guangdong-Hong Kong-Macao Greater Bay Area universities. In 2023, it was awarded the title of "Excellent Course" of Wisdom Tree Network. A total of 10 semesters were held, involving a total of 14 800 students, 13 elective schools and 380 schools to which students belong. ⑥ The curriculum infrastructure has achieved fruitful results. The course was approved as "Guangdong Excellent Resource Sharing Course" in 2013; in 2015, it was approved as "Guangdong Teaching Team"; the "Biochemistry Experiment Skills Competition" established was upgraded to Guangdong Provincial Discipline Competition; in 2020, it won the "Guangdong Provincial Biochemistry Online and Offline Mixed First-class Course"; and in 2023, the biochemistry course became a national first-class undergraduate course—online and offline mixed first-class undergraduate course. The achievements of these curriculum infrastructure construction provide a strong guarantee for carrying out ideological and political teaching and cultivating innovative agricultural talents.

Significance of ideological and political teaching with agricultural characteristics for biochemistry course

Biochemistry is the chemistry of life, and it is a subject that uses chemical theories and methods to study life phenomena and

explain the chemical nature of life phenomena. Biochemistry is a basic compulsory course for biological science, biotechnology, agriculture, forestry, medicine, animal husbandry and veterinary food, as well as a basic core course, and it is a bridge connecting genetic breeding, agricultural product processing, agricultural biotechnology, plant protection, plant pathology, fruit science, vegetable science, food engineering, animal husbandry and veterinary medicine and other professional courses. Through the study of biochemistry course, students can systematically master knowledge such as structures and functions of biological molecules, material metabolism and regulation, and the transmission and expression of genetic information. It can cultivate students' ability to analyze and solve related problems in agricultural production practice applying the principles and techniques of biochemistry, and explore their innovative thinking ability in exploring cutting-edge issues in agricultural scientific and technological innovation and development^[4-5]. Ideological and political education in the biochemistry course is carried out by combining the characteristics of agricultural colleges and universities, using biochemistry professional knowledge as a carrier, and integrating patriotism and cultural confidence into teaching, so as to cultivate students to establish a strong feeling and lofty ideals of "agriculture, rural areas and farmers in a great nation" and encourage them to strengthen agriculture and promote development. It also aims to cultivate students' scientific thinking and innovative consciousness, and guide students to shape a good outlook on values and professional spirit of serving rural revitalization. Students are cultivated to uphold a pragmatic spirit and practice the mission of strengthening agriculture. It is of great significance for implementing the fundamental task of strengthening moral education and cultivating people, and ensuring that educational work runs through the entire process of education and teaching.

Exploration of Ideological and Political Teaching for Biochemistry Course in Agricultural Colleges and Universities

The teaching content of biochemistry course can be divided into three parts. The first is basic theoretical learning, also known as static biochemistry, which studies the material basis that makes up living organisms, as shown in Chapters 2 to 6 of Table 1. The second part is metabolic biochemistry, which includes sugar metabolism, lipid metabolism, protein and amino acid metabolism, nucleic acid and nucleotide metabolism. The third part is the synthesis and regulation of biological macromolecular nucleic acids and proteins. At the same time as imparting professional knowledge in the biochemistry course, a new teaching system that is organically integrated with ideological and political education has been added, with a particular emphasis on the new teaching system of agricultural characteristic ideological and political elements added to the curriculum (Table 1). In Table 1, there are a total of seven aspects of ideological and political elements with agricultural characteristics in the biochemistry course. Firstly, the

reference of values is to integrate the socialist core values of rural revitalization into the teaching process of each chapter, so as to cultivate students to establish a correct outlook on life and values and a strong feeling and lofty ideals of "agriculture, rural areas and farmers in a great nation" and encourage them to strengthen agriculture and promote development. Emphasis is placed on teaching the forefront and innovation of agricultural technologies.

