Board Of School Education Haryana

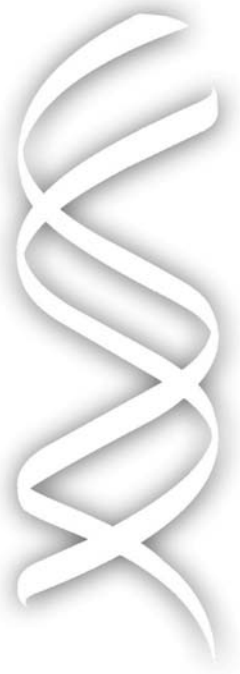
CLASS-XII

Subject

Biology

BIOLOGY

TEXTBOOK FOR CLASS XII



हरियाणा विद्यालय शिक्षा बोर्ड, भिवानी
Board of School Education Haryana, Bhiwani

मूल संस्करण-
राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्, नई दिल्ली
अभीग्रहीत-
हरियाणा विद्यालय शिक्षा बोर्ड, भिवानी
चतुर्थ संस्करण
मार्च, 2017
फाल्गुन.-1938
संख्या- 5000 प्रतियाँ

आभार प्रदर्शन

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्, नई दिल्ली ने इस पुस्तक को छापने तथा हरियाणा के विद्यालयों में इसे पाठ्य-पुस्तक के रूप में पढ़ाने की अनुमति हरियाणा विद्यालय शिक्षा बोर्ड, भिवानी को प्रदान करने की कृपा की है।

हरियाणा विद्यालय शिक्षा बोर्ड, भिवानी इसके लिए उनका हृदय से आभार प्रकट करता है।

सचिव

मूल्य- रु. 170/-

टैक्सट 80 जी.एस.एम. पेपर पर तथा कवर 150 जी.एस.एम. पेपर पर मुद्रित।

सचिव : हरियाणा विद्यालय शिक्षा बोर्ड, भिवानी द्वारा प्रकाशित
एवं अमर उजाला पब्लिकेशन्स लिमिटेड, नौएडा द्वारा मुद्रित।

FOREWORD

The National Curriculum Framework (NCF) 2005, recommends that children's life at school must be linked to their life outside the school. This principle marks a departure from the legacy of bookish learning which continues to shape our system and causes a gap between the school, home and community. The syllabi and textbooks developed on the basis of NCF signify an attempt to implement this basic idea. They also attempt to discourage rote learning and the maintenance of sharp boundaries between different subject areas. We hope these measures will take us significantly further in the direction of a child-centred system of education outlined in the National Policy on Education (1986).

The success of this effort depends on the steps that school principals and teachers will take to encourage children to reflect on their own learning and to pursue imaginative activities and questions. We must recognise that, given space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. Treating the prescribed textbook as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. Inculcating creativity and initiative is possible if we perceive and treat children as participants in learning, not as receivers of a fixed body of knowledge.

These aims imply considerable change in school routines and mode of functioning. Flexibility in the daily time-table is as necessary as rigour in implementing the annual calendar so that the required number of teaching days are actually devoted to teaching. The methods used for teaching and evaluation will also determine how effective this textbook proves for making children's life at school a happy experience, rather than a source of stress or boredom. Syllabus designers have tried to address the problem of curricular burden by restructuring and reorienting knowledge at different stages with greater consideration for child psychology and the time available for teaching. The textbook attempts to enhance this endeavour by giving higher priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience.

The National Council of Educational Research and Training (NCERT) appreciates the hard work done by the textbook development committee responsible for this book. We wish to thank the Chairperson of the advisory group in science and mathematics, Professor J.V. Narlikar and the Chief Advisor for this book, Professor K. Muralidhar, Department of Zoology, University of Delhi, Delhi for guiding the work of this committee. Several teachers contributed to the development of this textbook. We are grateful to their principals for making this possible. We are indebted to the institutions and organisations which have generously permitted us to draw upon their resources, material and personnel. We are especially grateful to the members of the National Monitoring Committee, appointed

by the Department of Secondary and Higher Education, Ministry of Human Resource Development under the Chairmanship of Professor Mrinal Miri and Professor G.P. Deshpande, for their valuable time and contribution.

