

Teaching exploration of Frontier content of developmental biology course

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Abstract: developmental biology, as a professional elective course for senior undergraduate students, is the frontier course of life science and one of the most active fields of current research. The talent training goal of this major is to improve students' comprehensive quality and consolidate students' professional foundation and practical ability. From the current situation of developmental biology teaching, this paper discusses in detail how to effectively integrate the latest research trends and hot issues in teaching, summarizes the methods and means of developmental biology classroom teaching, as well as the reform of assessment methods, and puts forward suggestions on how to further improve the quality of teaching.

Key words: developmental biology; Frontier; teaching

The research of developmental biology can be traced back to more than 2000 years ago. Ancient China mastered and applied chicken artificial hatching technology earlier than European and American countries, and there is a record of "hatching in the first month" in historical data. In the 5th century BC, Harvey, an ancient Greek doctor, observed the development of chicken embryos day by day and wrote the book on the occurrence of animals, which is the first book on the development of organisms in human history. This is considered to be the rudiment of developmental biology. In 384 BC, Macedonian Aristotle made the first systematic study of development, and then there was a dispute between pre embryonic theory and post embryonic theory. Later, developmental biology studies the formation of living embryos, from spermatogenesis and oogenesis to fertilization, cleavage, gastrula, and three germ layer formation, which forms the content of classical developmental biology research. Since then, with the gradual improvement of cell theory and theory, it has been gradually realized that eggs and sperm are cell structures. Genetics and molecular genetics have further developed. The core of development is inheritance, which is realized through the development process. Since the 1980s and 1990s, many important advances in the field of biology have been closely related to developmental biology. Now, many colleges and universities at home and abroad have introduced and opened this course, which has been opened in comprehensive universities, normal universities, medical colleges, agricultural and forestry colleges and other related disciplines. The teaching objects include undergraduate students, master students and other levels.

1 The present situation of teaching and the necessity of reform

Since 2015, several rounds of teaching have been completed in the normal biological science specialty. According to the actual problems in the teaching process, the research group, after discussion and analysis, has summarized several Reform Opinions on this course:

1. Teaching materials

Combined with the actual situation, online and offline hybrid teaching methods are adopted in teaching, high-quality network resources and courseware are reasonably used for pre class preview, heuristic teaching method, problem-based teaching method and classroom discussion teaching method are used in class, and multimedia courseware, animation, video and other teaching methods are combined to understand the basic concepts, research contents and basic methods of developmental biology course, Stimulate students' interest in learning, improve students' ability of active learning and in-depth learning, and have the ability to analyze and solve problems. Through mining and sorting out excellent ideological and political materials at home and abroad in the teaching content of developmental biology, carry out ideological and political education, cultivate students' critical thinking, and establish the concept of lifelong learning, so as to ensure the achievement of goals.

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2. Teaching methods

In the process of teaching, guiding students to form a systematic knowledge system is inseparable from more appropriate teaching methods, in order to fully reflect the educational concept of “taking students as the main body and teachers as the leading role”.

(1) Traditional classroom teaching

Teachers use a variety of means and multimedia technology to carry out traditional classroom teaching. Traditional classroom teaching is the most basic, direct and effective of all teaching methods. Through the teacher’s explanation, the teaching purpose of “preaching, teaching and solving doubts” is achieved. In the process of direct communication between teachers and students, the teacher’s personality charm is used to infect students, so as to achieve the ideological and political effect of “moistening things silently”, and also make students intuitively feel the organization of teaching. The structure of the classroom and the practical application of teaching methods include both “oral teaching” and “personal teaching”.

(2) Blended teaching

Teachers carry out online and offline teaching with the combination of chapter knowledge points and course Ideological and political education, and drive students’ independent inquiry, participate in group cooperation, and complete relevant course tasks and goals through the design of questions / tasks.

(3) Case teaching method

Select relevant cases with strong pertinence, conduct in-depth analysis, and put forward thoughtful questions. Under the guidance of teachers, through the two-way interaction between teachers and students, gradually deepen, draw conclusions and put forward solutions to problems, so that students can obtain specific and vivid developmental biology knowledge, stimulate students’ interest in learning, and mobilize students’ consciousness of learning.

