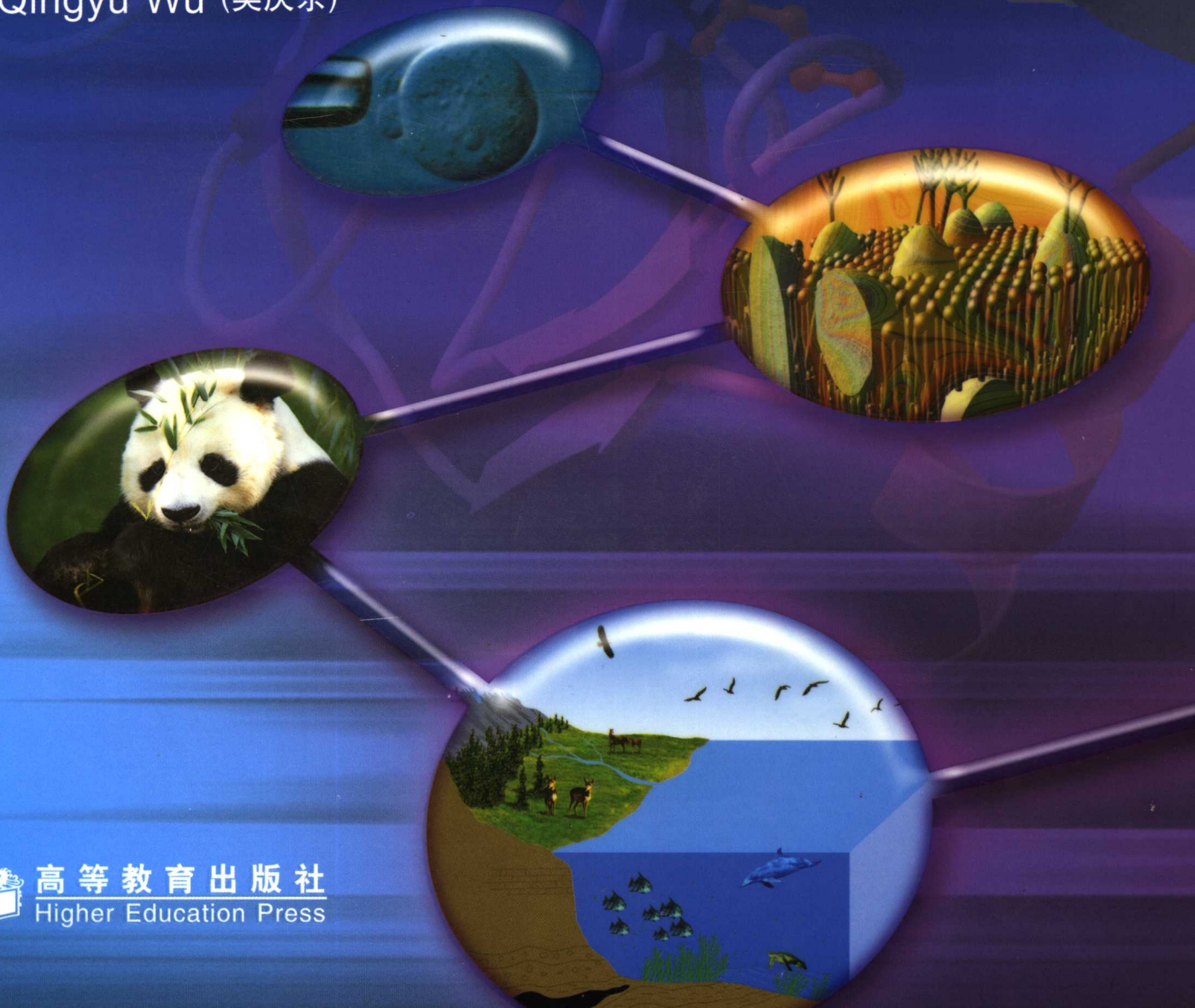
Essentials of Life Science

基础生命科学 (英文版)

■ Jianping Xu (徐建平)
■ Qingyu Wu (吴庆余)



