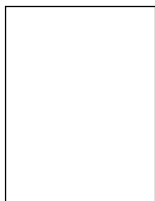


## Concepts in Biotechnology

An affordable Overview of  
Biotechnology Through Self Study  
and by Open Learning

**Narayan S Punekar**



*Concepts in Biotechnology*  
Edited by  
D Balasubramanian and others  
Universities Press, 1996, Rs.295.

योगः कर्मसु कौशलम् ।

‘Dexterity in action is the best evidence of  
application of technology’  
Bhagavadgeeta [Chapter II, Stanza 50]

Biotechnology is an exciting area of human endeavour that encompasses a range of sciences and technologies. They include - chemistry, biochemistry, biophysics, molecular biology, genetics, microbiology, plant and animal cell culture, fermentations, chemical engineering, biochemical engineering and process engineering. The multidisciplinary nature of biotechnology is thus self-evident. Like the proverbial elephant as recognised by the four blind men, biotechnology means many different things to different people. Although variously defined, it is a new biological approach to a wide range of industrial processes. Any comprehensive attempt to

present this subject therefore can at best be an overview with emphasis on concepts. This book aims to do just that.

Biotechnology as an activity has existed since ancient times. Then what is new? The present excitement in biotechnology is because we have begun to understand and manipulate biological systems at the molecular level. As Arthur Kornberg put it - “DNA and RNA provide the script, but the enzymes do the acting”. Our ability to achieve controlled modifications of DNA is known as recombinant DNA technology. These selective changes to DNA allow us to impart new/modified messages in a variety of species. With this powerful tool at the molecular level, we are able to express a desired property in a macromolecule, a bacterium, a cultured cell or an entire organism.

A book on biotechnology by single author brings in the associated special flavour and prejudice. The book under review is unique in that it has chapterwise contributions by experts in each discipline. A degree of repetition of material in some of the chapters (as in chapters 5 and 11) is an unavoidable flip side. As projected in chapter 1, the book assumes exposure to high school level chemistry and physics; a built-in emphasis to target biology background audience is apparent. Such an approach harbours the dangers of being more descriptive and less quantitative (e.g., chapters 7 and 8).



It is commendable that such a vast subject is well covered in this book. The value of its presentation is complemented through pertinent references at the end of each chapter and a short glossary at the end. The concepts have been beautifully reinforced with self-assessment exercises and assignments.

The first four chapters introduce the basics and hence make essential reading, especially in brushing up cell biology fundamentals. Chapters 4 and 5 provide the essence of recombinant DNA methodology. With the explosion of information — in genomic DNA sequences and protein data bases — computational biology has kept pace; Chapters 6 and 14 cover the rapid strides made in bioinformatics and structure prediction leading to rational design of these molecules.

Any treatment of biotechnology without a coverage on enzymes is incomplete. The topic on immobilized enzymes and their use in bioreactors and biosensors is uniquely brought out in chapter 7. Readers with prior background in enzyme catalysis and kinetics would savor this chapter. Chapter 8 is a nice coverage of biochemical engineering principles and microbial fermentations. Chapter 12 provides a meticulous and up-to-date overview of the oldest of all biotechnologies — the plant

biotechnology.

Approaches to exploit animals and animal cells in furthering human health and related industry are the subject of chapters 9, 10, 11 and 13. The concepts on immune system, hybridoma technology, DNA/immuno-diagnostics, *in vitro* fertilisation and embryo transfer are lucidly described with examples. No doubt, with the recent advent of “Dolly — the cloned sheep”, aspects of totipotency in chapter 13 will soon have to be redefined.

The social, ethical and environmental impact of biotechnology and the issues concerned are summarised in the last three chapters.

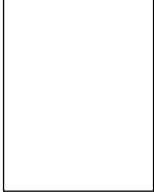
It is commendable that such a vast subject is well covered in this book. The value of its presentation is complemented through pertinent references at the end of each chapter and a short glossary at the end. The concepts have been beautifully reinforced with self-assessment exercises and assignments. But for a few errors in structures (such as p.108), the book is easily readable and covers all aspects of biotechnology known to us today. It is a worthy effort in introducing this subject to the undergraduate as well as M.Sc levels, and is available at an affordable price.