(4) Group collaborative learning

Focus on group themes or project tasks, divide work and cooperate, independently read textbooks and video course contents, extensively consult relevant materials, and carry out project design such as group based problem discussion, inquiry learning and video paper production, so as to develop students’ ability of cooperation and communication and practical curriculum teaching design and development. When students discuss problems, teachers play a leading role to prevent vague comments; Enlighten and guide the discussion in a timely manner so as not to deviate from the central topic.

3. Thirdly, the combination of production, study and research

Teachers add new knowledge to the teaching content and integrate scientific research results into the teaching content in time. For example, the research of Nobel Prize winning scientists promotes the development of developmental biology and effectively combines theory with practice. Encourage students' hands-on practice, conduct experiments on chickens, frogs, fruit flies and other experimental model animals through the second classroom, observe the embryonic development process, and carry out research activities such as artificial insemination and embryo transfer by hand. It has added the visiting practice teaching method, called on students to visit the women's and children's Hospital, animal husbandry and breeding base, and the animals in the National Nature Reserve to further master the development and application of animal and human reproductive auxiliary technology. Through practical activities, we can understand the development trends and social needs of developmental biology, enhance learning motivation, and cultivate students' sense of responsibility and mission.

2 Cutting edge content of the course

1. Determine the basic content of animal developmental biology teaching

Since developmental biology is offered in many majors, it is necessary to select appropriate teaching contents according to the characteristics and training objectives of different majors and students’ learning levels and foundations. Students analyzed the biology textbook of middle school and added frontier issues of developmental biology and human health. Such as stem cells and gene therapy, epigenetics and drug screening, etc., so as to broaden students’ knowledge and academic vision, reference the latest research results at home and abroad, reference the Chinese and English literature, and properly integrate them into the syllabus and teaching content. Make full use of multimedia and online teaching to provide teaching information, such as illustrations, animation, audio and video. This method is flexible and diverse, which is conducive to students’ comprehensive learning of developmental biology knowledge. The basic content of the course is the basis for students to master the systematic knowledge of the course. According to the characteristics of animal developmental biology, the teacher carried out the teaching according to the animal individual development program mode, with the main line of germ cell generation, fertilization, cleavage, gastrula formation, nerve embryo formation, organ formation, birth or hatching, metamorphosis, aging and death, Teach the developmental mechanism that runs through the whole life process step by step. Students are required to clarify that animal development includes two core issues, one is the mechanism of cell differentiation, and the other is the mechanism of morphogenesis. Mastering this part of knowledge is conducive to mastering the formation process and sequential regulation mechanism of all biological life, which not only enables students to experience the magic of life development, but also stimulates their curiosity and interest in learning, so as to achieve the basic teaching objectives of this course.

2. Clarify the frontier content of animal developmental biology

In 1894, German biologist Rox and others founded developmental biology. Developmental biology developed rapidly, covering the theories and technologies of anatomy and histology and embryology, cell biology, genetics, molecular genetics, physiology and other

disciplines. It penetrated and crossed with related disciplines. The research content extensively involves the whole process and mechanism of organisms from spermatogenesis, fertilization, embryonic development, postembryonic growth, aging and death. Its application prospect is also very broad, and it also covers stem cell biology, reproductive and embryonic engineering, environmental development biology and other branches. The research on embryology is the basis of artificial assisted reproduction and breeding of animals and plants. Several discipline leaders in the field of developmental biology of science summarized the frontier problems and unsolved problems, which generally include the following aspects:

- (1) molecular mechanism of morphogenesis,
 - (2) the relationship between development and evolution
 - (3) how cells go to a special fate
 - (4) intercellular signaling during development
 - (5) establishment of early embryo model
 - (6) neuron establishment
 - (7) cell division and tissue and organ formation
 - (8) how transcription factors control differentiation, etc
4. Hot issues in the course