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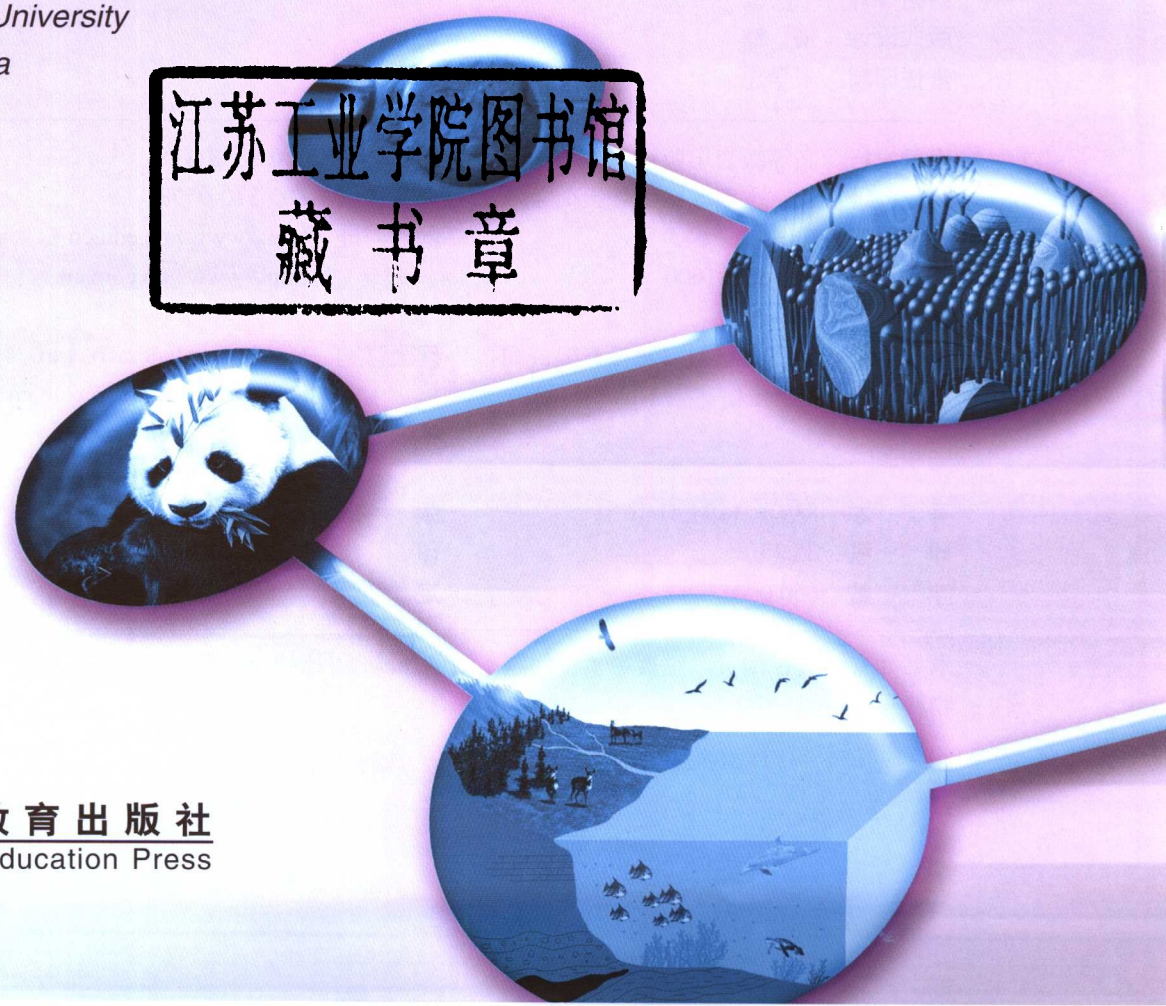

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Preface

The 21st century has often been called the century of life science. Our understanding of the living world is growing explosively. Every day, we hear about significant progress in life science research. This book, *Essentials of Life Science*, is our attempt to capture the milestones in life science and to bring the excitement of life science research into university classrooms. This book is designed as a general biology textbook for non-biology students, as well as an introductory textbook for students majoring in the diverse fields of biological science such as agriculture, forestry, animal science, biotechnology, and medicine.

