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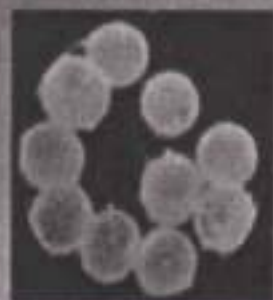
স্নাতক মহলাৰ উদ্ভিদ বিজ্ঞান

অণুজীৱৰ বৈচিত্ৰতা আৰু অপুষ্পক উদ্ভিদ

(Diversity of Microbes
and Cryptogams)

(সোধাৰণ পাঠ্যক্ৰমৰ প্ৰথম
সাপ্তাহিকৰ বাবে)

কৰুণা কান্ত দাস



TDC Botany (1st Semester) : A Text book of TDC Botany, written by Prof. Karuna Kanta Das
in accordance with the latest (Semester) syllabus prescribed by Gauhati University and published
by ASSAM BOOK DEPOT, Panbazar, Guwahati-781001, Ph : (0361) 2543896,
e-mail : asbeedee25@gmail.com

প্রকাশক :

অসম বুক ডিপো

পানবজাৰ, গুৱাহাটী : ৭৮১০০১

ফোন : (০৩৬১) ২৫৪৩৮৯৬

e-mail : asbeedee25@gmail.com

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প্রথম প্রকাশ : জুন, ২০১৭

মূল্য : ₹ 350.00

ISBN : 978-93-82384-63-2

জি. টি. পি. :

অসম বুক ডিপো

২৪/এ, বাজা হামমোহন বাগ সৰণি

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ফোন : ২৩৬০-০০৯১

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শ্রী সবধু প্রিন্টিং ৱাৰ্ক্‌ছ

৬১৮/এ, জি. টি. ৰোড (বটতলা)

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ফোন : ২৬৫২-১৪২৩

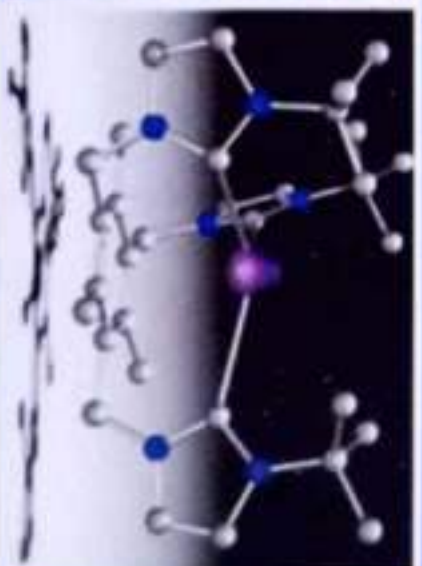
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B.Sc. CHEMISTRY-I: A text book on Chemistry (General) for Three year Degree course (1st semester) in accordance with the syllabus of Gauhati University written by Sri Dipu Kr. Das & Sri Jayanta Kr. Baishya, M.Sc., M.Phil and published by Mani Manik Prakash, Panbazar, Guwahati-781001.

Published by :

Anupam Dutta
Mani Manik Prakash
Jaswanta Road, Panbazar,
Guwahati-781001

First Edition : 2017

Price : Rs. 210/-

ISBN : 978-81-85917-76-0

Copyright © Authors

Printed at :

Trishnatur Printers
G.N.B. Road, Silpukhuri
Guwahati-781003

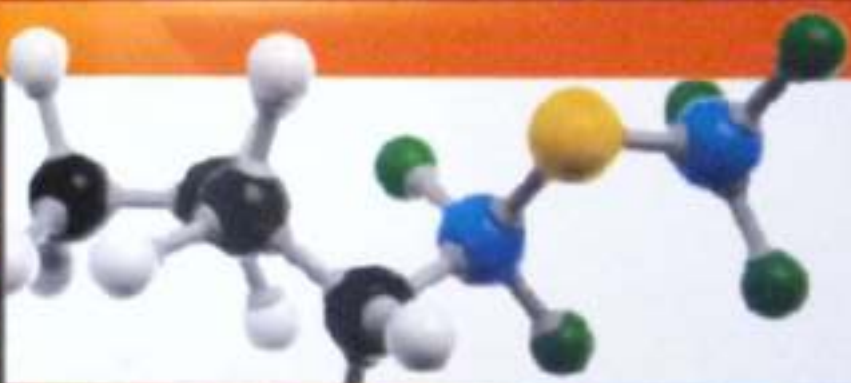
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প্রকাশক :

অসম বুক ডিপো

পানবজাৰ : গুৱাহাটী-৭৮১০০১

ফোন : ০৩৬১-২৫৪৩৮৯৬

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প্রথম প্রকাশ : চেপ্তেম্বৰ, ২০১৪

দ্বিতীয় প্রকাশ : মে', ২০১৭(সংশোধিত আৰু পৰিৱৰ্তিত সংস্কৰণ)

মূল্য : ₹ ১৩০.০০

ISBN : 978-93-82384-75-5

অক্ষৰ বিন্যাস :

নিবন্ধন লেজাৰ পয়েন্ট

১০৬বি, ৰাজা ৰামমোহন সৰণি

কোলকতা - ৭০০০০৯

মুদ্রক :

শ্রীসৰষু প্ৰিণ্টিং ৱাৰ্কছ

৬১৮/এ, জি. টি. ৰোড (বটতলা)

শ্রীৰামপুৰ, হুগলী

ফোন : ২৬৫২-১৪২৩/২৬৫২-৮২১৩

Cultural Heritage of Assam

Editors

Savit K. Chaudhuri

Mini Bhattacharyya Thakur



Indira Gandhi Rashtriya Manav Sangrahalaya
(National Museum of Mankind Bhopal)



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First Published, 2017

Published by



Gyan Publishing House
S, Ansari Road
Daryaganj, New Delhi 110002
Phone: 9811692460
E-mail: books@gyanbooks.com

and



Indira Gandhi Rashtriya Manav Sangrahalaya
Sharda Hills, Bhopal
Phones: 0755-2661290, 2661319
Fax: 91-755-2661458

Printed at: G. Print Process, Delhi.

Cataloging in Publication Data—DK

Country: D K. Agencies (P) Ltd. <docinfo@dkagencies.com>

Cultural heritage of Assam / [editors], Sarit K. Chaudhuri, Mini Bhattacharyya Thakur.

pages cm

Contributed articles.

Includes bibliographical references.

ISBN 9788121213424

1. Cultural property—India—Assam. 2. Assam (India)—
Social life and customs. I. Chaudhuri, S. K. (Sarit Kumar),
editor. II. Thakur, Mini Bhattacharyya, editor

DS485.A852C85 2017

DDC 363.690954162 23

Contents

<i>List of Tables</i>	9
<i>List of Figures</i>	11
<i>List of Contributors</i>	13
1. Introduction 15	
— <i>Sarit K. Choudhury, Mini Bhattacharyya Thakur</i>	
2. The Role of Ojāpālī in Creating Social Awareness and the Need to Reinstate it in the Modern Assamese Society 25	
— <i>Aparna Goswami</i>	
3. An Attempt at Re-defining Caste, Tribe and Gender in Fifteenth Century Assam from the Neo-Vaishnavite Bhakti Perspective of Mālapurush Srimanta Śankaradeva and its Emphasis on Democratisation of Bhakti 35	
— <i>Archana Barua</i>	
4. Assamese Cuisine in Folk Literature and Economic Empowerment of Women through Assamese Cuisine 55	
— <i>Archana Kalita</i>	
5. Role of Puppetry in the Development of Communication Skills in Children 63	
— <i>Binita Devi, Simanta Sarma</i>	
6. Appeasing the Bamboo Deity in Assam: A Study with Special Reference to Bhatheli 75	
— <i>Bijinchi K. Medhi, Jitmit Bora</i>	
7. An Exploration of the Sacred Complex of Visisthasrama of Assam .. 89	
— <i>Bijinchi K. Medhi, Kunal Choudhury</i>	

Appeasing the Bamboo Deity in Assam: A Study with Special Reference to Bhatheli

— Birinchi K. Medhi, Jilmil Bora

Introduction

Bamboo occupies an indispensable place in the socio-cultural life of the Assamese since time immemorial. It is highly auspicious for the people of Assam and it can be understood from its usage in most of the day-to-day affairs, especially in the Assamese folk life. When we look into the annals of history, we find that bamboo was regarded as a rich natural resource, as the forests of Assam were full of different species of bamboo. Almost all the Assamese people residing in the villages or rural areas have bamboo plantations at their backyards. This reflects the close association of the Assamese people with bamboo. There is a popular Assamese proverb in this regard:

Jar nai bah tar naisah i.e. one who does not possess bamboo, does not have courage also.

The typical pattern of a rural Assamese compound is as follows:

Pube hah

Pachime bah

Uttareguwa

Daksinedhoua, i.e., ducks or the tank in the east, bamboo plantations in the west, areca palms in the north and open space in the south. This indigenous compound pattern is very scientific. The eastern side is kept open for the passage of air and for the morning sunlight which are considered

Drishtikon

দৃষ্টিকোণ

Refresher Course

(6th March to 26th March 2017)

UGC-Human Resource Development Centre

Gauhati University

Guwahati

Editor

Mukut Pathak

Biju Rajkhowa



PURBAYON
publication

Drishtikon **দৃষ্টিকোণ**

A collection of articles on various aspects, Edited by Mukut Pathak and Biju Rajkhowa and published by Purbayon Publication, Satmile, Guwahati-14, Assam on behalf of Refresher Course (6th March to 26th March 2017); UGC-Human Resource Development Centre, Gauhati University, Guwahati

Email- purbayonindia21@gmail.com

First Edition : March, 2017

Rs. ₹ 300 /-

ISBN- 978-81-92955-67-4

Drishtikon

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Prof Dilip Bora, HOD, Dept of MIL & LS, GU

Dr. S.K. Chakraborty, Deputy Director, HRDC, GU

Editor:

Mukul Pathak

Biju Rajkhowa

First Edition: March, 2017

Price: ₹ 300/-

Cover: Sanjib Bora

Published By: Purbayon Publication

Satmile, Near Gauhati University

Guwahati: Assam: India

Email- purbayonindia21@gmail.com

☎ 9864422157

Since the articles of this book are collected from individual authors, the responsibility for the facts, views, conclusion and plagiarism, if any in this book is entirely that of the authors. The editors and the publisher bear no responsibility for that.