As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions which will enable us to undertake further revision and refinement.

Director
National Council of Educational
Research and Training

New Delhi
20 November 2006

PREFACE

Biology is the study of life in its entirety. The growth of biology as a natural science during the last 1000 years is interesting from many points of view. One feature of this growth is changing emphasis. Initially it was description of life forms. Identification, nomenclature, classification of all recorded living forms enjoyed the attention of scientists for a long time. Description of their habitats and (in the case of animals) their behaviour was included in this study. In later years, the focus was physiology and internal morphology or anatomy. Darwinian ideas of evolution by natural selection changed the perception completely. Classical descriptive and clueless biology found a theoretical framework in the evolutionary theory of Darwin.

In the nineteenth and twentieth centuries, Physics and Chemistry were applied to Biology and the new science of Biochemistry soon became the dominant face of biology. On one hand Biochemistry was integrating with Physiology, becoming almost synonymous with it. On the other hand it gave rise to Structural Biology (structure of biomacromolecules), originally called Molecular Biology. The work of Bernal, Pauling, Watson and Crick, Hodgkins, Perutz and Kendrew, Delbruck, Luria, Monod, Beadle and Tatum, Lederberg, Brenner, Benzer, Nirenberg, Khorana, Mclintock, Sanger, Cohen, Boyer, Kornbergs (father and son), Leder, Chambon and scores of others brought in and established a modern version of Molecular Biology dealing with life processes at molecular level.

Physics and Chemistry dominated public perception of science for a long time. Daytoday life of man was influenced by developments in Physics, Chemistry and their respective manufacturing industries. Slowly and steadily, Biology, not to be left behind, demonstrated its utility for human welfare. Medical practice, especially diagnostics, green revolution and the newly emerging biotechnology and its success stories made the presence of biology felt by the common man. Patent laws brought biology into political domain and commercial value of biology became obvious.

For more than a century, classical and so-called reductionist biology fought artifical battles. The fact is both are important. Ecology brought in synthesis of both approaches and emphasised integrated understanding of biology. Form and process are both equally important. Systems biology, using mathematical tools, is bringing about a modern synthesis of both the aspects of Biology.

The Class XI and XII textbooks in biology essentially were to reflect these threads of biological thought. While the Class XI book dealt with morphology, taxonomy, molecular and cellular aspects of physiology, the Class XII book deals with the physiological process of reproduction in flowering plants and humans, the principles of inheritance, the nature of genetic material and its function, the contributions of biology to human welfare, basic principles of biotechnological processes and their applications and achievements. The Class XII book also relates genes to evolution on one hand and presents ecological interactions, behaviour of populations and ecosystems on the other. Most important, the guidelines under NCF-2005 have been followed in letter and spirit. The total learning load has been reduced

considerably and themes like environmental issues, adolescent problems and reproductive health have been dealt with in some detail. Studied together, the class XI and class XII textbooks in Biology would enable the student to —

(i) become familiar with the diversity of biological material.
(ii) appreciate and believe in the Darwinian evolutionary process exhibited by the living world.
(iii) understand the dynamic state of constituents of living bodies, i.e., metabolic basis of all physiological processes in plants, animals and microbes.
(iv) realise the structure and function of genetic material in directing the inherited phenotype pattern as well as a mediator of evolutionary process.
(v) appreciate the profound contributions of biology to human welfare.
(vi) reflect on the physico-chemical basis of living processes and at the same time realise the limitation of reductionism in understanding behaviour of organisms.
(vii) experience the humbling effect of this realisation that all living organisms are related to each other by virtue of shared genetic material.
(viii) realise that biology is the story of the struggle of living organisms for existence and survival.

One may notice a perceptible change in the writing style. Most of the chapters are written in an easy dialogue style engaging the student constantly while some chapters are in the form of critical comments on the subject matter. A number of questions have been provided at the end of each chapter though answers to some may not be found in the text. Students have to read supplementary material, upon advise from the teacher, to answer such questions.