The organization and writing of this book reflect the following underlying principles:

1. Use simple language and figures to illustrate complex biological issues.
To help students learn, we have attempted to use simple language to illustrate complex concepts. We also believe in the mantra that "a picture speaks a thousand words". Throughout the book, we have used color figures to illustrate key concepts and biological processes. To facilitate both teaching and learning, we have included a set of computer disk files containing: 20 sets of powerpoint files; 538 color figures; blueprints for making your own enhanced powerpoint files; a teaching video called "Entering the Age of Life Science"; and a comprehensive set of 270 overheads with 582 pictures.

2. Emphasize both fundamental biological principles and current research efforts and trends.
To ensure that students have a broad exposure to and background in biology, we have put great emphasis on fundamental principles in biology. However, we believe basic background knowledge in biology is insufficient for modern university students. Therefore, we have introduced up-to-date information on current research efforts and potential breakthroughs in many areas. It is our hope that this book will serve as a springboard to guide students' developing interests in many advanced fields of biology.

3. Integrate all spatial and temporal scales of investigations in biology.
Biological systems are complex systems. Biologists in various branches of biology often focus on one specific level. These levels include those of molecules (proteins, nucleic acids, lipids, carbohydrates, and other cellular metabolites), organelles, cells, tissues, organs, individuals, populations, species, communities, ecosystems, and the biosphere. We pay special attention to the integration of these levels using underlying genetic concepts and the principle of evolution by natural selection. To help students appreciate the biological world, we start with a basic description of biodiversity, focusing on organisms we see frequently. We then introduce the basic units of life, cells and cellular components. This is then followed by the basic structures and functions of biological molecules. The levels gradually increase in size and scale, ultimately returning to ecology and the biosphere.

4. Stimulate students' interest in and enthusiasm for life science.

Throughout the book, we introduce many well-known biologists and describe how they made their important discoveries, often through the development of simple methods and clever logical reasoning. Color figures are extensively used for this purpose. We hope the stories and figures will stimulate your interest in biology and help attract many of you to become future biologists.

5. Be concise.

The enormous growth and changes in biology create a special challenge for textbook authors. How can an introductory biology textbook provide the basics, keep up with exciting new discoveries, and not become overwhelming for students? Indeed, the increasing size of textbooks is of great concern to authors, publishers, instructors, and most importantly to students. To help alleviate the problem, we focus on fundamental principles and use extensive and informative color figures to illustrate both the basic concepts and the development of key new discoveries and trends.

Because this is our first attempt to publish an introductory biology textbook in English, there are undoubtedly areas for improvement. In addition, life science is progressing rapidly. Some areas might be missing but deserve inclusion. We sincerely welcome any suggestions for future improvements, both in format as well as in content.

We are indebted to many individuals who have helped us with writing this textbook. We specially thank the following people for contributing artwork in this book (in alphabetic order): Bai Jing, Cao Guangqi, Cao Rongliang, Chen Qiang, Chen Yaheng, Cui Ting, Deng Yingnan, Deng Yongjian, Du Wei, Du Xiaohe, Fu Xiaohui, Guo Lusu, Guo Tao, He Miao, He Wenqing, Hu Gui, Hu Rui, Hu Xiaochuan, Huang Miaoyan, Huang Tang, Huang Xingyue, Jiang Ying, Li Alin, Li Da, Li Fei, Li Tieshi, Li Yingzhu, Li Yisu, Li Zhigang, Lin Chengxi, Lin Yan, Liu Dong, Liu Jie, Liu Jinlong, Liu Rujia, Luo Xiaowei, Peng Qiang, Qian Li, Qiang Shengrong, Qin Haiwei, Qu Timing, Luo Guiliang, Luo Kai, Luo Yang, Shen Jicheng, Si Lipeng, Sun Xiaofeng, Tang Kai, Tian Tao, Wang Feng, Wang Huo, Wang Jirong, Wang Wei, Wang Xue, Wang Yan, Wang Ying, Wei Huajiang, Wu Wei, Xu Wei, Xu Yanhui, Yang Yang, Yu Shen, Yuan Guoliang, Yue Bao, Yue Cuizhen, Zeng Baiyi, Zhang Fan, Zhang Nutao, Zhang Qing, Zhang Yuanzhang, Zhao Lei, Zhao Ru, Zhao Xiaorui, Zhou Jie, Zhou Lü, Zou Gengin.