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Drishtikou **দৃষ্টিকোণ**

ISBN- 978-81-92955-67-4

Parallelism between Greek and Indian Mythology: A Study of Select Greek Myths and Parallel Indian Myths

♦ Aparaz Goswami*

Introduction:

Johann Wolfgang von Goethe's concept of '*Welt Literatur*' propagated in 1827 and later reinstated by Rabindranath Tagore in Indian context through his notion of *Vishwa Sahitya* in 1909, has provided the readers and critics new parameters for judging as well as understanding literature in a more effective way. This approach can also help in national and also at times international integration as we find many common points linking different communities in a single thread. This paper endeavors to bring out parallelism between select myths prevalent in ancient Greece and ancient India. The scope of study encompasses the parallels drawn between mythical characters, between the plot structure of the myths and also between some common motifs adopted by the select myths representing the two different cultures.

Parallelism in Mythical Characters:

Zeus, regarded as god of all gods among the Greek pantheon is directly comparable with *Indra*, the Indian mythical god of the same

* Asst. Professor, Dept. of English, D.K. College, Mirza

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Editors

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Mini Bhattacharyya Thakur



Indira Gandhi Rashtriya Manav Sangrahalaya
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The views and opinions expressed in this book are author(s) own and the facts reported by them have been verified to the extent possible, and the publishers are not in any way liable for the same.

First Published, 2017

Published by



Gyan Publishing House
S, Ansari Road
Daryaganj, New Delhi 110002
Phone: 9811692460
E-mail: books@gyanbooks.com

and



Indira Gandhi Rashtriya Manav Sangrahalaya
Sharda Hills, Bhopal
Phones: 0755-2661290, 2661319
Fax: 91-755-2661458

Printed at: G. Print Process, Delhi.

Cataloging in Publication Data—DK

Country: D K. Agencies (P) Ltd. <docinfo@dkagencies.com>

Cultural heritage of Assam / [editors], Sarit K. Chaudhuri, Mini Bhattacharyya Thakur.

pages cm

Contributed articles.

Includes bibliographical references.

ISBN 9788121213424

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Social life and customs. I. Chaudhuri, S. K. (Sarit Kumar),
editor. II. Thakur, Mini Bhattacharyya, editor

DS485.A852C85 2017

DDC 363.690954162 23

Contents

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1. Introduction	
— <i>Sarit K. Choudhuri, Mini Bhattacharyya Thakur</i>	15
2. The Role of Ojāpālī in Creating Social Awareness and the Need to Reinstate it in the Modern Assamese Society	
— <i>Aparna Goswami</i>	25
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The Role of Ojāpālī in Creating Social Awareness and the Need to Reinstate it in the Modern Assamese Society

— *Aparna Goswami*

Introduction to the North-East: Land and People

North-East India, geographically and topographically distinct from the mainland India has a peculiar identity of its own. It is a region of myriad variety of cultures as it has settlers from diverse parts of the land as some are from the regions like Kanauj in central India while some are from the ancient Mongol regions. All have contributed in building the composite culture of the region by adding to it the nuances of their respective traditions. While the earliest inhabitants were supposed to be different indigenous tribes of the Mongoloid stock like the Boro, Rabhas, Tiwas, Lalungs, Garos, Khasis, Jaintias, Tai-Turungs, Matakis, some Sonowal Kacharis etc., the coming of the Aryans in historical times and the resultant intermix gave the area the demographic character it has today. Today these indigenous communities, the non-tribal Hindus of different castes, some people subscribing to Islam and Buddhism and some other groups, inhabit the region. It is largely due to this, that the caste or community division in this area is not as rigid as in other parts of India. (Goswami, 2013)¹ The region has always been looked upon as 'An anthropologist's paradise' for its rich diversity of ethnic culture and is also considered 'A linguist's paradise' due to its multilingual continuum. Around forty five different languages are spoken by different communities in and around this area which is the meeting place of three different language families as per the available data. Austro-

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Indian Military Academy
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India

ISSN 2364-1878 ISSN 2364-1886 (electronic)
Springer Series on Polymer and Composite Materials
ISBN 978-3-319-46456-5 ISBN 978-3-319-46458-9 (eBook)
DOI 10.1007/978-3-319-46458-9

Library of Congress Control Number: 2016952501

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Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Contents

Conducting Polymer Nanocomposites: Recent Developments and Future Prospects	1
Changyu Tang, Nanxi Chen and Xin Hu	
Magnetic Nanoparticles-Based Conducting Polymer Nanocomposites	45
A. Muñoz-Bonilla, J. Sánchez-Marcos and P. Herrasti	
Polypyrrole Nanotubes-Silver Nanoparticles Hybrid Nanocomposites: Dielectric, Optical, Antimicrobial and Haemolysis Activity Study	81
J. Upadhyay and A. Kumar	
Conductive Polymer Composites Based on Carbon Nanomaterials	117
Santosh Kr. Tiwari, Jawahar Mishra, Goutam Hatui and G.C. Nayak	
Clay-Based Conducting Polymer Nanocomposites	143
Alessandra F. Baldissera and Carlos A. Ferreira	
A Review of Supercapacitor Energy Storage Using Nanohybrid Conducting Polymers and Carbon Electrode Materials	165
Punya A. Basnayaka and Manoj K. Ram	
Conducting Polymer Hydrogels and Their Applications	193
Kashma Sharma, Vijay Kumar, B.S. Kaith, Susheel Kalia and Hendrik C. Swart	
Conducting Polymer Nanocomposites for Sensor Applications	223
Subhash B. Kondawar and Pallavi T. Patil	
Conducting Polymer Nanocomposite-Based Supercapacitors	269
Soon Yee Liew, Darren A. Walsh and George Z. Chen	
Composites Based on Conducting Polymers and Carbon Nanotubes for Supercapacitors	305
Paramjit Singh	

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Sikan Abhigaman Aaru Kousal : A Textbook for Two years B. Ed. 1st Year course of Gauhati University, written by Dr. Indira Saikia and Dr. Utpal Kalita and published by Shri Sujit Kanti Bhattacharyya on behalf of SHANTI PRAKASHAN, Guwahati.
Price : Rs.140/-only.

প্রকাশক : শ্রীসুজিত কান্তি ভট্টাচার্য
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গুৱাহাটী - ১

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নোলোৱাকৈ এই কিতাপৰ কোনো
অংশেৰে যিকোনো ধৰণৰ প্রতিলিপি
অথবা নকল কৰিব নোৱাৰিব

প্রথম প্রকাশ : জুলাই, ২০১৮

অঙ্কৰ বিন্যাস :

কে. ডি. কম্পিউটেক
নৰনাৰায়ণ পথ, কামাখ্যা গেট
গুৱাহাটী-৯

ISBN No. 978-93-844663-7-9

ছপাওতা : অৰোৰা ফাইন আৰ্টছ
বামুনীমৈদাম
গুৱাহাটী-২১

মূল্য : ১৪০.০০ টকা

Recent Trends in Life Sciences

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UGC - HRDC
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RECENT TRENDS IN LIFE SCIENCES

A collection of articles on various aspects of Life Sciences research and recent developments in the field published by Purbayon Publication, Satmile, Guwahati-14, Assam on behalf of UGC-Human Resource Development Centre (HRDC), Gauhati University, Guwahati- 14

Email- purbayonindia21@gmail.com

First Edition : July, 2018

₹ 1200/-

Recent Trends in Life Sciences

First Edition:

July, 2018

ISBN : 978-93-87263-67-3

© Editors

Cover:

Dr. Pankaj Chetia

Published by:

Purbayon Publication

Satmile, Near Gauhati University

Guwahati- 14, Assam, India

Email-purbayonindia21@gmail.com

website: purbayonpublication.com

Contact No. +91- 9864422157

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11. Status of Orchids in Nagaon District of Assam
Chiranjeev Bezbaruah and Basistha Kalita – 80
12. Ecology and diversity of aquatic fauna of the wetlands (Beels) in Assam
Sarat Baruah – 84
13. *Grus nigricollis* (Przewalski, 1876) distribution and shifting in wintering locality in Arunachal Pradesh, North East India.
Daniel Mize – 91
14. Potentiality of Biosurfactant
Rashmi Rekha Saikia – 100
15. Health and Wellness
Mamoni Saikia – 106
16. Ecological Footprint: Are you a Green or Brown consumer?
Monali Chakraborty – 110
17. Cyanobacteria as a most important and potential source of antimicrobial secondary metabolites
Harisankar Dey – 116
18. Rice cum Fish Culture System in Assam and Its Prospects
Debananda Mainali – 123
19. An insight to water borne diseases in Indian context
Lalit Mohan Goswami – 127
20. Desiccation Tolerant Fern gametophytes: an experimental tool of modern day research
Kakali Sen – 134
21. Cholesterol and Parkinson's disease: An update
Anupom Borah, Banashree Chetia Phukan & Rajib Paul – 140
22. Climate change: A challenge for livelihood in North-East India
Pori Devi – 146
23. GM crops: Recent advancement in plant biotechnology
Soumitra Paul – 151

24. Dissecting the role of glutathione in abiotic stress tolerance in plants
Riddhi Datta – 157
25. Pharmacogenetic Analysis of NAT2 and CYP2D6 Genes: An Approach to Personalized Medicine
Purabi Deka Bose, Utkarsha Kakati & Bibhusita Sarma – 164
26. Zebrafish (*Danio rerio*) as a model vertebrate for investigating human disease
Sentiyanger Longkumer & Pranay Punj Pankaj – 169
27. An insight into telomere length homeostasis
Debasish Borbora, Jagadish Mahanta & Kantar Narain – 175
28. The Revelation of RNAi as the regulator of gene expression and the source of revolution in the current field of life-Science
Susanta Sarma – 186
29. *Pseudomonas fluorescens*: Nature's answer to plant disease management
Gargi Chakravarty – 191

II. Original Research Articles

1. Carbon Stock and Rate of Sequestration by Aquatic Macrophytes in Wetlands of Lower Assam
Gunajit Kalita – 199
2. Species diversity of the genus *Nitzschia* from silica rich site of Assam, India
Dharitri Borgohain & Bhaven Tanti – 205
3. Bio-Chemical Analysis of Curcumin Percentage in Different Brands of Turmeric Powder
Dipak Kumar Bora – 211
4. Folklore medicinal Plants Used for Female Reproductive Health Care in Golaghat District of Assam
Debasit Saikia – 217

Recent Trends in Life Sciences

ISBN : 978-93-87263-67-3

***Pseudomonas fluorescens*: nature's answer to plant disease management**

Gargi Chakravarty*

Abstract

Pathogenic microorganisms affecting plant health are a major and chronic threat to food production. As agricultural production intensified over the past few decades, producers became more and more dependent on agrochemicals as a relatively reliable method of crop protection. However, increasing use of chemical inputs causes several negative effects, i.e., development of resistance to the applied agents and their non-target environmental impacts. This has led to a search for natural substitutes for these products. Among the biocontrol agents, *Pseudomonas fluorescens*, a plant growth promoting rhizobacteria (PGPR) has been one of the most effective agents for plant disease management. This effect is the result of competitive exclusion of pathogens due to colonization of the rhizosphere, production of a number of secondary metabolites including antibiotics, siderophores and hydrogen cyanide as well as induced systemic resistance. However introduction in a suitable substrate carrier and proper method of application are required for using it in the field and for commercial success of the formulation.

