



**Publishers :**

Thanuj International Publishers  
8/173-B, Vengayapalayam, Rasipuram,  
Namakkal, Tamil Nadu, India - 637 406.  
E-mail : thanujinternationalpublishers@gmail.com

**Printers :**

Dhazh Computers (Graphic Designer)  
No: 442- A, 10<sup>th</sup> East Cross Street,  
Munthirithoppu, Annanagar,  
Madurai – 20, Tamil Nadu, India.  
E-mail: narennarayanamy@gmail.com

ISBN : 978-93-94638-23-5



9 789394 638235

**Biosensors : Types & Applications - Nirmala Rajkumar**

**Editor  
Nirmala Rajkumar**

# Biosensors

## Types & Applications

*First Edition*



Thanuj International  
Publishers



# **Biosensors**

**Types & Applications**

**Editor**

**Nirmala Rajkumar**

## Publisher Info

First published in India in 2023

This edition published by Thanuj International Publishers

©2023. Thanuj International Publishers. All rights reserved.

Apart from any use permitted under Indian copyright law, this publication may only be reproduced, stored or transmitted, in any form, or by any means with prior permission in writing of the publishers or in the case of reprographic production in accordance with the terms of licenses issued by the Copyright Licensing Agency.

Copy Right policy is to use papers that are natural, renewable and recyclable products and made from wood grown in sustainable forests. The logging and manufacturing processes are expected to conform to the environmental regulations of the country of origin. Whilst the advice and information in this book are believed to be true and accurate at the date of going to press, neither the Authors and the publisher can accept any legal responsibility or liability for any errors or omissions that may be made. In particular, (but without limiting the generality of the preceding disclaimer) every effort has been made to check quantity of chemicals; however it is still possible that errors have been missed.

**ISBN: 978-93-94638-23-5**

**Price: Rs: 650.00**

**Published by:**

Thanuj International Publishers,  
8/173-B, Vengayapalayam, Kakkaveri, Rasipuram,  
Namakkal, Tamil Nadu,  
India – 637406.

[www.darshanpublishers.com](http://www.darshanpublishers.com)

E-mail: [thanujinternationalpublishers@gmail.com](mailto:thanujinternationalpublishers@gmail.com)

**Printed by:**

Dhazh Computers (Graphic Designer)  
No: 442- A, 10<sup>th</sup> East Cross Street,  
Munthirithoppu, Annanagar,  
Madurai – 20, Tamil Nadu, India.  
E-mail: [narennarayanamy@gmail.com](mailto:narennarayanamy@gmail.com)



## Abbreviations

<b>TBBS</b>	Tissue based biosensor
<b>PLGA</b>	Poly Lactic-co-Glycolic Acid
<b>OPP</b>	Organophosphorus pesticide
<b>AAO</b>	Ascorbic Acid Oxidase
<b>FIA</b>	Flow Injection Analysis
<b>HPLC</b>	High Power liquid Chromatography
<b>LSPR</b>	Localized SPR
<b>MNP</b>	Metallic Nanostructure
<b>RIFS</b>	Reflectometric Interference Spectroscopy
<b>SERS</b>	Surface-Enhanced Raman Scattering
<b>SPR</b>	Surface Plasmon Resonance
<b>SPRi</b>	SPR imaging
<b>AuNP</b>	Gold nano particles
<b>QD-FRET</b>	Quantum dots- fluorescent resonance energy transfer
<b>QCM-DNA</b>	Quartz crystal microbalance – DNA
<b>qPCR</b>	Quantitative polymerase chain reaction
<b>IAA</b>	Indole-3-acetic acid
<b>ABACUS</b>	Absciscic acid concentration and uptake sensor
<b>Ab</b>	Antibody
<b>Ag</b>	Antigen
<b>Mab</b>	Monoclonal antibody
<b>Fv</b>	Fragment antigen binding
<b>SCFV</b>	Single chain fragment variable
<b>Ig</b>	Immunoglobulin

<b>SPR</b>	Surface plasma resonance
<b>AFP</b>	Alpha fetoprotein
<b>TDM</b>	Therapeutic drug monitoring
<b>ACS</b>	American cancer society
<b>TSGs</b>	Tumor suppressor genes
<b>Rb</b>	Retinoblastoma Protein
<b>NCI</b>	National cancer institute
<b>PSA</b>	Prostate specific antigen
<b>CA</b>	Cancer antigen
<b>PCD</b>	Programmed cell death
<b>OB</b>	Optical biosensor
<b>TDM</b>	Therapeutic drug monitoring
<b>PS</b>	Plasmon surface
<b>WhO</b>	World health organization
<b>FAO</b>	Food and agricultural organization
<b>SPR</b>	Surface plasmon resonance
<b>AE</b>	Adverse effect
<b>GCMS</b>	Gas chromatography mass spectroscopy
<b>HPLC</b>	High performance liquid chromatography
<b>SERS</b>	Surface enhanced Raman scattering
<b>TIRF</b>	Total internal reflection fluorescence
<b>MiRNA</b>	MicorRNA
<b>ISE</b>	Ion selective terminals
<b>CV</b>	Cyclic voltammetry
<b>ESI</b>	Electrochemical Impedance Spectroscopy
<b>AuNPs</b>	Gold nanoparticles
<b>SiNW</b>	Silver nanowire
<b>SsDNA</b>	Single strand DNA
<b>MFC</b>	Microbial fuel cells