We thank our families for their love, support, and sacrifice during our writing and editing. We owe a special thank you to Heather Yoell for proofreading and editing the whole text. At Higher Education Press, we thank Wu Xuemei, Wang Li, Zhang Nan, and Wang Linbo for their patience and unconditional support. At Thomson International, we thank the people for their suggestions and critical reviews. This book would not have been possible without all their help.

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About the Authors

Jianping Xu received a Bachelor's degree in Agronomy from Jiangxi Agricultural University, a Master's degree in Agricultural Microbiology from Nanjing Agricultural University, and a Ph.D. degree in Population Genetics and Evolution from University of Toronto in Canada (1997). Following 3.5 years of Postdoctoral training at Duke University in North Carolina, USA, he moved to the Department of Biology at McMaster University in Canada to become an independent investigator. He is currently an associate professor and his research focuses on understanding how microbes evolve. He has (co-) authored over 40 peer-reviewed research papers, 7 book chapters, and is editing a book titled *Evolutionary Genetics of Fungi*. He is the recipient of an Ontario Premier's Research Excellence Award (2002–2007) and the Young Investigator's Award of the Genetics Society of Canada (2005). His non-scientific interests include running, soccer, swimming and gardening.

Qingyu Wu is a professor at the Department of Biological Sciences & Biotechnology, Tsinghua University (from 1996). He worked at Nanjing University as an assistant professor (1985–1988), associate professor (1990–1992) and full professor (1992–1996). As a visiting scientist, he conducted research in the Department of Biology at William Paterson University, New Jersey, USA (1988–1990), in the Department of Botany at Arizona State University, USA (1993–1994), and in the Department of Biology at Niigata University in Japan (1997). Prof. Wu has done extensive research on molecular microbiology, biogeochemistry and renewable energy from biomass. He has received numerous national grants for advanced research. In 1996, he obtained National Science Fund for Distinguished Young Scholars. His academic achievements include over 100 papers, three awards and numerous basic research grants.

郑重声明

Brief Contents

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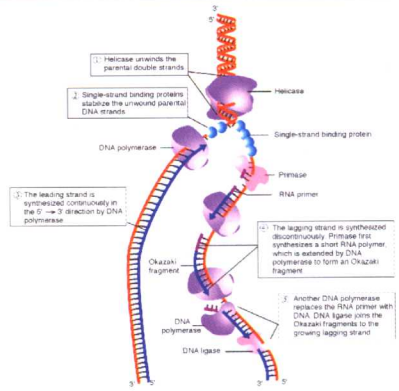