Key words: *Pseudomonas fluorescens*, PGPR, Biocontrol

The continuous use of chemicals as fertilizers and pesticides has caused immense harm to the environment and ecosystem and has

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ENVIRONMENT :

Emerging Problems & Management

Part - II



Unity Education Foundation
Guwahati

Edited By :
Dr. Safiqur Rahman
M.A., M. Ed., LL.B., PGDHRM, M. Phil, PhD.

*** Environment : Emerging Problems & Management (Part - II) :**

A comprehensive book on environment for Graduation Courses and Interested Public.

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Teachers Service Commission, Nairobi, Kenya

Published By : Kaziranga Printing House, Chandmari, Guwahati-03
on behalf of Unity Education Foundation, Guwahati
© Unity Education Foundation, Guwahati

First Published : January 2018

ISBN : 978-81-935219-1-5

Price : INLAND : 1450/-

: Overseas : US\$45

Printed at : Kaziranga Printing House, Chandmari, Guwahati-21

Disclaimer :

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Contents

CHAPTER-1 Environment and Development	1-7
1.1 Introduction <i>Dr. Likhoneswar Ghatowar</i>	1
1.2 Environment and Development <i>Rashmi Sarkar</i>	4
CHAPTER-2 Environmental Problems	8-30
2.1 Environmental Degradation Due to Improper Garbage Disposal and Poor Sanitation Facility <i>Hornali Adhikari</i>	8
2.2 Environmental Problems <i>Meenakshi Dutta</i>	17
2.3 Shifting Cultivation and Its Impacts on Local Environment Under Denghar-Umpanai Revenue Village of Amri Block of West Karbianglong District, Assam <i>Raxing Hanse</i>	20
2.4 Changing Relationship Between Man and Environment Through Time <i>Tirthankar Sarma</i>	24
2.5 Environmental Degradation and Hazards <i>Jyotisma Mahanta</i>	27
CHAPTER-3 Management of Environmental Problems	31-57
3.1 Management of Environmental Problems <i>Dr. Gargi Chakravarty</i>	31
3.2 Underlying Causes and Impacts of Environmental Degradation <i>Mili Hojai</i>	35
3.3 E-Waste and Environment <i>Dr. Sewali Pathak</i>	40
3.4 Environmental Degradation and Sustainable Development Issues and Challenges <i>Kabita Medhi</i>	46
3.5 Genotoxic Effect of Arsenic in the Freshwater Fish <i>Channa punctatus</i> and its Possible Revival With <i>Curcuma</i> <i>Kokilu Patowary</i>	52
CHAPTER-4 Climate Change	58-69
4.1 Climate Change : a challenge to World Food Security <i>Neha Kar</i>	58
4.2 Understanding Climate Change and Human Rights <i>Dr. Saifur Rahman</i>	62
4.3 Climate Change <i>Bikason Hanse</i>	67

CHAPTER-5 Environmental Education	70-76
5.1 History of Environmental Education	
<i>Amarjit Hazarika</i>	70
5.2 Role of Environmental Education in Environmental Awareness	
<i>Kakali Deka</i>	73
CHAPTER-6 Environment and Economy	77-82
6.1 Role of Geographical Factors in the Development of Agricultural Economy With Special Reference to Lakhimpur District, Assam, India	
<i>Jyoti Saikia</i>	77
CHAPTER-7 Environmental Law	83-87
7.1 Environmental Law and Constitutional Provisions & Mechanism in India	
<i>Dip Jyoti Bhuyan</i>	85
CHAPTER-8 Environment and Society	88-106
8.1 Narmada Bachao Andolan and Peoples' Participation	
<i>Shrutilekha Barman</i>	88
8.2 Man and Environment in Assam	
<i>Mitali Rabha</i>	92
8.3 Environmental History	
<i>Mrigakhee Saikia</i>	95
8.4 Timber trade, livelihood and Sustainable development : A Study of Timber Traders, Tangla	
<i>Rima Debnath</i>	99
8.5 Analysis of Water Quality of The Borali Beel, Borbihaug Block, Nalbari District, Assam, India	
<i>Mitali Haloi</i>	102
CHAPTER-9 Research Paper	107-112
9.1 Solid Waste Management of Morigaon Town, Morigaon, Assam	
<i>Mr. Hafijul Islam / Ayesha Siddika</i>	107
9.2 Community Participation in Landslide Mitigation in Itanagar Arunachal Pradesh	
<i>Minu Gaduk</i>	118
9.3 Status of Wetlands in Western Kaliabor From 1996 to 2016	
<i>Priyanka Mahanta</i>	131

3.1 Management of Environmental Problems

Dr. Gargi Chakravarty

Environmental problems cause environmental degradation which is a complex process involving transformation, alteration or material loss from any one of the environmental components. It may arise either by natural processes or by man-made activities.

Management of the environmental resources is linked to environmental protection, sustainability and integrated landscape management. The measures taken for management of problems associated with environment resources are listed below-

1. Management of land degradation and soil erosion:

The loss of the top soil or disturbance of soil structure is a grave environmental problem leading to loss of arable land and important soil microbial resources. Biological management of the problem include afforestation as root systems of trees supply organic material which helps to stabilize the soil while water uptake and canopy interception serve to reduce the frequency and intensity of surface run off. *Lourea alba*, *Agave americana*, *Ricinus communis*, *Dalbergia sissoo*, *Tamarindus indica* serve as useful windbreaks which check the blowing away of fertile top soil. Vegetation cover reduces the wind velocity near the ground while grasses such as *Cynodon dactylon* act as soil binders. Sustainable land use practices involve mixed cropping, crop rotation, cultivation of land parallel to the contours, reduced tillage, increased use of organic fertilizers, retention of landscape barriers such as tree lines, hedgerows and walls and comprehensive land husbandry programmes. Mechanical methods of management of the problem include contour terracing which is to construct channels along slopes to intercept and divert the runoff water.

2. Management of air pollution:

The air pollutants which are primarily particulates and gaseous pollutants should be checked at the source of emission. The NO_x and SO_x pollutants are generated from vehicles and industrial processes. This can be mitigated through electric and hybrid vehicles and decent public transportation systems reducing the vehicular traffic. Cleaner fuels based on hydrogen are being worked out for new engine technology thereby reducing harmful emissions into the air. Chlorofluorocarbons (CFCs) widely used as coolants in air conditioners and refrigerators and contributors of ozone layer depletion in the stratosphere are replaced by other devices such as 'ice cleaning'. Burning of coal and other fossil fuels which emit hazardous pollutants is being replaced by alternative cleaner forms of energy such as solar energy, wind energy, hydraulic

Assistant Professor, Department of Botany, D.K. College, Assam

Issues and Challenges in Economics and Commerce : A Perspective

Editors:

Ratul Mahanta & Amrit Pal Singh



Refresher Course

(8 -28 November, 2018)

UGC-Human Resource Development Centre

Gauhati University

Guwahati-14

Issues and Challenges in Economics and Commerce : A Perspective

A collection of articles on various aspects of Economics and Commerce edited by Ratul Mahanta & Amrit Pal Singh and published by Purbayon Publication, Satmile, Guwahati- 14, Assam on behalf of Refresher Course (Economics and Commerce 2018) UGC-Human Resource Development Centre, Gauhati University, Guwahati

Edition: November, 2018

Price : Rs. 500/-

ISBN- 978-93-88593-01-4

First Edition:
November, 2018

© Editors

Price: 500/-

Cover:
Sanjib Borah

Published by:
Purbayon Publication
Satmile, Near Gauhati University
Guwahati- 14, Assam, India
Email-purbayonindia21@gmail.com
website: www.purbayonpublication.com
Contact No. +91- 9864422157

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Shakti Peethas (UPA-Peetha) of Assam with special Reference to Billeswar Devalaya and Its Public Relation /64

✧ Benudhar Kalita

Informal Sector and Women Empowerment /69

✧ Brajen Das

A Study on Awareness among Consumers about the Security in Digital Payment System /76

✧ Babita Lahkar

An Analysis on the Management Perspective of Srimanta Sankaradeva /86

✧ Chandan Sharma

Consumers Preferences towards Organic Tea: Special Reference to Golaghat Town, Assam /94

✧ Chinzakhum

Contribution of Small Tea Growers towards Rural Development and Environment: A case of Golaghat District, Assam /104

✧ Debajyoti Goswami

Role of Technological Intervention in Financial Inclusion /112

✧ Devajeet Goswami

Economic Empowerment of Rural Women Through Self-Help Groups (SHGs) Under Bajali Development Block of Barpeta District of Assam /120

✧ Diganta Haloi

Trend of LIC's Micro Insurance in Assam- A Case Study /126

✧ Dilip Bania

Grounded Theory: A Qualitative Method /135

✧ Gautam Huidrom

Demonetization and its consequences /142

✧ Gitanjali Goswami

Contents:

**A Quick View on the Status of Pradhan Mantri Awaas Yojana –
Gramin (PMAY-G) in Assam /13**

✧Amiya Sarma

The Ethnic Identity of Kumar Community /21

**(A Case Study in Neemati Bhiton Kakila Kumar Gaon, Jorhat,
Assam)**

✧Apurba Kr. Gogoi

**Worklife Balance : A Thrust Towards Organisational Stability
and Commitment /27**

✧Arpita Sharma Nath

**Determinants of Birth Spacing Among the Tea Garden
Labourers of Assam /37 -**

✧Arupanjali Borah

**Fruits and Vegetables in the Context of Food Processing :
Few Observations /45**

✧Bani Kachari

**A Study of Global Gender Gap and its Challenges
with Special Reference to India /54**

✧Barnali Hazarika

Problem of Horticulture Crops in Assam /236

(A study in Goalpara District)