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## Life of R A Fisher

**A P Gore**



*RA Fisher - The Life of a Scientist*  
 Joan Fisher Box  
 John Wiley & Sons, New York, 1978.  
 512+xii, US\$26.95

Ronald Aylmer Fisher (17 February 1890-29 July, 1962) can be rightly considered the father of modern statistics. Geneticists and evolutionary biologists are often surprised to know that his basic background was in mathematical statistics and he rose to eminence first through his work on foundations of statistical inference and then on design of experiments, analysis of variance and other statistical methods.

After schooling in Harrow, Fisher went to Gonville and Caius College, Cambridge on a scholarship to become a Wrangler in 1912. He received D.Sc. from Cambridge in 1926 and F.R.S. in 1934. He was knighted in 1952. Ironically, in his entire career, Fisher never held a professorship of statistics. In 1933 he joined University College, London as professor of eugenics and in 1943 became professor of genetics at Cambridge from where he retired in 1957.

Fisher's first scientific job after teaching in schools for 5 years was at the Rothamstead

Experimental Station to which he was recommended by Leonard Darwin, nephew of Charles Darwin. Here he was asked to examine long term records of wheat yields etc. and to develop new insights. He did much more. He developed an entire range of statistical methods for agricultural and other research. He trained many statisticians from all over the world and his book *Statistical Methods for Research Workers* became very popular.

The aim of statistics is to draw valid inferences from a sample. Fisher's method of maximum likelihood estimation is one of the most successful approaches to inference. He founded the branch called *design of experiments*. Until then, scientific method involved experiments in which one aspect was varied at a time and any consequent changes in response were attributed to that variation. Fisher dazzled experimental scientists by showing them how to design experiments in which many factors are changed simultaneously and how to extract valid information from them.

Right from his student days Fisher was keenly interested in the field of eugenics and hence in the new science of genetics. There were two major schools in genetics. Mendelians claimed that inheritance was particulate and predicted how different phenotypic proportions should turn out in different crosses. Traits studied by Mendelians (eye colour, hair colour, etc.) were considered trivial by the other school



lead by Francis Galton and Karl Pearson who were interested in intelligence, height, yield etc. Fisher showed convincingly that discrete and continuous traits differed only in detail but the same basic formulation explained both. This synthesis played a fundamental role in genetics as well as in evolution.

Darwin had explained that evolution through natural selection was based on phenotypic variation in a population. Fisher showed, in the fundamental theorem of natural selection, that speed of evolution was proportional to the variance in the trait of interest.

When data are large, they have to be summarized, which inevitably means loss of information. Fisher introduced a mathematical measure of this information and showed that loss of information is zero if the summary is based on the so called *sufficient statistics* developed by him.

Fisher was one of eight siblings. He collected data on thousands of British families with eight children and found that the pattern of the number of daughters and sons differed a lot from a model of throwing a coin eight times. It appears now that a better model is one in which probability of couples to have a son varies considerably.

Fisher had very poor eyesight. Hence, when he volunteered to join the British armed forces in the first world war he was

rejected. An Indian agricultural statistician, Koshal had written a paper comparing favourably Fisher's method of maximum likelihood with Karl Pearson's classical method of moments. Karl Pearson, the grand old man of statistics at that time attacked Koshal venomously. The Indian Government even contemplated sacking Koshal. Fisher wrote a scathing rebuttal partly to protect Koshal and partly to point out Pearson's errors. This article is worth reading (Collected Works of Fisher, Vol. IV, paper 2).

Fisher inspired a whole generation of statisticians. He was very helpful in promoting statistics in India. He impressed upon the colonial government the need to support the endeavours of P C Mahalanobis. He was the Ph.D. guide of C R Rao, perhaps the most famous living Indian statistician today.

A peculiar feature of Fisher's life is the fact that with one of the most illustrious careers in science in this century, Fisher found himself foot-loose after retirement. He spent his last years not in his home country but in Australia where a former student looked after him.

