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Basic and Applied Aspects of Biotechnology

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Dedicated to teaching fraternity and students

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2. Prakash J, Singh H, *Gupta Varsha* (2012) Evaluating arthroscopic debridement as a surgical option for patients with differing grades of knee osteoarthritis. *Current Orthopaedics Practice*. 23: 218-220.
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Abstract

Biotechnology is multidisciplinary field which has major impact on our lives. The technology is known since years which involves working with cells or cell-derived molecules for various applications. It has wide range of uses and is termed “technology of hope” which impact human health, well being of other life forms and our environment. It has revolutionized diagnostics and therapeutics; however, the major challenges to the human beings have been threats posed by deadly virus infections as avian flu, Chikungunya, Ebola, Influenza A, SARS, West Nile, and the latest Zika virus. Personalized medicine is increasingly recognized in healthcare system. In this chapter, the readers would understand the applications of biotechnology in human health care system. It has also impacted the environment which is loaded by toxic compounds due to human industrialization and urbanization. Bioremediation process utilizes use of natural or recombinant organisms for the cleanup of environmental toxic pollutants. The development of insect and pest resistant crops and herbicide tolerant crops has greatly reduced the environmental load of toxic insecticides and pesticides. The increase in crop productivity for solving world food and feed problem is addressed in agricultural biotechnology. The technological advancements have focused on development of alternate, renewable, and sustainable energy sources for production of biofuels. Marine biotechnology explores the products which can be obtained from aquatic organisms. As with every research area, the field of biotechnology is associated with many ethical issues and unseen fears. These are important in defining laws governing the feasibility and approval for the conduct of particular research.

1.1 Introduction

The term “biotechnology” was coined by a Hungarian engineer Karl Ereky, in 1919, to refer to the science and methods that permit products to be produced from raw materials with the aid of living organisms. Biotechnology is a diverse field which involves either working with living cells or using molecules derived from them for applications oriented toward human welfare using varied types of tools and technologies. It is an amalgamation of biological science with engineering whereby living organisms or cells or parts are used for production of products and services. The main subfields of biotechnology are medical (red) biotechnology, agricultural (green) biotechnology, industrial (white) biotechnology, marine (blue) biotechnology, food biotechnology, and environmental biotechnology (Fig. 1.1.). In this chapter the readers will understand the potential applications of biotechnology in several fields like production of medicines; diagnostics; therapeutics like monoclonal antibodies, stem cells, and gene therapy; agricultural biotechnology;

pollution control (bioremediation); industrial and marine biotechnology; and biomaterials, as well as the ethical and safety issues associated with some of the products.

The biotechnology came into being centuries ago when plants and animals began to be selectively bred and microorganisms were used to make beer, wine, cheese, and bread. However, the field gradually evolved, and presently it is the use or manipulation of living organisms to produce beneficiary substances which may have medical, agricultural, and/or industrial utilization. Conventional biotechnology is referred to as the technique that makes use of living organism for specific purposes as bread/cheese making, whereas modern biotechnology deals with the technique that makes use of cellular molecules like DNA, monoclonal antibodies, biologics, etc. Before we go into technical advances of DNA and thus recombinant DNA technology, let us have the basic understanding about DNA and its function.

The foundation of biotechnology was laid down after the discovery of structure of DNA in

Fig. 1.1 Major applications of biotechnology in different areas and some of their important products