✎Manalisha Bhattacharyya

Importance of marketing communication skill in rural market with reference to Rangapara Block /245

✎Munindra Baishya

Socio-Economic Status of the Tribals Women in Golaghat District of Assam: A case Study /251

✎Nareswar Basumatary

A Case Study of Commerce Students' Attitude Towards Entrepreneurship with Reference to Gargaon College /259

✎Nomami Dutta

Right to Information Act, 2005: experience after a decade /267

✎Padmaja Chetia

Perception of the Students Towards Entrepreneurship- A Case Study of JDSG College /273

✎Papori Borah

Effectiveness of different Sales Promotion Measures to different demographics variables /282

✎Prabhat Kumar Singh

A Study on the Implementation of Swachh Bharat Mission (Gramin) in Khowang Gaon Panchayat Area Under Dibrugarh District of Assam /293

✎Pramod Lahon

Academic Research vs Professional Research in the context of Accounting : A Review /397

✎Rajat Sharmacharjee

"Sustainable Development in a Rural Backward area"- A Case study of Matia C.D. Block under Goalpara District of Assam /305

✎Rajmohan Kalita

Consumer Awareness Among the Bodo People of Assam– A Case Study /150

✎ Hara Kanta Nath

GST (Goods and Service Tax) and Its Impact on Business Sector with Special Reference to Namrup Area /158

✎ Indira Baruah

Challenges of Micro, Small and Medium Enterprises (MSMEs) in India with reference to Assam /166

✎ Indrani Kalita Choudhury

Women Entrepreneurship in Assam: Problems and Prospects /174

✎ Jyotismita Borah

Role of ASHA (community health workers) in providing maternal health care services /182

✎ Jonali Nath

In Heading towards Act East Policy: Reflection in North East India /192

✎ Jayashree Chowdhury

Is Structure of Water Market in Water Abundant Region different from Water Scarce Region? /201

✎ Jitu Tamuli

Is Agricultural Land in Assam Intensively Used?

An analysis in terms of Cropping Intensity /210

✎ Jayanta Saud

Role & Importance of Agriculture in Economic Development of Assam Role & Importance of Agricul /219

✎ Kalyan Chandra Nath

“Entrepreneurship Eradicate Unemployment Attitude; A Look Through Self Employed Entrepreneurs’ Feedback, with Special Reference to Dibrugarh District of Assam.” /226

✎ Keshabananda Haloi

Role of ASHA (community health workers) in providing maternal health care services

a study in selected three districts of Assam

Jonali Nath

Abstract:

In 2005, Govt of India introduced National Rural Health Mission (NRHM) all over the country to provide easily accessible health care services to the rural poor people. And to achieve this Govt. introduce female Accredited Social Health Activist (ASHA) in every villages with at least 1000 population. The women who employed as a ASHA must be literate within the age group 25-45 years and should have good communicative skill so as to effectively link between community and primary health care services. In India Accredited social health activist (ASHA) are women selected and trained to work at the interface between member of their own community and the public health system (NRHM, GOI, 2012). To accelerate the expansion of basic health care coverage Govt. of India employed ASHA workers all over the country. The main objective of this paper is to access the role of ASHA to provide maternal health

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Bisesh Siksha: A Textbook of Education for TDC course, 6th semester (Major Course) 6.03 of Gauhati University, written by Dr. Indira Saikia and Dr. Utpal Kalita and published by Shri Sujit Kanti Bhattacharyya on behalf of SHANTI PRAKASHAN, Guwahati.
First Edition : January, 2018

Price : Rs.250/-only.

প্রকাশক : শ্রীসুজিত কান্তি ভট্টাচার্য
শান্তি প্রকাশন
গুৱাহাটী - ১

© : লিখক

প্রকাশক আৰু লিখকৰ লিখিত
অনুমতি নোহোৱাকৈ এই কিতাপৰ
কোনো অংশৰে যিকোনো ধৰণৰ
প্রতিলিপি অথবা নকল কৰিব
নোৱাৰিব

প্রথম প্রকাশ : জানুৱাৰী, ২০১৮

অঙ্কৰ বিন্যাস :

কে. ডি. কম্পিউটেক
দুৰ্গাসৰোবৰ
গুৱাহাটী

ছপাওতা : অৰোৰা ফাইন আৰ্টছ

বামুনীমৈদাম
গুৱাহাটী-২১

ISBN No. 978-93-844663-2-9

মূল্য : ২৫০.০০০ টকা

(গুৱাহাটী বিশ্ববিদ্যালয়ৰ স্নাতক মহলাৰ মাধ্যমিক পাঠ্যক্ৰম অনুসৰি
তৃতীয় বৰ্ষৰ ষষ্ঠ মাধ্যমিক শিক্ষা বিষয় (প্ৰধান) শ্ৰেণীৰ (প্ৰথম
কাকত) ৰ বাবে প্ৰস্তুত)

বিকাশমূলক মনোবিজ্ঞান (Developmental Psychology)

ষষ্ঠ মাধ্যমিক শ্ৰেণী (প্ৰধান)
কাকত — 6.01

দীপিকা দেৱী,

সহযোগী অধ্যাপিকা, শিক্ষা বিভাগ,
দক্ষিণ কামৰূপ মহাবিদ্যালয়, গিজা

অশোক বুক ষ্টল

পানবজাৰ, গুৱাহাটী ১

DEVELOPMENTAL PSYCHOLOGY : A Text Book of
Education Sixth Semester (Major course) of Gauhati University written
by Dipika Devi, Associate Professor, Education Dept., Dakshin
Kamrup College, Mirza and published by Sri Madhab Das on behalf
of Ashok Book Stall, Panbazar, Guwahati-1

First Published : 2018

Price Rs. : 180/-

প্রকাশক : অশোক বুক ষ্টল
পানবজার, গুৱাহাটী-১

ISBN : 978-93-84946-15-2

প্রথম প্রকাশ : ২০১৮

মূল্য : ১৮০.০০ টাকা

মুদ্রণ : ইলোবা অফসেট
হেদায়েৎপুর, গুৱাহাটী -৩

Rethinking Colonialism and Globalisation

the historical saga of India from the
19th century onwards

Madhuri Saikia



DVS PUBLISHERS
Guwahati ♦ New Delhi

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First Published 2018

DVS PUBLISHERS

H. B. Road, Panbazar, Guwahati - 781 001, Assam, India
Phone : 2638295, 2730057

WZ-33, Lane No.2, Shiv Nagar, New Delhi - 110058, India

e-mail : dvspub@gmail.com, dvspublisher@gmail.com

website : www.dvspublishers.com

Type setting : Pankaj Saikia

ISBN: 978-93-85839-22-1

Printed at : Bhabani Graphics

Contents

Foreword / vi

Acknowledgement / vii

Preface / ix

Introduction / 01

Diversification of **Capital**: The Case of Oil Industry in Assam

Ditee Moni Baruah / 09

Immigration of Tea **Garden** Labourers in Assam: British Imperialism as **Push and Pull** Factor

Nizwm Sona Baro / 21

Contribution of **British** Missionaries in Mizoram towards constructing colonial modernity during the 19th century.

Emily F. Lalnunpuii / 44

Modern Education among the Bodos: the Colonial **Rule** and the Christian **Missionaries**

Satyendra Kr. Sarmah / 53

Socio-Demographic Impact of Immigration in Assam during the Colonial **Rule**

Dhrubajyoti Gogoi / 65

Architecture and Heritage Planning in British Colonial Period: An Indian **Journey**

G.Viswanadha Kumar / 74

- Identity and the Contemporary Issue of Colonial Built Environment - the city of Guwahati
Madhuri Saikia / 94
- Historiography and the Fourth Estate: A study in the Context of Nineteenth Century Assam
Navaneeta Baruah / 108
- Science Communication by the Missionaries in Colonial Assam - a study of the First Newspaper-cum-Magazine *Orunodoi*
Meghna Choudhury / 121
- Gender Discourse in the Re-construction of Hindu Myths in Shashi Deshpande's Select Short Stories
Aparna Goswami / 135
- Reading Mulk Raj Anand's *Untouchable* as a Critique of Colonial Modernity
Arpana Nath / 147
- A Post-Colonial Deconstruction of the Assamese Woman (An Emphasis on Ruplekha Devi's *Onyotro Birola* Devi and Arupa Patangia Kalita's Selected Works)
Snigdha Deka / 158
- Mamoni Raisom Goswami's *Theng Phakhri Tahsildarar Tamar Tarowal* : A Postcolonial Reading
Devajit Das and Namita Choudhury / 170
- Mahatma Gandhi's Satyagraha and its Philosophical Dimension
Joba Kalita, Shivane Kumari & Puspunjali Baruah / 181
- Colonialism and Gandhian Swaraj: A philosophical study
Sajiya Sultana Begum / 192

Understanding the cross perspective dimension of Indian and Assamese nationalism of colonial India

Namita Devi / 210

Mizo National Movement 1966 -- Issues and Challenges in Indian National Movement from the context of North-East India

Vanlal Tanpuia / 230

Use of technologies for rural development with special emphasis on 19th and 20th century Lower Assam (India)

Pallabi Das / 238

List of Contributors / 250

Index / 252

Socio-Demographic Impact of Immigration in Assam during the colonial Rule

Dhrubajyoti Gogoi

The most curious thing about Assam is the conspicuous ignorance about it on the part of the people of India. A brief review of the history of Assam under the British rule i.e. from 1826 onwards would reveal that far-reaching changes were brought about in the region during that period. Demographic structure of Assam during colonial period is an important source for understanding socio-demographic aspects and its related features like fertility, infant and child mortality, population composition, sex ratio etc. Analysing the course of population composition and transformation of Assam from the beginning of the colonial period to the end many scholars and social scientists agreed on the fact that migration was an important contributory factor for Assam's abrupt growth of population. The population of a country or region may increase through natural causes, such as excess of births over death or through immigration from other places. In Assam also, immigration played a vital role in the growth of population during the colonial period.