Through the integration of cutting-edge professional knowledge with modern agricultural production needs, we aim to enhance the knowledge and technical reserves and theoretical literacy of agricultural college students for knowing agriculture, and cultivate top-notch innovative agricultural talents in response to the needs of agricultural scientific and technological progress and industrial development.

Table 1 Teaching outline of ideological and political elements with agricultural characteristics for biochemistry course (partial)

Teaching content	Ideological and political elements with agricultural characteristics	Supported curriculum objectives
Chapter 1 Introduction to life science		
1 Definition of biochemistry and contents of research	(1) Establishing the Socialist Core Values of Scientific Outlook on Development and rural revitalization;	This chapter focuses on the basic concepts and new advances in biochemistry, laying a foundation for following chapters.
2 Brief history of biochemistry development	(2) Establishing dialectical thinking and dialectical materialism;	
3 Application and prospects of biochemical technologies in agriculture	(3) Enhancing students' national pride, cultivating the feelings of "agriculture, rural areas and farmers in a great nation", and taking strengthening agriculture and promoting agriculture as their responsibility;	Students will master knowledge about molecular structures of nucleotides and nucleic acids, especially the spatial conformation of DNA, and further understand the physical and chemical properties of nucleic acids and the application of nucleic acid technologies in agriculture.
Chapter 2 Nucleic acid chemistry	(4) Paying attention to? the frontier of agricultural science and technology, cultivating students' spirit of exploration and scientific spirit of looking for the truth and being pragmatic;	
1 Chemical composition and structures of nucleotides	(5) Focusing on agricultural science and technology innovation, cultivating students' innovation awareness and improving their scientific literacy;	Students will master the molecular structures of amino acids and proteins, especially the spatial conformation of proteins, and further understand the physical and chemical properties of proteins and the application of their technologies in agriculture.
2 Molecular structure of DNA	(6) Paying attention to the social hotspots of agricultural development and cultivating students' sense of social responsibility in serving rural revitalization;	
3 Molecular structure of RNA	(7) Cultivating students to become new talents "knowing and loving agriculture" and willing to facilitate "strengthening agriculture and promoting agriculture" .	Students will master the composition, structural characteristics, and properties of enzymes, especially the catalytic mechanism of enzymes and kinetics of enzymatic reactions, and further understand the enormous application potentiality of enzymes in agriculture.
4 Important physical and chemical properties of nucleic acids and their application in agriculture		
5 Application of nucleic acid technologies such as molecular hybridization in agriculture		Students will master the concepts of vitamins and coenzymes, further understand the structural characteristics of water-soluble B vitamins and functions of coenzyme, as well as their application in agricultural production.
Chapter 3 Protein chemistry		
1 Composition and structures of amino acids		Students will master the concept of biological oxidation, especially the mechanisms of electron transfer chain and oxidative phosphorylation, and further understand its enormous application potentiality in agriculture.
2 Molecular structures of proteins		
3 Important physical and chemical properties of proteins and their applications in agriculture		
4 Research techniques for proteins and their applications in agriculture		
Chapter 4 Enzymology		
1 Composition, structural characteristics and properties of enzymes		
2 Catalytic mechanism of enzymes		
3 Kinetics of enzymatic reactions		
4 Activity determination and separation and purification of enzymes and their application in agriculture		
Chapter 5 Vitamins and coenzymes		
1 Structural characteristics of important water-soluble vitamins and the role of coenzymes		
2 Structural characteristics of fat-soluble vitamins		
3 Application of vitamins and coenzymes in agricultural production		
Chapter 6 Biological oxidation and energy conversion		
1 Overview of biological oxidation		
2 Electron transport chain of mitochondria and its oxidation system		
3 Oxidative phosphorylation		
4 Other terminal oxidation systems		
5 Application of biological oxidation mechanism in agricultural production		
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Practice of Ideological and Political Teaching for Biochemistry Course in Agricultural Colleges and Universities