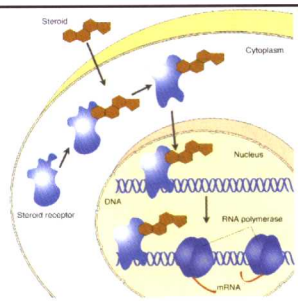

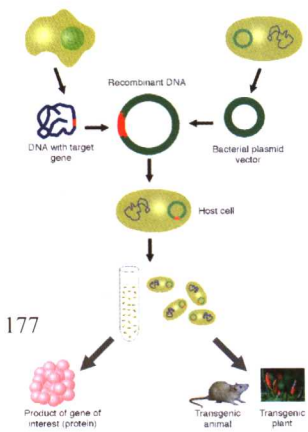

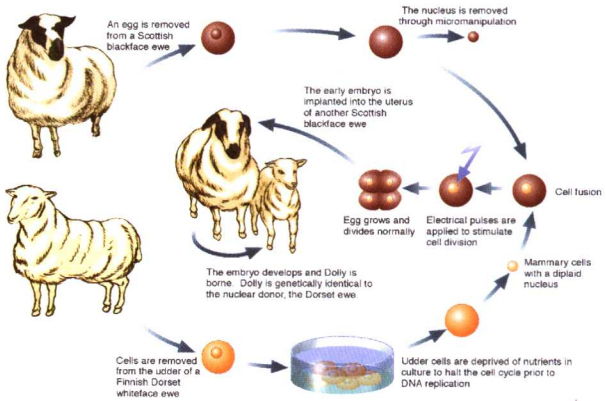

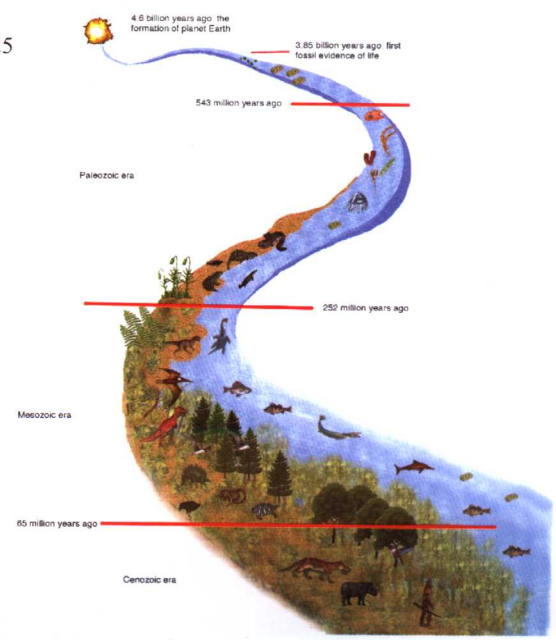

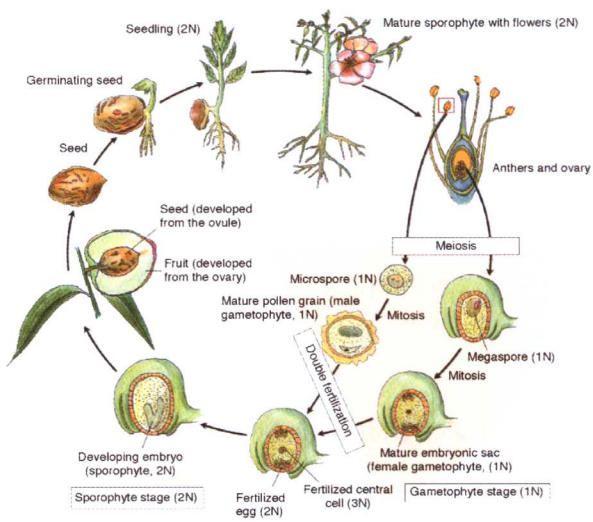

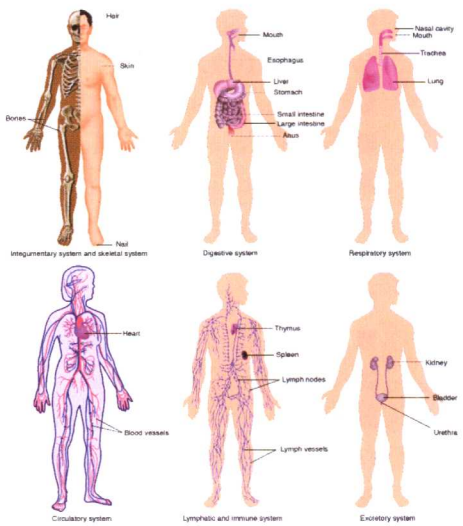

1 INTRODUCTION TO LIFE SCIENCE

1.1 What Is Life?

- The cell is the basic unit of life
- Metabolism
- Growth, reproduction and DNA as the basic genetic material
- Individual developmental history and potential for evolution
- Adaptation to environmental changes

1.2 Why Do We Study Life Science?

- From Darwin's theory of evolution to the cloning of Dolly the sheep
- Challenges facing humans
- Modern university students require a basic understanding of modern life science
- Your participation will be crucial to the advancement of life science

1.3 What Will You Learn?

- Concepts and theories in life science
- Integrated multilevel exposure and a comprehensive view of life
- Emphasis on most recent developments in life science

1.4 How Do You Study?

- Interest is the best teacher
- Dare to ask questions and be imaginative
- Experimentation is a key to learning and scientific investigation in life science

Chapter Summary
Review Questions for Discussion
Relevant Internet Sites