Rethinking Colonialism and Globalisation

the historical saga of India from the
19th century onwards

Madhuri Saikia



DVS PUBLISHERS
Guwahati • New Delhi

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First Published 2018

DVS PUBLISHERS

H. R. Road, Panbazar, Guwahati - 781 001, Assam, India
Phone : 2638295, 2730057

WZ 33, Lane No.2, Shiv Nagar, New Delhi - 110058, India
e-mail : dvspub@gmail.com, dvspublisher@gmail.com
website : www.dvspublishera.com

Type setting : Pankaj Saikia

ISBN: 978-93-85839-22-1

Printed at : Bhabani Graphics

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Madhuri Saikia / 94

Historiography and the Fourth Estate: A study in the Context of Nineteenth Century Assam

Navaneeta Baruah / 108

Science Communication by the Missionaries in Colonial Assam - a study of the First Newspaper-cum-Magazine *Orunodoi*

Meghna Choudhury / 121

Gender Discourse in the Re-constitution of Hindu Myths in Shashi Deshpande's Select Short Stories

Aparna Goswami / 135

Reading Mulk Raj Anand's *Untouchable* as a Critique of Colonial Modernity

Arpana Nath / 147

A Post-Colonial Deconstruction of the Assamese Woman (An Emphasis on Ruplekha Devi's *Onyotro Birala Devi* and Arupa Patangia Kalita's Selected Works)

Snigdha Deka / 158

Mamon: Reison Goswami's *Theang Phakhri Tahsildarar Tamar Tarawal* : A Postcolonial Reading

Devajit Das and Namita Choudhury / 170

Mahatma Gandhi's Satyagraha and its Philosophical Dimension

Jaba Kalita, Shivancee Kumari & Puspanjali Baruah / 181

Colonialism and Gandhian Swaraj: A philosophical study

Sajiya Sultana Begum / 192

Gender Discourse in the Re-construction of Hindu Myths in Shashi Deshpande's Select Short Stories

Aparna Goswami

Introduction

If a brief review, of the myths incorporated in Hindu mythology is taken, we get to see that majority of the tales deal with the deeds of heroism accomplished by male protagonists. The role of a woman is often marginalised or is designed in such a way that suits the patriarchal set-up of the society. These myths, written by men about other prominent men of the past systematically keep the female characters at the background and those in the forefront are depicted as docile women who are either obedient daughters or loyal and patient wives. Shashi Deshpande, in her attempt to reinterpret some of these myths, gives the focal point to a female figure in the myth who from her status as a subaltern in the original version steps into the role of a protagonist only to reveal female perspective of the same myth. This perspective generates many questions that might be termed as iconoclastic as they pose strong challenges to the status quo maintained so far. Three stories by Shashi Deshpande are selected for the purpose



The intent is clearly to foster economic development through private, long-term investment in capital-intensive operations. That is, most of the investments in the Third World countries were made in the infrastructure to develop domestic and foreign trade. Transportation, such as roads, ports, and the communications network, has been the main focus of the investments. The investments have been made in the infrastructure, but the investments have not been made in the manufacturing sector, which is the main source of employment and income in the countries. The investments in the infrastructure have been made in the countries, but the investments have not been made in the manufacturing sector, which is the main source of employment and income in the countries.

30/2/2020

Rethinking Colonialism and Globalisation

the historical saga of India from the
19th century onwards

Madhuri Saikia



DVS PUBLISHERS
Guwahati + New Delhi

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First Published 2018

DVS PUBLISHERS

H. R. Road, Panbazar, Guwahati - 781 001, Assam, India
Phone : 2638295, 2730057

WZ-33, Lane No.2, Shiv Nagar, New Delhi - 110058, India

e-mail : dvspub@gmail.com, dvspublisher@gmail.com
website : www.dvspublishers.com

Type setting : Pankaj Saikia

ISBN: 978-93-85839-32-1

Printed at : Bhashani Graphics

Contents

- Foreword / vi
Acknowledgement / vii
Preface / ix
Introduction / 01
- Diversification of Capital: The Case of Oil Industry in Assam
Diltee Moni Baruah / 09
- Immigration of Tea Garden Labourers in Assam: British Imperialism as Push and Pull Factor
Nizwm Sona Baro / 21
- Contribution of British Missionaries in Mizoram towards constructing colonial modernity during the 19th century.
Emily F. Lainunpuh / 44
- Modern Education among the Bodos: the Colonial Rule and the Christian Missionaries
Satyendra Kz. Sarmah / 53
- Socio-Demographic Impact of Immigration in Assam during the Colonial Rule
Dhrubajyoti Gogoi / 65
- Architecture and Heritage Planning in British Colonial Period: An Indian Journey
G. Viswanadha Kumar / 74

Identity and the Contemporary Issue of Colonial Built Environment - the city of Guwahati

Madhur Sankar / 94

Historiography and the Fourth Estate: A study in the Context of Nineteenth Century Assam

Navaneeta Baruah / 108

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Mahatma Gandhi's Satyagraha and its philosophical dimension

Jaba Kalita, Shivanee Kumari and Puspanjali Baruah

The period between 1917- 1947 witnessed the rise and growth of the Indian National Movement which, under the undisputed leadership of Mohandas Karamchand Gandhi assumed a popular and mass character. During this period which is famous as the Gandhian era, Satyagraha was the key tool which was used by Gandhi to pave a new era in the history of the Indian National Movement. Gandhi had an innate belief that Satyagraha would be the only effective way to fight against the powerful British, because two centuries of colonial rule had economically, politically and morally emasculated the Indian people to such a degree that any other form of resistance was bound to fail. Gandhi believed that Satyagraha was the only legitimate way to earn ones political rights as well as spiritual freedom. It is a matter of great significance that Gandhi introduced religion into politics. By introducing religion into politics Gandhiji wanted to introduce morality into politics. The principles of Truth and Non-violence (Ahimsa and Satya) were the central features of Gandhiji's political activity

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গোৱালপাৰা মহাবিদ্যালয়, গোৱালপাৰা।

মানস প্ৰতিম বৰুৱা

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SNATAK MAHALAR BIHARATIYA RAJNITI-I : A Text book on Political Science written by Rafique Zaman and Manash Pratim Baruah in accordance with the latest Syllabus (Semester) prescribed by Gauhati University and Published by Assam Book Depot, Panbazar, Guwahati-781001, Ph. 03612543896, email : aabeedee 25 @ gmail.com and abdkolkata2014@gmail.com

প্রকাশক :

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পাণবজাৰ, গুৱাহাটী-১

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প্রথম প্রকাশ : আগষ্ট, ২০১৫

পুনর্মুদ্রণ : ২০১৯

মূল্য : ₹ ১৭০.০০

ISBN : 978-93-82384-26-7

অক্ষর বিন্যাস :

দিগন্ত শর্মা

সাই লেজাৰ, পাণবজাৰ, গুৱাহাটী-১

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Protaen : Research Papers & Articles- A Collection of Research Papers, Articles on Arts, Humanities, Management & Social Science. Protaen is a research based International Book of Multidisciplinary Studies with Peer reviewed book. Published by Sanjib Jyoti Haloi, Kaziranga Printing House, Guwahati on behalf of Unity Education Foundation, Guwahati.

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Published By : Kaziranga Printing House
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First Published : August 2020

ISBN : 978-81-944808-6-0

Price : INLAND : 1000/-

Printed at : Kaziranga Printing House, Chandinari, Guwahati-21

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Contents

1.	Covid-19 : Boost Up E-Learning in India	<i>Dr Phakir Singh Negi / Ms Astha Chaudhary</i>	1
2.	Application of Microbes in Augmenting Tea Production in Assam	<i>Dr. Gorgi Chakravarty</i>	5
3.	An Analytical Study on Philosophy of Action	<i>Prarthana Duanah</i>	10
4.	Mob Lynching : Is It Become a Discursive Practice?	<i>Priyanka Hazarika</i>	18
5.	Women Education and The Status of Women in Colonial India	<i>Debohrat Doley</i>	23
6.	Vedanta From the Perspective of Vivekananda	<i>Parnita Chowdhury</i>	29
7.	Importance and Need of Including Children With Special Needs in Education : A Case Study Report	<i>Mrinal Kr. Gogoi</i>	33
8.	Changing Pattern of Infrastructure Development in Assam (1991-2011) : A Carto-Statistical Analysis	<i>Franjit Thakuria</i>	38
9.	Role of ICT in 21st Century's Among the Individuals with Special Reference to the Students and Students Trainees	<i>Chandan Patgiri</i>	47
10.	E Learning in Times of a Pandemic : The Case of Online Learning in India	<i>Pranjal Kuli</i>	52
11.	Crime Against Women - Witch Hunting an Archaic Practice with Special Reference to Assam	<i>Mrs Bhargabi Baruah Mr Lokesh Reddy</i>	57
12.	Tourism in Sikkim : Defining the Fields and Challenges	<i>Saraswati Bhattarai / Kironmoni Borgohain / Dehajani Baruah</i>	62
13.	Acid Attack on Women in India	<i>Bitupan Doley</i>	73
14.	A Study of Telecom Sector in India : Experiences and The Way Forward	<i>Deepshikha Duttu</i>	79
15.	A Study on Avifaunal Diversity and Distribution in the Sagmara Beel of Barpeta District, Assam	<i>A. Deka / M. Dutta</i>	86
16.	Trends in Infant Mortality Rate and Gender Gap in Assam	<i>Shrudhanjali Bhattacharjee / Ritusmita Gautam</i>	92

Application of Microbes in Augmenting Tea Production in Assam

Dr. Gargi Chakravarty

Abstract : Tea is the most widely consumed beverage and the tea industry of Assam is a major foreign exchange earner for the country. With the practice of organic farming clearly established as the means for producing pesticide free food and drink and maintenance of sustainable environment, the exploration of indigenous microbes for crop productivity, holds significance. This article gives an overview of the beneficial microbes in growth promotion of the tea plant and production of biofertilizers and biopesticides for disease management of the economically valuable crop.

Keywords : Tea, Bacteria, Fungi, Biofertilizer, Biopesticide

Tea is the most widely consumed nonalcoholic, caffeinated beverage in the world. The tea industry is a major foreign exchange earner for India, besides being a source of income for lakhs of workers.

The beverage is obtained from the tea plant (*Camellia sinensis* (L.) O. Kuntze) of the family Theaceae. The tea plantation is one of the oldest organized practices in India with massive plantation in the Northeast corner of the agro climatic belt. Assam is the largest tea producing state in India.

Since Tea is a long-duration crop, it is prone to attack by several pests and pathogens that ultimately result in extensive annual crop loss (Mareeswaran *et al.*, 2015). Inorganic chemical-based fertilizers have been applied over the last few decades to remedy this situation (Adesmyee and Kloepper, 2005).