For young statisticians, Fisher's life has two messages. Statistics cannot survive (let alone thrive) in a vacuum. One must identify a genuine problem in science or technology and develop statistical tools to solve it. Secondly, one must delve deep into the



subject matter to which statistics is to be applied. Fisher became an ecologist, evolutionary geneticist and agronomist all in one. He was a living example of interdisciplinary research. This book written by his daughter, Joan Fisher Box is inspiring reading for any budding scientist.

### Suggested Reading

- ◆ Fisher, R.A., 1925 (most recent edition, 1970). *Statistical Methods for Research Workers*. Oliver and Boyd, Edinburgh.
- ◆ Fisher, R.A., 1958. *The Genetical Theory of*

*Natural Selection*. Oxford University Press, Oxford.

- ◆ Fisher, R.A., 1935 (most recent edition, 1966). *The Design of Experiments*, Oliver and Boyd, Edinburgh.
- ◆ Fisher, R.A. and Yates, F. 1938 (most recent edition 1963). *Statistical Tables for Biological, Agricultural and Medical Research*, Oliver and Boyd, Edinburgh.
- ◆ Bennett, J.H. Ed. 1971-1974. *Collected Papers of R.A. Fisher*, Vol.1-5, The University of Adelaide.

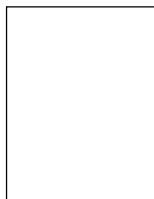
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## Algebra, Volume I: Groups

A Good Text Book on Group Theory for Post Graduates

**K N Rajeswari**



*Algebra, Volume-I: Groups*  
 I S Luthar and I B S Passi  
 Narosa Publishing House, New Dehli  
 ISBN-81-7319-077-1, 1996  
 pp. xxxvi + 242

The basic notions in various branches of modern algebra are analogous to those in group theory. So, it is important to make group theoretical concepts and ideas as clear as possible. This book is a successful attempt in this direction. The most concrete groups such as symmetric groups and matrix groups

The exposition in the book is self-contained, in the sense that it includes proofs of several useful results which are often left as exercises to the readers or even overlooked in standard books on the subject.

are used as main sources of examples. Various abstract concepts are explained through these examples, making it easy for the reader to grasp them. The exposition in the book is self-contained, in the sense that it includes proofs of several useful results which are often left as exercises to the readers or even overlooked in standard books on the subject. To mention a few such instances — results of section 6 on cardinal arithmetic in preliminaries, several explicit formulae concerning symmetric groups in chapter 2.

Each section is followed by a long list of exercises. Most of these are direct consequences of material developed in earlier sections.

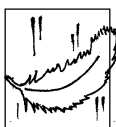
The authors begin with the discussion of preliminaries on set theory, matrices, and cardinal arithmetic. Symmetries of plane configurations are discussed in chapter 1. This discussion, besides providing a motivation to the concept of a group, provides concrete examples of groups. Notions of semi groups, groups, group homomorphisms and symmetric groups are introduced in chapter 2. In chapter 3, subgroups and normal subgroups are considered. Material covered in these two chapters can be found in any standard book on the subject. General homomorphism theorems are proved for groups with operators in chapter 4 and these constitute a good part of this chapter. However, these results, in this generality, are not used elsewhere in the text in any essential manner. Rather than being helpful, a beginner may find the generality somewhat difficult to comprehend. Group actions, free groups and presentations of finite groups are also dealt

The book is well written, easily understandable and covers syllabi of the group theory courses offered at the Master's level in most of the Indian universities.

with in this chapter. One special feature of this chapter is a well presented account of the *Todd-Coxeter algorithm* for finding the index of a subgroup of a finite group. Chapters 5 to 8 cover standard material on direct, semi-direct products, Sylow's theorems, solvable groups, nilpotent groups, structure of finitely generated Abelian groups etc. The book concludes with the classification of finite rotation groups of the real Euclidean plane and 3-space.

In a nutshell, the book is well written, easily understandable and covers syllabi of the group theory courses offered at the Master's level in most of the Indian universities. Hence it can be profitably used as a text book at that level.

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In questions of science the authority of a thousand is not worth the humble reasonings of a single individual.

*Galileo*