Innovative practice of ideological and political teaching with silent transforming influence for biochemistry course

The report of the 20th National Congress of the Communist

Party of China pointed out: "The construction of a strong agricultural country will be accelerated and the revitalization of rural industries, talents, culture, ecology and organization will be solidly promoted." [2,6]. How should we implement the spirit of the 20th Party Congress? In order to promote rural revitalization and cultivate outstanding talents in agriculture, forestry, medicine, animal husbandry, veterinary food and other fields, we have carried out a

series of teaching reform practices in the biochemistry course, integrated and innovated resources from clear course objectives, superior course resources and distinctive agricultural characteristic course ideological and political system, and established a new model of ideological and political teaching in the biochemistry course with silent transforming influence (Fig. 1). In the process of professional knowledge teaching of biochemistry course, the ideological and political teaching goal with agricultural characteristics is integrated silently. The specific methods are as follows: first, we should cultivate students to set up lofty ideals and aspire to strengthen agriculture and promote agriculture. University students in South China Agricultural University should aim high and keep in mind the mission of strengthening agriculture and rejuvenating agriculture, shoulder the heavy responsibility of strengthening agriculture and rejuvenating agriculture through science and technology, and integrate their personal growth and progress into the torrent of the times of promoting national development and national rejuvenation. Second, we should cultivate students to inherit red blood and deeply implant the feelings of "agriculture, rural areas and farmers in a great nation". Students in South China Agricultural University should follow the example of the older generation of scientists in South China Agricultural University, such as Acade-

mician Ding Ying and Academician Wing Gen Lou, inherit the red genes and continue the red veins, breathe with the times for the development of "agriculture, rural areas and farmers", and share the destiny with the motherland. Third, we should train students to practice excellent skills and bravely climb the peak of science and technology. As the successors of the cause of "agriculture, rural areas and farmers", the students of South China Agricultural University should practice their internal capacity, enhance their ability, and thus obtain sufficient reserves of knowledge and ability, in order to undertake the glorious mission of "knowing and loving agriculture, strengthening agriculture and promoting agriculture". Fourth, we should cultivate students to uphold the pragmatic spirit and practice the mission of strengthening agriculture. Students of South China Agricultural University should carry forward the fine tradition of hard work and pragmatism accumulated by their alma mater in the past century, inherit the "Ding Ying spirit" of "studying hard and firmly and being sensible and moral, and practicing in person". They should stand on solid ground, work hard, dare to think and act, and use the power of science and technology to promote modernization of agriculture and rural areas to take a new step.