However, the application of chemicals onto tea plantations is prohibited for several reasons, including: deterioration of soil quality (Gurusubramanian *et al.*, 2005), air and groundwater pollution, undesirable residues in made tea (Muraleedharan *et al.*, 1988; Kodomari, 1993; Chaudhuri, 1999), escalating costs (Pimental *et al.*, 1992), resurgence of primary pests (Das, 1959; Hazarika *et al.*, 2009), followed by an outbreak of secondary pests (Cranham, 1956) and resistance development (Kawai, 1997; Gurusubramanian *et al.*, 2008; Roy *et al.*, 2010; Saha and Mukhopadhyay, 2013), variation in susceptibility, impedance of natural regulatory agents and lethal effects in warm-blooded animals, including humans (Mobed *et al.*, 1992).

In this context agricultural practices employing indigenous beneficial microbes play a significant role not only to increase crop production but also to enhance the nutrient content of the crop and maintain soil health and productivity. This paper gives an overview of the application of microbes in varied aspects of tea crop plantation and production.

Microbial inoculants as plant growth promoters :

With the rising trend towards organic agriculture there is increased dependence on soil

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As Per New Syllabus (Semester I & II)
Under CBCS, Gauhati University

Edited by
Dr. Gargee Chakraborty

Distributor
Assam Book Depot
Panbazar, Guwahati

B.A. & B. Com. English, Regular (CC) A Text Book of TDC English,
edited by Dr. Gargee Chakraborty in accordance with the latest
Syllabus (Semester I & II) Prose & Poetry. Under CBCS, Gauhati
University.

Published by :
Sairam Publication
Panbazar, Guwahati.

© Editor

Acknowledgements

The Editor & Publisher have made all efforts to obtain permission for all the copyright materials printed in this book and due acknowledgement will be made at the first opportunity.

First Edition : July, 2019

ISBN : 978-93-87797-36-9

Price : ₹ 220.00

Printed at :
Kali Press
Kolkata - 700 009

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Price : 300/-

প্রকাশক :

শ্রীঅনুপম দত্ত

মণি-মাণিক প্রকাশ

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প্রথম প্রকাশ : ২০১৩

সপ্তম সংশোধিত আৰু পৰিবৰ্দ্ধিত প্রকাশ : ২০১৯

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ISBN: 978-81-85917-10-8

মূল্য : ৩০০.০০ টকা

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প্রকাশক :

নীতিনুপম দত্ত

মণি-মাণিক প্রকাশ

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প্রথম প্রকাশ : ২০১৪

পঞ্চম প্রকাশ : ২০১৯

ISBN: 978-81-85917-39-6

মূল্য : ২২০.০০ টকা

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K. Barshya, M.Sc., M.Phil. and published by Mani Manik Prakash, Panbazar
Guwahati- 781001, 4th Edition, 2019 Price 210/-

প্রকাশক :

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তৃতীয় প্রকাশ : ২০১৮

চতুর্থ প্রকাশ : ২০১৯

ISBN: 978-81-85917-57-4

মূল্য : ২১০.০০ টাকা

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a. Women Empowerment & Status of Early Women in "Chalgaon Village" of "Vidhansabha" - A Critical Analysis	Narmada Kulkarni	58
b. Gender Inequality in School Education	Chandrika Ghosh	71
c. Role of Education in the Empowerment of Women in India and Its Future Perspectives	Abhinav Kumar Shrivastava	79
d. Women Empowerment and the Issues of Women's Political Participation	Narmada Kulkarni	83
e. Village-level Empowerment: A Journey Through the History of Women's Empowerment in India	Maya Patel, Anshu K. Chaudhary	87
f. Economic Empowerment of Women Through Entrepreneurship in Rural India: A Study of Women's Self-Help Groups	Chandrika Ghosh	101
g. Role of Self-Help Groups in the Empowerment of Women in the Rural India: A Study of Women's Self-Help Groups	Chandrika Ghosh	107
h. A Study on "The Role of Self-Help Groups in Empowering Rural Women with Special Reference to Rural Block of Kailash District"	Pratima Mohanty	117
i. Women's Empowerment Through Education: A Study of Women's Self-Help Groups in Rural India	Dr. Anjali Singh	127
j. Education of Gender Equality in Building Philosophy	Dr. Anjali Singh	138
k. Gender Inequality in Women's Empowerment	Dr. Anjali Singh	148
l. The Role of Education in "Gender" in Gender Inequality	Dr. Anjali Singh	154
m. Women's Empowerment Through Education	Dr. Anjali Singh	159
n. Women's Empowerment Through Education	Dr. Anjali Singh	168
o. Women's Empowerment Through Education	Dr. Anjali Singh	177



Reinventing Nationalism
Secularism & Plurality
MEDIA
Discourses &
Deconstruction

Edited by
K V Nagaraj
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Nationalism, secularism and plurality are the notions under constant scrutiny in any geographical polity, democratic or otherwise. These have been conveniently used by power politics all over the world, as they appeal to human emotions. We in India have been endlessly debating through all public fora for mass political acceptance of our perspectives. Mass media, on their part, have not lagged behind in their reporting and analysis. Though these concepts have been borrowed from the West, in reality, they did exist in our political philosophy, but camouflaged differently. The ancient Indian political dialectics mentioned the use of many political traps in pursuit of power. As the geo-political constellations become coarser and coarser, sharper and sharper, as of now, the discourse on these concepts has acquired expanded dimensions. Of course, this has also contributed for a state of confusion. On one side, we propose support to a global village which is technologically determined, and on the other, a clamour for de-Westernisation of every other thing in the world, be it political or cultural. This includes the notion of nationalism, secularism and plurality. The range of media discourses on these encompasses print, electronic and social media as well. The present volume is a sincere effort to present variegated perceptions of different ideological hues, as varied as India. The ultimate value of the volume is in its academic 'mindfulness' to the future path markers in media research.

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Rashid Kumar R. Vaishali Kapoor
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Shy Mathews
- Catalyst for Growth of Print Media in Arunachal Pradesh with special reference to Daily Newspapers 352
Anita Padi
- Facts vs FRP: the Role of Electronic Media in Reporting of Faith Related Issues 357
Jyoti Koushik
- An assessment of media literacy amongst children of government schools of West Garohat 370
Masturkha Adhikari
- Women's Role Stereotyping in Magazine Advertisements: A Content Analysis 378
Samir Sarkar

- The Role of Media in Construction of Perceptions of Nationalism in India's Democratisation 421
Sanjeev R.R.
- Political Economy of Television News Industry in Telugu Regions 430
Pamihubini Srinivas
- Film and Nationalism: An Interpretation of Khasi Identity through the Film 'Ba' 436
Abhismit Sonowal
- Issues in restoring balance between media and judiciary in India 466
Jenifer Dutta
- The Nationalism of the Marginalized: A Study of Media's Role 475
Kavindranath
- Dial Local Media: Fail or Thrive? Role in Assam's Conflict Situation? 484
Bijoy Sankar Saikia
- The Digital Discourse of Communication in the Era of Fake News 496
Sud Mohan Raja Hrisach
- Democratization of Information through Digital Democracy 514
Shreeyoti Das Baruah, Deepak Upadhyay
- Deconstructing Secularism and Nationalism: A Study of Contemporary Media Narratives in India 524
Jagadeesha Sarmam, Binayut Barua Sarmah, Giris Deka
- Need for a democratic public information system to bring about societal development: The role of ICT with special reference to community media 533
Triha Dewarath Baruah
- Media and Religion: Analysis of Development and Changes 549
Jagriti Barua, Shapita Khurana
- Facebook as Homogenization of Ideology: Change of Information Society to Network Society 558
Rajib Nandy

Impact of Secularism Vs Nationalism Views through Social Network Platforms on the Integrity of India as a Nation

Shabnam Shahin

Abstract:

According to the Indian constitution, India is a secular country and every citizen of India is granted the right to follow any religion they wish to follow without hurting the sentiments and beliefs of other religious communities residing in the country. Whereas nationalism on the other hand, is something which is deep rooted in the soul of every citizen. Nationalism is the respect and devotion shown by a citizen towards its nation to uphold its superiority over other countries.

Today, the dynamics of secularism have been affected to a great extent as every small instances of religion is displayed or even food habits of communities are being scrutinised by anybody and everybody on the social networking sites. As social networking sites have minimal level of gatekeeping, the boundaries displayed through these mediums leads to conflict and agitation among people of different religious back-

Impact of Secularism Vs Nationalism Views through Social Network Platforms

grounds. The social networking sites like Facebook, Twitter gives free access to anybody who has an account to put their views on display for others to see and comment on it. Such an open display of secular or nationalist views might give rise to debates which gives way to open display of intolerance and verbal abuse. Such instances are a subject to this study and how these online display of secularism and nationalism view through verbal debates have put Indian integrity in a low light among the world.

Introduction

India being a secular country is known to all, but with the passage of time the meanings of terms like secularism and nationalism have changed in the people's subconsciousness. Now when someone puts forward a "secular" view or opinion, people tend to believe it is against the "nationalistic" view of others.

India has historically been a repository of people from varied religious and cultural backgrounds and languages; inevitably, the range of opinions is equally diverse.

The introduction of social networking sites has afforded the common people a platform to put forward their views and opinions uninhibitedly for the whole world to see. Originally envisaged as media of communicating or sharing information, social media have morphed into a country-generational insignificant issues start trending by getting linked to religion and nationalism, and end up provoking wide sections of the populace.

Many controversies of sort had their genesis on social networking sites that snowballed into 'breaking news' in the mainstream media. These media milk-controversial posts or discussions on social networks sites to generate TRP, but in doing so they have also stirred religious intolerance among the general public, positing a new history of secularism versus nationalism. Social media posts with conflicting opinions and views become fodder for news debates; what's more, the broadcast media often leverage social network platforms to connect with the general public and boost ratings on these debates.

A country with a billion-plus people following varied cultures, religions, food habits and others is bound to have conflicting views and opinions as aforementioned, but the issue here is how the lengths to which people go to justify their views on religious issues on social media.

Prominence of Sustainable Entrepreneurship Development in Recent Times in India



Editor:
Dr. Shobanendra Dahi Nath

This book is a collection of research papers presented at the International Conference on Sustainable Entrepreneurship Development in Recent Times in India, held at Gurukul Kangri Vishwavidyalaya, Dehra Dun, India, on 15-16 October 2023.

