# Preface

The present era belongs to molecular genetics and biotechnology. Therefore, to become proficient in teaching, research, and applications of the subject matter, the underlying concepts, phenomena, hypotheses, theories, laws and principles must be thoroughly understood at the molecular level. The blueprint or genetic material responsible for the physical appearance of an organism resides inside the cell. This genetic material stores all the information for development and survival of the individual and transmission of biological properties from one generation to the next. The first step for studying molecular biology/genetics/biotechnology is to gain an understanding of the nature, structure, molecular forms, location, organization, analysis, sequencing, synthesis, packaging, recombination, damage, repair, and protection of genetic material in viruses, prokaryotes and eukaryotes. Genetic material performs its function by organizing itself in the form of gene, the unit of heredity. Knowing above-mentioned aspects of genetic material sets the stage for knowing about gene. In order to understand how a gene expresses itself to perform its function, its various aspects, viz., gene structure, gene organization, genome evolution, gene function, transcription, RNA processing, genetic code, translation, and fate of finished proteins, used ribosomes and messenger RNAs need to be understood. Finely regulated mechanisms exist in the cell to control expression of gene at every level of its expression. Every gene requires a large number of proteins to help it perform its assigned function. DNA and protein modifications influence gene expression. Without proper coordination of gene regulatory mechanisms, which "switch on" or "switch off" particular genes, whose products are required by the cell in a spacio-temporal manner, development and evolution cannot be thought of in the present era of molecular biology. Thus gene regulation is the molecular basis of development and evolution.

*Essentials of Molecular Genetics* has been written with the objective of providing concise but complete knowledge on the above-mentioned aspects of the chemical basis of life, genetic material (deoxyribonucleic acid and ribonucleic acid), and expression and regulation of gene in viruses, bacteria and eukaryotes. This book also briefly deals with the role of epigenetic modifications in gene regulation. This book is primarily designed as a text book for undergraduate students studying molecular genetics in any discipline of life sciences, agricultural sciences, medicine, and biotechnology in all the conventional, medical, and agricultural universities. However, postgraduate students, teachers, research workers, and biotechnology professionals working with molecular biotechnology companies/colleges/institutes/schools across the world can very conveniently use it as a reference book.

This book provides a brief historical background in introductory paragraph(s) of every chapter. Recent progress on the topic is discussed. Work of 70 Nobel laureates finds a special mention. Various hypotheses, principles, concepts, phenomena of molecular genetics have been dealt with in a simple and lucid language. The text is supported by a number of important original and recent references, tables, figures and flow diagrams where necessary. Special attention has been paid to precise definitions of various terms in the subject in light of the present day knowledge. For this, there is a separate section on glossary of important terms used in the book. Important literature relevant to the subject matter has been cited in the text and all such references have been listed at the end of every chapter. A few thought-provoking problems are also included in every chapter. Where there are six or more authors, only first three have been mentioned, followed by et al. Throughout efforts have been made to briefly pin-point applications/implications of different discoveries in the area of molecular genetics and biotechnology. Extensive cross-referencing has been done.

*Essentials of Molecular Genetics* should be extremely useful to those who are preparing for national and international level competitive examinations, entrance tests, and interviews for jobs/fellowships. I trust the book will provide enjoyable reading experience. Strenuous efforts have been made to include all important information relevant at undergraduate level; however, if something important is missing, the readers are urged to inform the author so that deficiencies can be corrected in a subsequent printing/edition. Style of presentation and selection of examples are purely my choice. I am responsible for any omissions and commissions. Readers' feedback will be appreciated.

Class-room has been my lab for my teaching experiments. Students have always been a guiding force to me in an indirect way in deciding order of different chapters in the book and organization of the contents in a chapter. Thus contribution of my present and past students in my books has been tremendous. During the writing of this book I have consulted a large number of original research papers, review articles, books, monographs, and web sites. My head bows with respect before all these great authors for their landmark work. I thank various copyright holders to grant me permission for use of their published work in this book.

I am grateful to Dr. Kuldeep Singh, Director, School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, India for his moral support and providing me facilities for this work. Dr. S.S. Gosal, Director of Research, Punjab Agricultural University, Ludhiana, India, who is an experienced author, made very useful suggestions in the preparation of this book. Stewardship provided by Dr. Manjit Singh Kang, former Vice-Chancellor, Punjab Agricultural University, Ludhiana, India, who has edited and authored several books in the area of genetics, is gratefully acknowledged. I enjoyed full support of Dr. Baldev Singh Dhillon, Vice-Chancellor, Punjab Agricultural University, Ludhiana, India in the writing of this book.

Dr. Darshan S. Brar, former Head, Plant Breeding, Genetics and Biotechnology Division, International Rice Research Institute, Los Baños, The Philippines, presently Honorary Adjunct Professor, School of Agricultural Biotechnology, Punjab Agricultural University, Ludhiana, India advised me to include some thought-provoking questions/problems at the end of every chapter to test comprehension of the reader: for this and many other useful pieces of advice, I am thankful to Dr. Brar.

I am indebted to Dr. Gurdev S. Khush, former Principal Plant Breeder and Head, Division of Plant Breeding Genetics and Biochemistry, International Rice Research Institute, Los Baños, The

Philippines, and presently Adjunct Professor, University of California, Davis, USA for showering his blessings on me by writing Foreword of this book.

I must make mention of my immediate family, relatives and friends without whose involvement and support, completion of this book would not have been possible. No one can do any creative work, such as writing of a book, without the cooperation of his/her spouse. My wife Harjit showed utmost patience and cooperation during the preparation of this book. My son Jemmy and daughter-in-law Parvi made sure that I was kept away from tedious household duties like depositing bills and making purchases from the market. My daughter Simmi and son-in-law Shally frequently motivated me by checking up on the progress of the book. My grandchildren, Prabhasis, Harmehar and Bhavneet were more of an encouragement rather than a disturbance to me. Because of his experience in writing manuals and books, I often consulted my dear nephew, Dr. Sandeep Singh, Assistant Entomologist, Punjab Agricultural University, Ludhiana, India, who also assisted me in compiling the subject index.

Mr. Gagandeep Singh typed the manuscript and drew figures meticulously. Mr. Gurdeep Singh of ALPS Educational Services, Ludhiana formatted the book for camera-ready printouts. I like the way the book *Essentials of Molecular Genetics* has come up with respect to format and design. For this, I whole heartedly thank Mr. N.K. Mehra, Managing Director, Narosa Publishing House Pvt. Ltd., New Delhi.

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