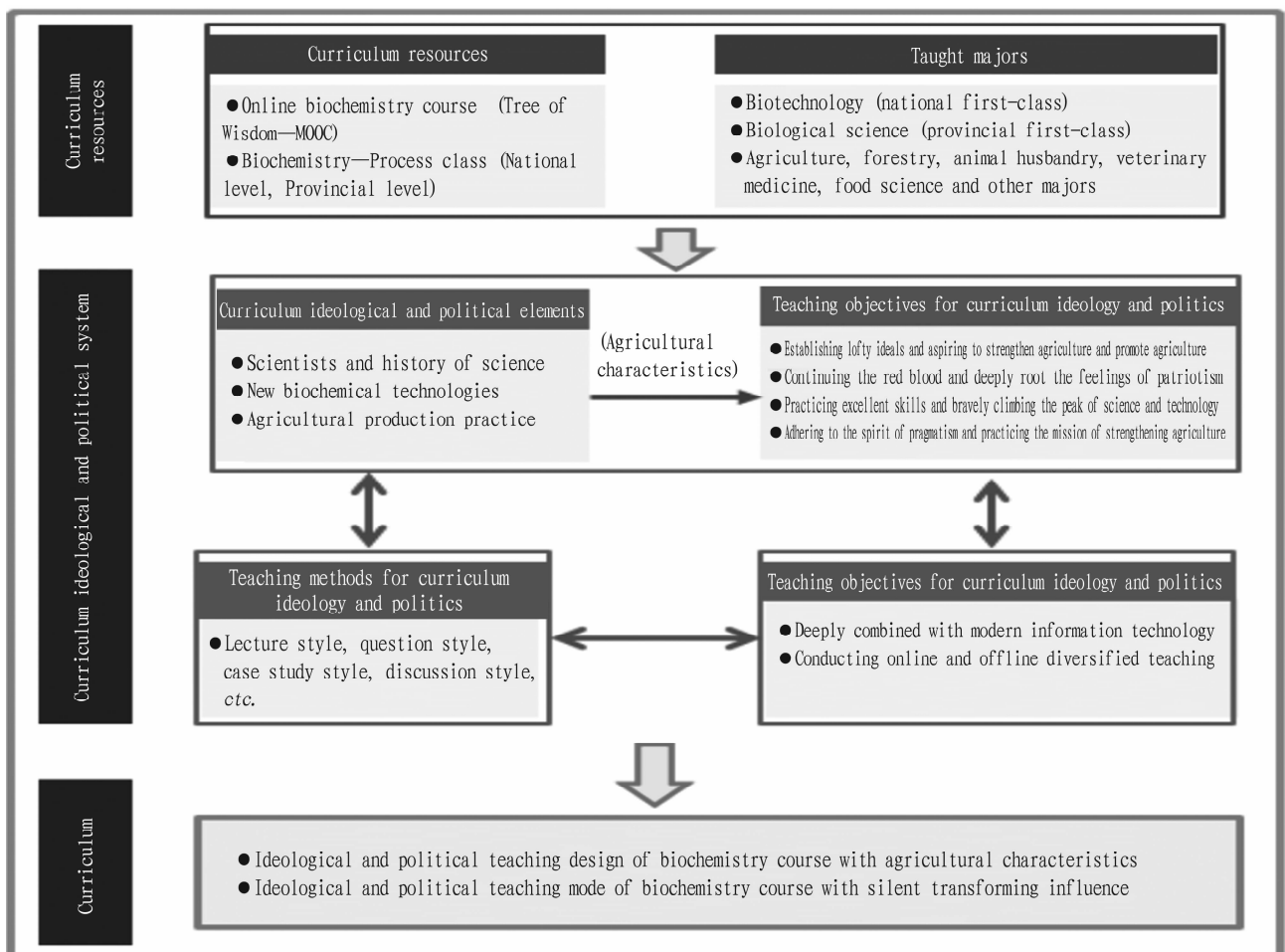


Fig. 1 A new mode of ideological and political teaching in biochemistry course

Exploration and establishment of diversified ideological and political teaching carriers and cases with agricultural characteristics for biochemistry course

One concern about introducing ideological and political education into the classroom is that it will occupy the time for teaching professional knowledge, while blended online and offline teaching mode can help to explore the "second classroom" of ideological and political education in the classroom, and subtly integrate ideological and political elements into professional course learning. South China Agricultural University has already established online MOOC teaching on the Wisdom Tree Online Education Public Platform for biochemistry course from 2019, and carried out blended online and offline teaching. In 2023, it became a first-class undergraduate course in the national blended online and offline teaching. For exploring and establishing diversified carriers for ideological and political education in biochemistry course with agricultural characteristics, the first is to emphasize the guidance role of offline teachers in mixed teaching. The mixed online and offline teaching model emphasizes taking students as the main body and teachers as the leading factor. In the online class, teachers throw a brick to allure a gem, and through the teaching of biochemical knowledge points, students are inspired to think deeply about ideological and political elements. The second is to pay attention to online discussion among students. Online learning gives students more free time and space to study, and thus, they can better grasp the initiative in learning. On the one hand, more ideological and political elements, cases and reading resources are added to the biochemistry MOOC. On the other hand, students are organized to discuss ideological and political elements and case topics related to knowledge points online in small groups, so as to expand relevant knowledge in a subtle way. And teachers help students cultivate the feelings of "agriculture, rural areas and farmers in a great nation" and establish a correct outlook on world, values and life with "enthusiasm, love and patience".