Editor: Dr. Shobanendra Dahi Nath

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Volume 1

Number 1, 2023

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CONTENTS

1. A Conceptual Overview of Sustainable Entrepreneurship Development
» **Tandraleem Kachhap** 7
2. Sustainable Agriculture Practices in India: The Challenges and Solutions: A Descriptive Study
» **Minak Ghosh & Mayurankhi Kachhap** 20
3. Entrepreneurship Education for Sustainable Entrepreneurship Development
» **Dr. Tushil Dasgupta** 25
4. Impact of Bank Loans on Small and Marginal Entrepreneurs for Sustainable Entrepreneurship Development in Assam with special reference to Kamrup Metropolitan District
» **Pooja Hahli** 39
5. Entrepreneurship Development in Assam
» **Parjat Dharali** 42
6. MSME Development: A new way to Entrepreneurship Development
» **Komal Kanti Datta** 50
7. An Inquiry into the Micro, Small and Medium Scale Enterprises (MSMEs) on Economic Development - A Study on Bongaigaon District of Assam, INDIA
» **Bidy Kumar Dey** 74
8. The Role of Women Entrepreneurs in sustaining Sustainable Development
» **Mayurankhi Kachhap & Minak Ghosh** 82
9. Sustainable Development of MSME in Assam: An Analysis
» **Doupa Karmakar & Anup Karmakar** 100
10. Enhancement of Rural Economy through sustainable innovative Commercial Practices with special reference to Vaishali District of Bihar
» **Narita Kumari Singh** 129
11. Sustainable Entrepreneurship Development in the Developing Countries with special reference to India
» **Dr. Tushil Dasgupta** 130



এবিডি-৮

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Snatak Mahalar Uddid Bigyan Jaiba Baichitra (1st Semester) : written by Prof. Karuna Kanta Das in accordance with the GU-CBCS Syllabus prescribed by Gauhati University and published by Assam Book Depot, Panbazar, Guwahati-781001. Ph: (0361) 2543896, e-mail : aabeeedee25@gmail.com.

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প্ৰথম প্ৰকাশ : জুন, ২০২০

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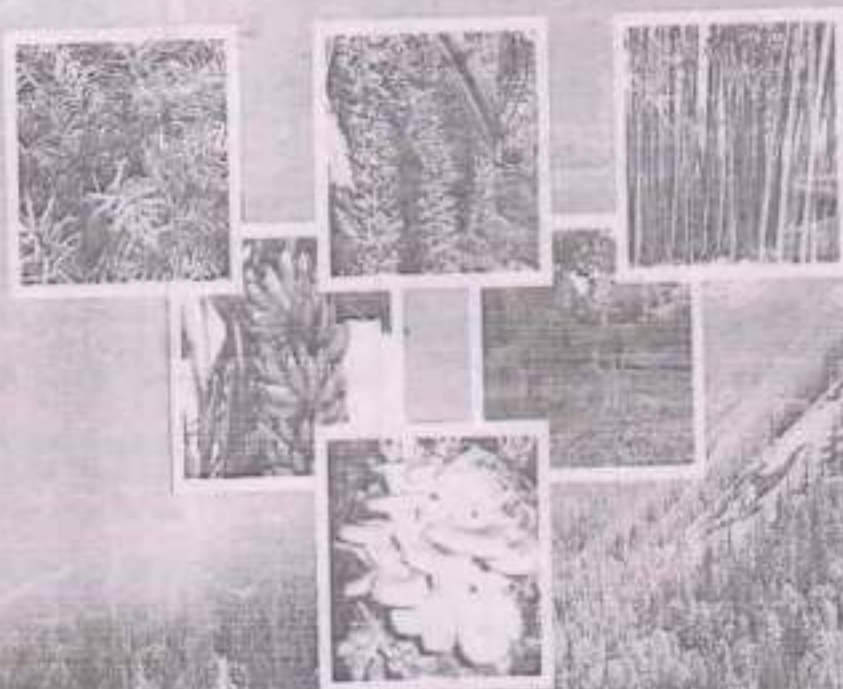
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CONSERVATION AND MANAGEMENT OF BIO-RESOURCES FOR RURAL DEVELOPMENT



DEPARTMENT OF BOTANY
UNIVERSITY OF SCIENCE AND TECHNOLOGY
KILING ROAD, 9TH MILE, G. S. ROAD, RIBHO, BARIDUA
MEGHALAYA-793101

Devika Ray

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Price : 450/- (Rupees Four Hundred Fifty only)

Published by:

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63	▲ Documentation of seeds and plant parts in traditional agronomy by Maitel Pangal Community in Manipur State, India	167
	✦ Mohd Mustaque Ahmed, R. Das and S. K. Borthakur	
75	▲ Diversity of wild edible plants and their usage by the local people in Amchang Wildlife Sanctuary, Assam	178
	✦ Nandita Sarma, U. Shankar and A. A. Mao	
89	▲ Phytochemical screening and cytotoxic effect of seed of <i>Thevetia peruviana</i> (pers.) K. Schum	194
	✦ Nilofer Sheikh, A. Narula and R. Roy	
97	▲ Studies on the antimicrobial activity of different citrus fruits by using essential oil extracted from peels against <i>Escherichia coli</i>	204
	✦ Padmani Kumari and P. K. Baruah	
112	▲ Assessment of medicinal plants used in traditional healing systems by Tiwa tribe of Morigaon District, Assam	211
	✦ P. Nath, M. R. Das and S. I. Bhuyan	
122	▲ Endophytic fungi associated with <i>Eryngium foetidum</i> L. and their antimicrobial potential	221
	✦ Rajreepa Talukdar and K. Toyung	
131	▲ Studies on morphological characterization of wood inhabiting macro fungi associated with horticultural crops of middle Assam, India	227
	✦ Ratul K. Nath, Dilip K. Bora and T. C. Sarma	
143	▲ A Review On The Studies on a few ethno-medicinal plants used by the Jaintia Tribe of Dima Hasao District	232
	✦ Rinti Roy and Karabi Barman	
150	▲ Assessment of Soil Organic Carbon and Carbon Fractions in Smallholder Tea Agroforestry System	238
	✦ Rinku Moni Kollita, A. K. Das and A. J. Nath	

Rinti Roy

ISBN 978-93-87275-47-8

A Review On The Studies on a few ethnic medicinal plants used by the Jaintia Tribe of Dima Hasao District

Rinti Roy and Karabi Barman

Assistant Professor (Ad-hoc), Department of Botany,
Jagiroad College, Morigaon - 782410, Assam

E-mail : rint21@gmail.com

Abstract

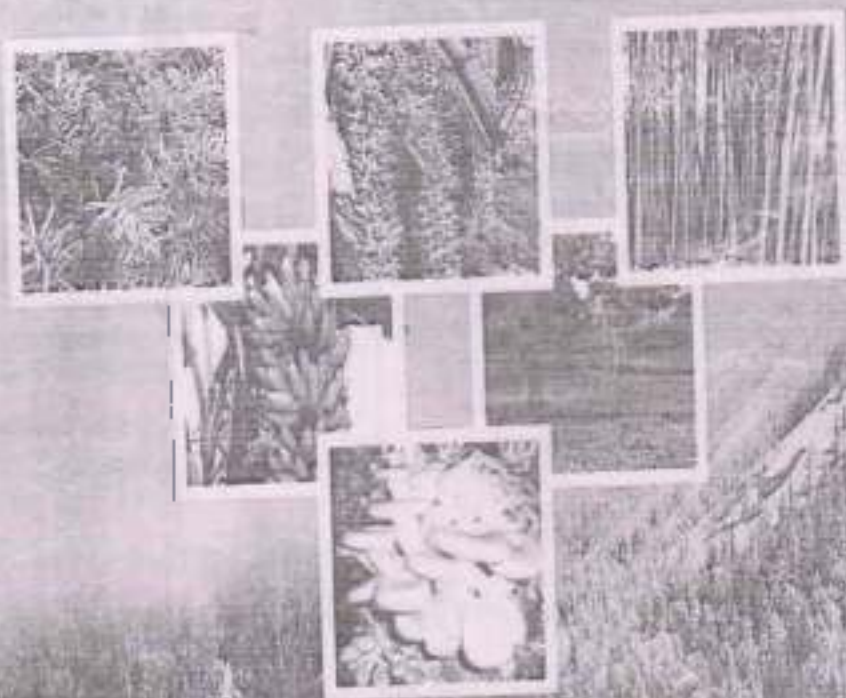
The Dima Hasao district is the only hill station of Assam, covering an area of 4890 sq km. The region is one of the richest region in the world in terms of natural resources. More than 13 ethnic tribes namely Dimas, Zeme, Biata, Jaintia, Hrangkhoh, Hmar, Vaiphei, Khelma etc. live harmony with one other. The tribal people have deep faith in their traditional knowledge and in most cases prefer them to modern systems of medicine. In the present study, a total of 10 plants species curing 12 types of ailments have been reported in addition to their parts used, phytochemical content, mode of preparation and dosage for curing diseases like diabetes, skin infection, dyspepsia, piles, diarrhoea etc. prevalent among the Jaintia tribe has been investigated. The study underlines the need for documentation of the ethno-medical plants along with their conservation.

Keywords: Jaintia tribe, Ethnic, Ethno-medical, Conservation, Documentation.

Rinti Roy

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ISBN 978-93-87275-47-8

Price : 450/- (Rupees Four Hundred Fifty only)

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63	▲ Documentation of seeds and plant parts in traditional agronomy by Meitei Pangal Community in Manipur State, India	167
	✦ Mohd Mustaque Ahmed, R. Das and S. K. Borthakur	
75	▲ Diversity of wild edible plants and their usage by the local people in Amchang Wildlife Sanctuary, Assam	178
	✦ Nandita Sarma, U. Shankar and A. A. Mao	
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Rinti Roy

ISBN 978-93-87275-47-8

Phytochemical screening and cytotoxic effect of seed of *Thevetiaperuviana* (pers.) K.Schum

Nilofer Sheikh¹, A. Narula² and R. Roy³

^{1,2} Department of Botany, University of Science and Technology, Meghalaya

³ Department of Botany, Jagroad College, Morigaon-782410, Assam

*E-mail : nilofersheikh83@gmail.com

Abstract

Qualitative phytochemical screening of seed of *Thevetiaperuviana* was done which confirmed the presence of various compounds like Terpenoids, steroids, alkaloids and cardiac glycoside in three aqueous extracts of methanol, ethyl acetate and water. The result suggested the presence of maximum phytochemical compounds in ethyl acetate than in the other two extract. The use of plants by the general populations for different purposes is still wide spread which makes the studies on cytotoxicity essential. The cytotoxic effects of *Thevetiaperuviana* seed extract were evaluated using *Allium cepa* root chromosome aberration study. Seeds extracts suppressed the mitotic activity of *Allium* roots after 5h, 8h, 12h, 24h and 48h at 35ml concentrations each. Analysis of data indicated about various chromosomal aberration in dividing and non-dividing cells such as anaphase bridge, sticky prophase, sticky metaphase, sticky anaphase, micronucleus, multiple nuclear lesion, nucleus showed disintegration, c-metaphase, ball metaphase and chromosome vagrant. The infusion for higher time showed significant effect on cell division on the onion cell. The phytochemical and cytotoxic activity of this plant provides valuable information about the safety or non-safe use of them for different purposes.

