

INITIATION OF DEVELOPMENTAL BIOLOGY IN THE PEOPLE'S REPUBLIC OF CHINA

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INTRODUCTION

Many aspects of bio-medical sciences in China are very advanced, notably the total synthesis of insulin, the development of male contraceptives and hepatitis research. Certain specific areas in applied biological disciplines, such as hydrobiology, mariculture, and agriculture sciences are in fact far ahead of western nations. Basic biology of more descriptive and classical nature like anthropology, taxonomy, embryology and invertebrate zoology, are as good as those in other countries. China's modern sciences, like molecular biology and cell biology, are however, in general, behind the western world. Developmental biology is, unfortunately, being left out of the biology curriculum even in leading institutions such as Beijing (Peking) University and Fudan University (Shanghai) both of which have been serving as models for other comprehensive institutions of higher learning in China.

RECENT CHANGES IN SCIENCE TECHNOLOGY

Realizing the need to catch up, China selected science-technology to be one of the "Four Modernizations" plans. Unlike many developing countries whose main effort is directed toward technological know-how rather than basic sciences, China is pushing forward on both fronts. Since the reactivation of the universities in 1978, China has employed her experience with assimilation-dissemination techniques for a rapid achievement of her Four Modernization plans. Most importantly, China does this with the future in mind. Our invitation from Beijing University last summer of 1980 was to teach a 7-week course in developmental biology. This invitation was an example of China's conviction to push forward in basic science as well as technology. This course was the most extensive single course organized in a biological discipline.

RESEARCH IN DEVELOPMENTAL BIOLOGY

Research in developmental biology is not new in China although it is not as extensive as it is in the United States. Like other sciences, research in developmental biology appears to be topically selective. In our visits to various laboratories, Tung's influence was quite evident. The late Professor T. C. Tung was as successful in nuclear transplants in goldfish as Briggs and King were in the frog. The use of marine embryo-

logical materials as bio-indicators for water pollution was in fact proposed in 1974 in China (C. Y. Lee, "Application of Embryology to the Study of Marine and Related Pollution," *J. of Oceanology* 5:6-16, 1974 [in Chinese]). The teaching of developmental biology in the universities has so far been only a 2-3 week segment in the first year zoology course. The content has been descriptive embryology laced with molecular and cellular aspects of development. Students and many junior faculty in China do not realize that developmental biology has been an important sub-discipline in biology. To prepare for the future, it was thought that teaching, and training in the teaching of developmental biology should proceed on a parallel course with research. Realizing the contribution which developmental biology has made in the United States and elsewhere, the Chinese government has established a new Institute of Developmental Biology as an entity within the Academia Sinica. The Academia Sinica serves as an umbrella for some 100 institutes and laboratories in all scientific disciplines and it is the pace setter for science-technology in China. With the initiation of the teaching aspect of developmental biology, our summer course, by Beijing University and together with the establishment of the Institute of Developmental Biology, China has illustrated her recognition of and commitment to basic research and teaching as being necessary, on the one hand, for rapid scientific and technological advancement and, on the other hand, for constructing a firm foundation for the future.

DESCRIPTION OF THE NEW COURSE

We designed the course content to begin with the principles of molecular biology (recombinant DNA and microtubular-microfilament studies inclusive) and its relation to developmental biology, continued through cell interactions, and ended with aging. The level of instruction was at our senior/beginning graduate student level. Since we did not know what the library facilities were like, we took along several copies of books to be used as references, and as sources of clarification of our lecture materials, in addition to transparencies and slides containing information from primary research journals. We brought along all essential supplies like sera and disposable ware for tissue culture and other small essential items for laboratory demonstrations because, again, we were in an unfamiliar arena. We did

not want to waste time looking for these special supplies even if they were available. We were advised by those who had lectured in China to prepare our lectures in a detailed, step-by-step manner, and to explain everything clearly because instruction in Chinese universities is by formal lecture, usually without interruptions or questions. In part, due to the limitation of preparation time, we decided to teach the way we do here. That is, by giving concepts and then illustrating them with experimental data rather than by having the participant memorize facts and figures. Throughout our lectures, we emphasized experimental and analytical approaches. We encouraged independent library study by the student rather than giving a highly detailed spoon-fed type of lecture which is the custom of our counterparts in China. The program consisted of 2½ hour lectures in the mornings and then informal discussions or visits to various laboratories in the afternoon. One of the seven weeks on instruction was devoted wholly to laboratory techniques to break the monotony of lecturing.

THE CHINESE STUDENTS

The original participants were 18 faculty from 15 key universities (universities in China are informally classified as key or minor institutions), five members in the new developmental biology group in the Biology Department of Beijing University, and several selected staff from the new Institute of Developmental Biology of the Academia Sinica. Within 2 days after we distributed the course syllabus (which was not the classical descriptive embryology as was originally believed by the participants), our class swelled to some 60 people. There were some undergraduates from the 1978 entering class, some graduate students, scientists from the Academia Sinica, and staff from biomedical research institutions in the Beijing area. This kind of turnout was unusual in that it was summer vacation and only skeleton staffs remained in the various institutions. Almost half of the participants sacrificed their only vacation to attend our course. This turnout illustrates the extent of enthusiasm in the scientific community to assimilate knowledge new to China. We were most impressed by the undergraduate students who had just finished their 2nd year and who have only had one year of general zoology, chemistry up to organic, calculus, and one year of physics. They were initially lost but within one week, i.e., 12 hours of lecture later, they came up with the best questions (if you could make them open up). One should realize that 4% of the some 5 million high school graduates would gain entrance to a college by taking a national college exami-

nation administered by the Ministry of Education.

We were informed that leading universities would attempt to modify their fairly inflexible current curriculum to include developmental biology as a course rather than merely a small segment in another course. We hope that our analytical approach to teaching and our use of information from primary research journals will stimulate students to begin to browse through journals instead of spending all the time in studying their teachers' notes as they customarily do. We hope that a change from a relative dependent attitude on the part of the student to a more independent attitude, a change in study habits, and the asking of more questions rather than asking for more facts will help significantly in the rapid progress in developmental biology and revitalization of related fields. These changes, we believe, should aid in long-term stabilization, expansion, diversification and advancement of biological sciences.

We mentioned earlier China's experience with and techniques for assimilation-dissemination of information without the luxury of readily available audiovisuals, telecommunications, photocopies, etc. The faculty from various parts of China were responsible for bringing back what they had gained from our course. To do so our lectures were recorded and later organized in writing, in Chinese, by the participants. We edited and corrected them with the help of the Beijing University staff for printing. The organized notes would be then distributed to the participants and to other institutions. The conversion of our oral presentations into written form which were usable as texts represents one way of assimilation-dissemination. This is necessary in order to reach a vast number of people in science who were deprived of their scholarly privileges for 10 long years. We hope that our Chinese counterparts will realize that our lectures can only serve as a starting point or stepping stone from which they must develop further. We also hope that our counterparts will realize that many materials in our lectures will probably be out-of-date in a very short time.

We were excited and pleased to be invited by Beijing University. We were impressed with the caliber of the students, the receptivity of the faculty, and the enthusiasm of every participant. We feel we have gotten "an extra mile" out of our training and profession. To play a part, however minute, in the beginning of a new horizon is a bit of Volunteer spirit!

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