I am thankful to Professor Krishna Kumar, Director NCERT; Professor G. Ravindra, Joint Director, NCERT and Professor Hukum Singh, Head, DESM, NCERT for constant support. I must place on record my deep appreciation for Dr B.K. Tripathi, *Reader*, DESM, NCERT for his relentless efforts as coordinator in bringing out the Biology textbook for both the Class XI and XII. All the members of the development team, the experts and reviewers, and the school teachers have contributed enormously in the preparation of this book. I thank them all. I am indeed highly thankful to the members of monitoring committee constituted by Ministry of Human Resource Development for their valuable observation that helped in the improvement of the book at the final stage. The book is prepared keeping in mind the guidelines of the NCF-2005 especially the emphasis on reducing the learning load. We hope that the book would meet the expectations of all the stakeholders. All suggestions for further improvement are always welcome.

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Chief Advisor
Biology Textbook for Class XII

Department of Zoology
University of Delhi

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The Council is highly thankful to Hukum Singh, *Professor and Head,* Department of Education in Science and Mathematics, NCERT for his valuable support throughout the making of this book.

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The efforts of the Publication Department, NCERT, in bringing out this publication are highly appreciated.

CONTENTS

Unit IX

Unit X

UNIT VI
REPRODUCTION

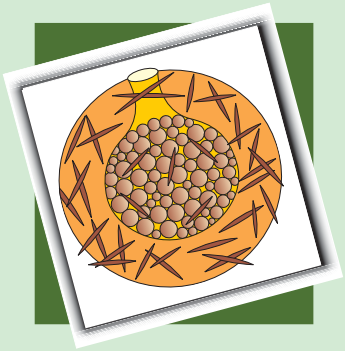
Biology in essence is the story of life on earth. While individual organisms die without fail, species continue to live through millions of years unless threatened by natural or anthropogenic extinction. Reproduction becomes a vital process without which species cannot survive for long. Each individual leaves its progeny by asexual or sexual means. Sexual mode of reproduction enables creation of new variants, so that survival advantage is enhanced. This unit examines the general principles underlying reproductive processes in living organisms and then explains the details of this process in flowering plants and humans as easy to relate representative examples. A related perspective on human reproductive health and how reproductive ill health can be avoided is also presented to complete our understanding of biology of reproduction.

PANCHANAN MAHESHWARI
(1904-1966)

Born in November 1904 in Jaipur (Rajasthan) Panchanan Maheshwari rose to become one of the most distinguished botanists not only of India but of the entire world. He moved to Allahabad for higher education where he obtained his D.Sc. During his college days, he was inspired by Dr W. Dudgeon, an American missionary teacher, to develop interest in Botany and especially morphology. His teacher once expressed that if his student progresses ahead of him, it will give him a great satisfaction. These words encouraged Panchanan to enquire what he could do for his teacher in return.

He worked on embryological aspects and popularised the use of embryological characters in taxonomy. He established the Department of Botany, University of Delhi as an important centre of research in embryology and tissue culture. He also emphasised the need for initiation of work on artificial culture of immature embryos. These days, tissue culture has become a landmark in science. His work on test tube fertilisation and intra-ovarian pollination won worldwide acclaim.

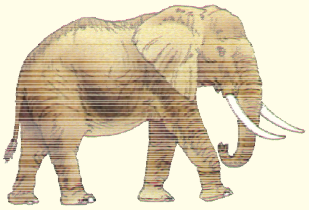
He was honoured with fellowship of Royal Society of London (FRS), Indian National Science Academy and several other institutions of excellence. He encouraged general education and made a significant contribution to school education by his leadership in bringing out the very first textbooks of Biology for Higher Secondary Schools published by NCERT in 1964.