During the construction of the national first-class biochemistry course in South China Agricultural University, a large number of ideological and political elements and teaching cases have been accumulated, especially cases about the application of cutting-edge new technologies and achievements related to the course in agricultural production, which have been gradually applied to teaching. Case 1 is Chapter 6: Ideological and political teaching case of biological oxidation—Introducing ecological civilization construction, in which students are guided to pay attention to ecological civilization and sustainable development, and then online or offline classroom discussions are conducted. The topics discussed include: How can we protect forests, the earth and the atmosphere? How can we develop the economy without damaging the environment? Through thinking and discussion, we should guide the outlook on values into knowledge imparting and ability training, and deeply root the ecological civilization construction and sustainable development concept of "Green Beauty Guangdong" in students' hearts. Case 2 is Chapters 9 and 10: DNA replication, RNA transcription, protein translation and expression, which are the main contents of genetic information transmission and expression of organisms. In the teaching of these chapters, a variety of ideological and political

cases related to new technologies applied to agricultural production practice are introduced, such as: from Academician Ding Ying, the "father of rice science in China" of South China Agricultural University, to Academician Lu Yonggen, an outstanding member of the Communist Party of South China Agricultural University, and then to Academician Liu Yaoguang of South China Agricultural University. The teams of these three academicians have been conducting research on key characters such as the protection and utilization of rice seed resources and the utilization of hybrid rice heterosis for a long time, successfully revealing the basic scientific problems of molecular genetics such as rice development, fertility regulation and photosynthetic efficiency, and developing a series of biological breeding technologies, which have provided strong support for scientific research and germplasm innovation in China. Professor Tang Xiangru from South China Agricultural University promoted the cultivation techniques of fragrant rice to help build a brand of high-quality Simiao fragrant rice in Xingning, Guangdong Province. The team of Professor Huang Xuming from South China Agricultural University promoted "new litchi and longan varieties and high grafting techniques for replacing cultivar" for local fruit farmers in Gaodong Village, Lianrao Town, Chaozhou City, Guangdong Province. Professor Qin Yonghua from South China Agricultural University promoted the grafting technique of dragon fruit to local fruit farmers in Conghua District of Guangzhou. In the process of teaching these diversified ideological and political cases, we should follow the example of our alma mater scientists, inherit the red genes and continue the red veins. We should pay attention to characteristic teaching that closely combines the teaching of course professional knowledge with production practice and the modernization of agriculture and rural areas. And we should cultivate outstanding agricultural and forestry talents who help rural revitalization as their own responsibility and serve rural revitalization, so as to truly promote agricultural efficiency, increase farmers' income, and comprehensively promote rural revitalization.

Conclusions

With the implementation of the rural revitalization plan in contemporary China and the rapid development of modern agriculture, there is an increasing need for high-level talents who know technology and volunteer to contribute to rural revitalization and development to participate in the tide of agricultural construction in the new era^[4,7]. To this end, we continue to explore the reform of ideological and political teaching in the biochemistry major course in agricultural colleges and universities, improve teachers' awareness of ideological and political teaching, and actively explore and tap ideological and political elements and case resources of the course which are integrated with professional knowledge in a diversified manner in the process of teaching complicated basic knowledge of biochemistry. All these efforts are to enrich teaching content, innovate teaching carriers and methods, and make students' professional knowledge and ability improve with cultural quality education. In a word, we aim to cultivate students who are willing to shoulder the glorious mission of "knowing and loving agriculture,

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strengthening and promoting agriculture", and to cultivate a large number of high-quality talents for promoting rural revitalization.

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