<b>BOD</b>	Biodegradable organic compounds
<b>PFM</b>	Proton exchange membrane
<b>SPU</b>	Signal processing unit
<b>BOD</b>	Biochemical oxygen
<b>PCB</b>	Polychlorinated biphenyl
<b>OP</b>	Organophorous
<b>BOD</b>	Biological and biochemical oxygen demand
<b>DNA</b>	Deoxyribo nucleic acid
<b>RTD</b>	Resistance temperature detector
<b>ELISA</b>	Enzyme linked immunosorbent assay
<b>TELISA</b>	Thermometric enzyme linked immunosorbent assay
<b>CRISPR</b>	Clustered regularly interspaced short palindrome repeats

## Contents

1	Tissue Based Biosensor <i>Divya Dharshini. A.</i>
2	Optical Biosensor <i>Pushpa.V.</i>
3	Enzymatic Biosensors <i>Bhuvaneshwari. D.</i>
4	Antibody Based Biosensor <i>Ramana Priya. T.</i>
5	Biosensor – A Prominent Device in Plant Biology <i>Sai Sowmiya. M.</i>
6	Electrochemical Biosensor in Cancer Detection <i>Pavithra. S.</i>
7	Microbial Fuel Cell as a Biosensor <i>Swetha. R.</i>
8	Optical Biosensors for Cancer Detection <i>Sharmila. S.</i>
9	Optical Biosensors in Therapeutic Drug Monitoring <i>Mohana. M.</i>
10	Electrochemical Biosensors <i>Dhivya Swarna. J.</i>
11	Soil Quality Monitoring Biosensor <i>Thiresa Bakiyawathi. A.</i>
12	Biosensor for Pollution Detection <i>Varshini. S.</i>
13	Biological Oxygen Demand Biosensor <i>Haripriya. R.</i>

14	Thermal Biosensor <i>Sugirdha. S.</i>
15	Biosensor in Cosmetics <i>Indhumathi. V.</i>
16	Biosensor for the Detection of Foodborne Pathogens <i>Monica. S.</i>
17	Biosensor in Agriculture <i>Narmadha. B.</i>
18	Biosensors in Crime Detection <i>Abimanyu. J.</i>
19	Water Quality Monitoring Biosensor <i>Jeevitha. M.</i>
20	Biosensor in the Detection of Toxicity <i>Vinaiprakash. N.</i>
21	Biosensor to Detect Biomolecules <i>Doss Aristotle</i>
22	Biosensor in Pregnancy Test <i>Kirithika. P.</i>
23	Biosensor for Detection Of Cancer <i>Deepika. A.</i>
24	Piezoelectric Biosensors <i>Venkata Krishnan. S.</i>
25	Biosensors in Detecting Food Contamination <i>Sharan. K. N.</i>
26	Biosensors for the Detection of Viral Respiratory Diseases <i>Sneha Surve</i>



## Preface

Biosensors is a device, it combines a biological component with physiochemical component to detect an analyte by producing a signal which is measurable. Recently, the research activities on biosensors is in growing interest among many researchers owing to their versatile usage in many applications in day-to-day life. Biosensors contribute to advances in next-generation medicines such as individualized medicine and ultrasensitive point-of-care detection of markers for diseases. The innovative development of biosensors require researches with interdisciplinary research skills. This book is dealt with the fundamentals of sensors, and its application in different fields like diagnostic, Forensic, Food industry, Environmental, medical application. This book give basic information on the sensors. This book will be helpful to the undergraduate, post graduate and the research students. This book will surely be the choice of budding researchers.

**Nirmala Rajkumar**

## Acknowledgements

First and foremost, I thank the **GOD Almighty** for the successful completion of this book.

I would like to thank our Management, Principal, for the motivation to Publish books

I would like to thank School of science Dean, HOD and Faculty Members of Biotechnology Department, Hindustan College of Arts & science Padur, Chennai - 603103 for their consistent support and encouragement.

I would like to thank the publishing team at Thanuj International Publishers, Tamil Nadu, India.

I would like to thank Dhazh Computers for their valuable support to bring out this Edition.

**Nirmala Rajkumar**

## Contributors

My heartfelt thanks to the contributors from the Department of Biotechnology, Hindustan College of Arts & Science, Department of Biotechnology, Padur, Chennai – 603103.

Divya Dharshini. A.

Pushpa. V.

Bhuvaneshwari. D.

Ramana Priya. T.

Sai Sowmiya. M.

Pavithra. S.

Swetha. R.

Sharmila. S.

Mohana. M.

Dhivya Swarna. J.

Theresa Bakiyawathi. A.

Varshini. S.

Haripriya. R.

Sugirdha. S.

Indhumathi. V.

Monica. S.

Narmadha. B.

Abimanyu. J.

Jeevitha. M.

Vinaiprakash. N.



Doss Aristotle

Kirithika. P.

Deepika. A.

Venkata Krishnan. S.

Sharan. K. N.

Sneha Surve

**Nirmala Rajkumar**

## About the Editor

Dr.Nirmala Rajkumar has completed her Ph.D. degree in Bionano System Engineering, Chonbuk National University, South Korea. She worked as Research Assistant Professor under government Projects at CBNU, South Korea. She is currently working as an Assistant Professor in the Department of Biotechnology, Hindustan College of Arts & Science, Chennai. She has been recognized as a supervisor for guiding scholars leading to award of Ph.D., in Biotechnology of University of Madras. She has excellent research and teaching experiences. She has been actively involved with research activities which include electrospinning of biopolymers for nanotechnological applications in environmental, energy, and medical areas. Her research is mainly dealt with the preparation of nanofibers and their characterization techniques. Her favorite research fields include bionanomaterials, nanotechnology, biotechnology, and microbiology. To her credit, she is having 2 patents and 85 papers in the internationally reputed journal with an h-index of 23. She has been involved in many technical committees. She has attended several workshops, conferences, and seminars to present her research works. She is a reviewer for many international journals.