CHAPTER 1

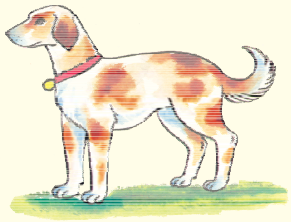
REPRODUCTION IN ORGANISMS

Each and every organism can live only for a certain period of time. The period from birth to the natural death of an organism represents its **life span.** Life spans of a few organisms are given in Figure 1.1. *Several other organisms are drawn for which you should find out their life spans and write in the spaces provided.* Examine the life spans of organisms represented in the Figure 1.1. Isn't it both interesting and intriguing to note that it may be as short as a few days or as long as a few thousand years? Between these two extremes are the life spans of most other living organisms. You may note that life spans of organisms are not necessarily correlated with their sizes; the sizes of crows and parrots are not very different yet their life spans show a wide difference. Similarly, a mango tree has a much shorter life span as compared to a *peepal* tree. Whatever be the life span, death of every individual organism is a certainty, i.e., no individual is immortal, except single-celled organisms. *Why do we say there is no natural death in single-celled organisms?* Given this reality, have you ever wondered how vast number of plant and animal species have existed on earth for several thousands of years? There must be some processes in living organisms that ensure this continuity. Yes, we are talking about reproduction, something that we take for granted.

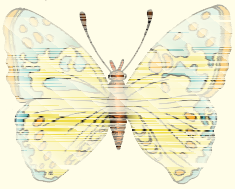


Elephant(_____)

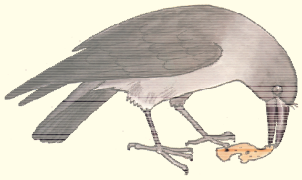
Rose (_____)



Dog (_____)

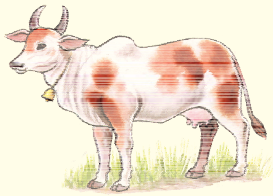


Butter fly (1-2 weeks)

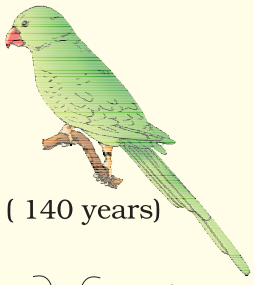


Crow (15 years)

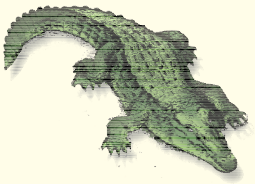
Banana tree (_____)



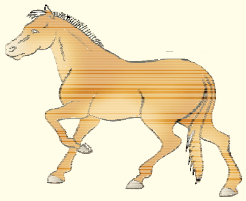
Cow (_____)



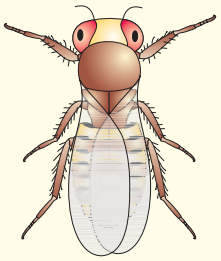
Parrot (140 years)



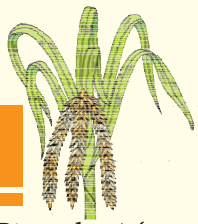
Crocodile (60 years)



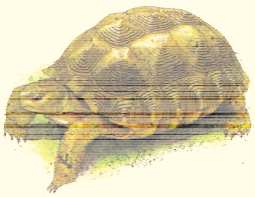
Horse (_____)



Fruit fly (_____)



Rice plant (_____)



Tortoise (100-150 years)

Banyan tree (_____)

Figure 1.1 Approximate life spans of some organisms

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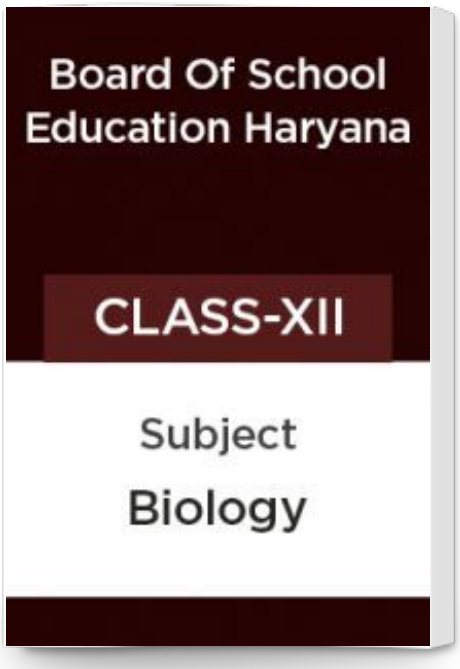

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