FOURTH EDITION

Biotechnology

Fundamentals and Applications

S. S. Purohit

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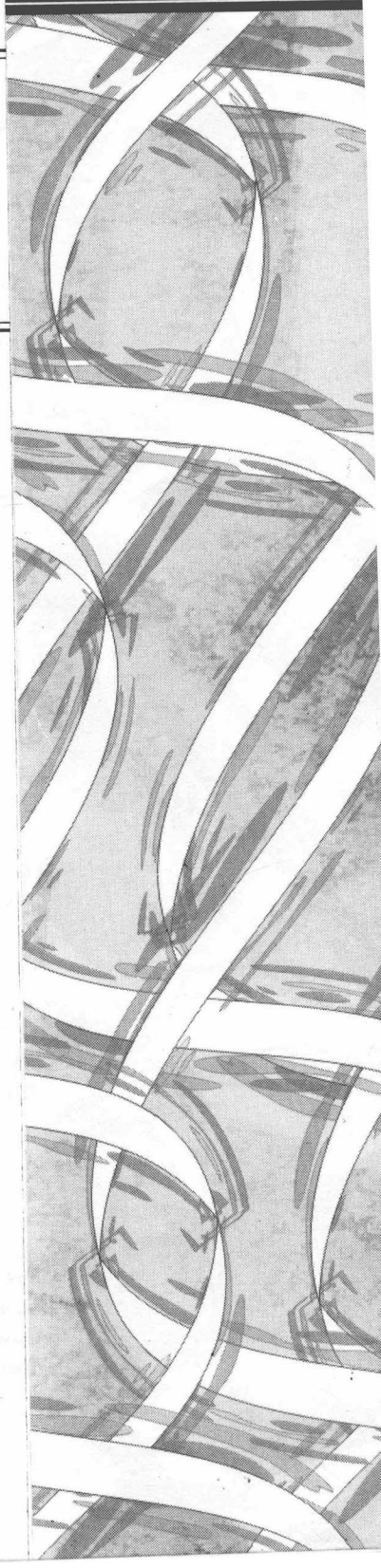

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PREFACE

Biotechnology is the manipulation of biological organisms to make products that benefit human beings. Biotechnology contributes to such diverse areas as food production, waste disposal, mining, and medicine. Although biotechnology has existed since ancient times, some of its most dramatic advances have come in more recent years. Modern achievements include the transferal of a specific gene from one organism to another (by means of a set of genetic engineering techniques known as transgenics); the maintenance and growth of genetically uniform plant- and animal-cell cultures, called clones; and the fusing of different types of cells to produce beneficial medical products such as monoclonal antibodies, which are designed to attack a specific type of foreign substance.

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When these technologies are applied at industrial level, they constitute bio-industry which include, on the one hand, industrial activities where biotechnologies can replace technologies normally or currently in use and, on the other hand, industrial activities where biotechnologies play an important driving role. There are several areas in which these technologies are being used. The important are chemical industry, food industry (mass production of yeast, algae and bacteria with a view of providing proteins, amino acids, vitamins, and use of enzymes), agricultural productivity, pharmaceutical industry, environmental protection and abatement of pollution, etc. Biotechnology is also helpful in feeding the World.

Biotechnology has multiple faces. The expansion of biotechnology in the medical arena, agricultural techniques (like, breeding and growth control, including genetic engineering for yield and quality traits, metabolite production, rapid clonal propagation, and germplasm conservation, etc.), in microbial agro-biotechnology (including new approaches to plant pest control, biofertilization, bioremediation, and fermentation of agricultural products), livestock biotechnology (including genetic manipulations for improving fertility and reproduction, growth, milk quality, egg production and disease control), marine

biotechnology (including the use and improvement of fish, macro- and micro-algae for food and biochemical production and environmental uses) made the studies of biotechnology essential for students. All these domains are concerned with food production and the conservation of our environment.

Biotechnology is an applied science and has made advances in two major areas, viz., molecular biology and production of industrially important biochemicals (including enzymes). The science has multiple applications in agriculture: (1) Automated bio-screening, (2) Bio-processing alkenes to valuable oxides and glycols, (3) Developing immobilized cell and enzyme systems for chemical process industries, (4) Engineering of a series of organisms for specific industrial use, (5) Genetical improvement of microorganisms for production of pharmaceutical products, (6) Human gene therapy, (7) Improved production of Vitamin B_{12}, (8) Large scale production of fructose from inexpensive forms of glucose, (9) Manufacturing ethanol by continuous fermentation, (10) Microbiological based production of human insulin and interferons, (10) Microbiologically upgradation of hydrocarbons, (11) Production and development of vaccine to prevent calibacillosis (a disease develops in newborn calves and piglets), (12) Production of biopesticide and biofertilizers, (13) Production of diagnostic kits for toxoplasmosis identification, (14) Production of monoclonal antibodies for organ transplant tissue typing, (15) Production of photosynthetically efficient plants, (16) Production of transgenic plants and animals, (17) Production of xanthan gum in oil fields for recovery of crude mineral oils, etc.

The book includes two important chapters viz., **Bioinformatics** and **Nanotechnology**. These are new emerging fields of biotechnology.

The text has been prepared with the help of several authentic literature. I do not claim for my original writing, however the way of presentation of the text is new. I thankfully acknowledge all the sources. I shall welcome suggestions for improvement of next edition.

I express my gratitude to Dr. Updesh Purohit, Managing Director, Agrobios (India) for cooperation and attractive presentation of the text.

Author

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