In the teaching process of normal undergraduate, the teaching and research group carefully analyzed the hot content of developmental biology, and reasonably selected and timely added it to the curriculum of developmental biology. Because development is a process in which organisms follow the instructions of genetic information, self-assembly and self-control to complete the life cycle. The frontier hotspots of developmental biology research in the world include: the fate determination of primordial germ cells (PGC), cell reprogramming, the sex determination mechanism of species, the interaction mechanism between germ cells and somatic cells, the genetic and environmental mechanisms of infertility, and the innovation of developmental biology research technology. Scientists are using new technologies and model systems such as embryo transfer, in vitro baby, embryonic stem cells, and transgene to study these main problems. The latest research progress in developmental biology should be increased. In order to stimulate students' interest in learning and encourage them to further study in relevant fields, we should teach students valuable scientific research progress, especially some real events around them, so that they can feel the charm of science.

3 Application of the latest thinking methods

Developmental biology is a fascinating subject. How to recognize the world, understand life and maintain health is the research content and basis of developmental biology. In the process of learning, summarizing the latest thinking methods is of great significance for students' learning and understanding.

1. Overall thinking

Normal developing organisms have stable mechanisms and laws, which are the main way to study the development problems, and have been playing a leading role in the whole process of the development of developmental biology. Including:

- (1) Studies on the development of normal embryos.
- (2) Study on the development of normal vegetative organs.
- (3) The study of anatomy, cytology, molecular biology, biochemistry and physiology on the formation and activity cycle of normal three germ layers.

2. Manual control thinking

The beginning of ontogeny is cells. The main experimental systems for studying developmental biology are cell culture and tissue culture. Because they are carried out under manual control, the conditions of occurrence and development are easy to adjust and the process is clear. However, the disadvantage of this study is that it lacks the position effect required for the development of some tissues in vivo, so it will be limited in the study of the development of specific tissues. Artificial animal breeding, breeding and cherishing wild animals, and using artificial assisted technology to solve the problem of human infertility.

3. Positive thinking

Mutants that occur naturally or artificially are called mutant systems, which are used to study the structure of mutant genes and their functions and regulation of development in organisms. For example, some developmental abnormalities, genetic diseases, cancer, aging and other issues are studied with this kind of thinking.

4., reverse thinking

Using the latest research methods of molecular genetics, for example, people first change a specific gene or protein, and then look for related phenotypic changes. Such as gene knockout technology or transgenic research. In short, forward genetics studies gene changes from phenotypic changes, while reverse genetics studies phenotypic changes from gene changes.

In addition, other thinking, such as overall thinking, local thinking and omnipotence thinking, are generated according to the characteristics of learning developmental biology courses, which are complex and difficult to understand and closely related to theory and experiment.

4 Reform of assessment methods

Diversification of assessment methods and incentive mechanisms. Because the teaching content is highly comprehensive, complex and difficult to understand, and the students' confidence and endurance are insufficient, the teaching should be flexible and diversified through the reform of assessment methods, such as the use of diversified assessment methods combining phased tests, course papers, PPT reports and literature learning, to encourage students' Autonomous learning, and at the same time. Using online teaching platforms such as smart tree, nailing, Tencent conference, etc., the course resources including teacher information, teaching team composition, course description, teaching courseware, exercise bank, network resource link, etc. will be online, and the online interactive teaching will be realized through the roll call, answering, grouping, discussion and other modules of the online teaching platform, So that students' intelligence and inspiration can be exchanged and affirmed in time. Through formative assessment, it also accurately reflects students' mastery of the course. Through the teaching reform, students' enthusiasm for learning the course has been fully mobilized, and students' course assessment results are relatively ideal.

Summary

As an independent discipline, developmental biology has a short history, but it covers a wide range of subjects, rich content, and diverse research levels and methods, which extend students' understanding of life science to the forefront. After years of teaching research and practice, a distinctive biological science curriculum system has been established, and satisfactory teaching results have been achieved. College students have high expectations for this course and have achieved good application in practice. Some students intend to be admitted to graduate students majoring in developmental biology, entered the scientific research stage in advance and achieved good results.

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Funding: HeiLongJiang Programs for Education Foundation 2020-KFFWF-0237