Keywords: cytotoxic, *Thevetiaperuviana*, chromosome aberration, phytochemical, *Allium cepa*.

Dr. R. Roy

Thevetiaperuviana (Apocynaceae) is a native ornamental plant in India. It is a perennial plant with a thick, woody stem. The leaves are opposite, lanceolate, and have a smooth margin. The flowers are small, tubular, and have a yellowish-orange color. The fruit is a small, round, red berry. The plant is known for its medicinal properties and is used in traditional medicine for various ailments. It is also a source of latex, which is used in the rubber industry.

Collection

The plant is collected from the wild in the hills of Meghalaya and Assam.

Phytochemical

The plant contains various phytochemicals, including terpenoids, steroids, alkaloids, and cardiac glycosides. These compounds are responsible for the plant's medicinal properties and its toxicity.

Screen

Test for

The plant is used for various purposes, including as a natural dye, a source of latex, and a medicinal plant. It is also used in traditional medicine for various ailments.

CONTEMPORARY ISSUES IN ASSAM ECONOMY

Editor
Dr. Devajit Mahanta



Contemporary Issues in Assam Economy: Collections of Research Paper edited by Dr. Devajit Mahanta and Publish by Chiranjib Sharma on behalf of Olympia Prakashan, Guwahati-781003

ISBN : 978-93-87035-59-1

Publisher : Olympia Prakashan, Guwahati-781003

First Published : June, 2020

Copyright : Editor

Cover Design : Chandan Bhatta

DTP & Print : Olympia Prakashan, Rajgarh Road, 6th Bye lane, Guwahati-781003, Assam

Price : Rs. 300.00 only

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Content...

❧	Dynamics in India's Fiscal Federalism looking into Evolution of Finance Commission	01-11
	♦ Dr. Nissar A. Barua	
❧	Education Loan in Guwahati City: Equity Issues	12-24
	♦ Dr. Arati Bharali	
❧	Socio-Economic Effects in households through Retirement Benefit Programmes in Assam	25-36
	♦ Dr. Angana Barua	
❧	Empowering Women through Entrepreneurship	37-51
	♦ Dr. Archana Mali	
❧	Understanding Fiscal Federalism: Theoretical and Empirical Evidences	52-65
	♦ Bandana Chowdhury	
❧	Financial Inclusion in Assam: A District-wise Analysis	66-81
	♦ Parijat Dhar	
❧	Does Education sector need reformation in Assam for its economy to develop	82-89
	♦ Pummy Sinha	
❧	Migration: Influencing Factor of Demography and Growth of Urban Centres-A Case Study of Guwahati City	90-104
	♦ Dr. Upasana Chakravarty	
❧	Fiscal Performance of Assam: An Empirical Analysis	105-117
	♦ Nitu Moni Bora	

as compared to the joint families, in unitary families the senior citizens get more opportunity to participate in the decision making. According to most of the senior citizens, the overriding effect of retirement benefits on their lives is that it removes their compulsion to continue working even after attaining retiring age.

References

1. Browning E.K. Browning J.M. (1994), *Public Finance & the Price System*, New Delhi: Pearson Education, Inc.
2. Directorate of Economics and Statistics (2014) *Statistical Handbook Assam 2014*, Gauhati: Government of Assam.
3. Directorate of Economics and Statistics (2015) *Economic Survey Assam 2014-2015*, Gauhati: Government of Assam.
4. Kjekie R.V. Morgan D.W. (1970) 'Determining Sample Size for Research Activities' *Educational and Psychological Measurement* 30, 607-610. [Online]
5. Koth H. Bongestabbs A. & Nimeh Z. (2016), 'Impacts of Old-Age Pensions: The Socio-Economic Impact of Social Security', *International Social Security Association*, Geneva [Online] Available: (accessed on 13.01.2020.)

Empowering Women through Entrepreneurship

Dr. Archana Mali

Associate Professor, D.K. College, Mirza, Assam

Abstract

In traditional society, role of women were confined to household management. But with the spread of education among women, they do not keep themselves within the four boundaries of house. Now women are engaged in all types of activities. They are also entering into entrepreneurship which was once considered to be the field dominated by men. This paper attempts to study the factors motivating women entrepreneurs, and impact of entrepreneurship in empowering women in Assam. Attempt is also made to study the strategy for development of women entrepreneurs in the state. To study the motivating factors and impact on empowerment, data are collected from 117 women entrepreneurs (both registered and unregistered) from Kamrup (Rural) and Kamrup (Metro) of Assam.

Keywords: Empowerment, Entrepreneur, Entrepreneurship

1. Introduction

In traditional society, role of women was just confined to the household management. They are simply considered as the queen of the kitchen and seen as 'home makers' (Rao, 2007). Women have to look after their family and do all the domestic chores. But, their contributions are not converted into money terms, therefore, due importance was not given to them in the family decision making process. Educational backwardness is another reason because of which women lag behind. As per 2011 census report, the female literacy rate in India was 65.46 percent as compared to 82.14 percent of male literacy. In many cases women are unaware of the essentials of their harbour within themselves.

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Head Office : L-9A, First Floor, Street No. 42,
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Phone No.: 9968628081, 9555149955 & 9013387535
E-mail : akhandpublishinghouse@gmail.com,
akhandpublishing@yahoo.com
Website : www.akhandbooks.com

Integrating Diverse Aspects of North East India Contexts and Perspectives

© Editor

1st Edition 2020

ISBN 978-81-948850-1-6

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Printed in India

Published by Jhappu Yadav for Akhand Publishing House. Cover Designed and Laser Typesetting at VM Graphics and Printed at Aarna Enterprises, Delhi.

Integrating Diverse Aspects of North East India Contexts and Perspectives

Dr. Jilmil Bora



AKHAND PUBLISHING HOUSE
DELHI (INDIA)

Contents

<i>Foreword</i>	v
<i>Preface</i>	vii
<i>Acknowledgements</i>	ix
<i>Editorial Board</i>	xv
<i>List of Contributors</i>	xvii
1. Spiritual Approach to Nature – A Tool for Environmental Protection: Its reflection in the Socio-Religious Beliefs of the Bodos — <i>Dr. Aditi Devi Choudhury</i>	1
2. Empowerment of Women: Policies and Status in India and Assam — <i>Dr. Alaka Hujari</i>	14
3. Attitude of the Nationalist Leaders towards the Tea Garden Workers during Non-Cooperation Movement in Assam — <i>Anmana Goswami</i>	28
4. Tourism Practises in and around Nameri National Park — <i>Annesha Borah</i>	38
5. Importance of Festivals in the Realm of Culture: A Glimpse of Deori Bihu Celebration of Assam — <i>Atrayee Kashyap</i>	50
6. Flood as a Hazard and its Mitigation Strategies in Assam — <i>Azruddin Khan, Debashree Borah</i>	63
7. Population Pressure and Deforestation in North East India — <i>Dr Bhanu Hazarika</i>	75

- | | | |
|-----|--|-----|
| 8. | The Colonial Gaze: Women in Colonial Photography, a North East Indian Perspective
— <i>Dr. Bhaskar Jyoti Gogoi</i> | 88 |
| 9. | Corporate Social Responsibility undertaken by various organizations in Assam with special reference to Environment
— <i>Bidisha Sarmah</i> | 105 |
| 10. | Political Participation of Women is an indispensable need for Women Empowerment: A Meticulous Sketch of Assam
— <i>Dr. Dhiraj Bhusan Sarmah, Dr. Chandamita Sarma</i> | 117 |
| 11. | Contextualizing Struggle for Survival: Mulk Raj Anand's Two Leaves... and Umakanta Sarma's Ejak Manuh Ekhan Aranya
— <i>Dr. Dipen Bezbaruah</i> | 133 |
| 12. | Assessment of Ecosystem Services and Functions for Human well-being: Current Status and Challenges Ahead
— <i>Durlav Nr. Singha, Gunajit Kalita</i> | 142 |
| 13. | Achieving food security in North East India through Sustainable Agriculture
— <i>Gargi Chakravarty</i> | 160 |
| 14. | Role of Folk tales in teaching English as a language in Lower Primary Government Schools of Assam: A Study
— <i>Himalinee Bezbaruah</i> | 172 |
| 15. | Jhum Cultivation of North-East India —Problems, Controls and Transition
— <i>Jayanta Barooah</i> | 181 |
| 16. | A Study in Utilisation of Maternal Health Care Services in Assam
— <i>Dr. Jonali Nath</i> | 188 |
| 17. | PHYTOREMEDIATION- A cost effective and eco-friendly approach towards a clean environment- With special reference to the North Eastern Region, India
— <i>Lakshmi Rupa Das</i> | 198 |

18. Scientific Valediction of traditional Phytomedicine
of North East India for zero Malaria 208
-*Nilakshi Gohain & Mohan Chandra Kalita*
19. Ethnicity and Conflict in North East India:
A Challenge to Identity 221
-*Priyanka Gogoi*
20. The Dhansiri (South) river: A Study on Land
use and Diversified livelihood patterns of the People 232
-*Dr. Shashwati Nath*
21. Humanitarian Law *vis-a-vis* Internal
Displacement and strokes on humanity in the
context of Assam 238
-*Dr. Smita Sarmah*
22. Uniting Assam with Bharat: Cultural
Nationalism in Sankardev's Neo-Vaishnavism 248
-*Sourabh Jyoti Sharma*
23. A Legal Study on the different aspects of National
Dimensions upon Climate Change with Specific
reference to the River Brahmaputra 259
-*Subal Chakravarty & Jahnu Das*
24. Man-Animal Conflicts in Assam: A Study of
Man-Elephant Conflict 273
-*Tinku Nath*
25. Progress of Distance Education and Assam 282
-*Dr. Utpal Kalita*
26. A Socio-Economic Survey on Pottery Works in
Rajapukhuri Village under Kamrup District (R),
Assam 294
-*Dr. Kumud Bhagawati, Dr. Archana Mali,
Dr. Jonali Nath, Mrs. Chayanika Goswami &
Ms. Hiramoni Goswami*

A Study in Utilisation of Maternal Health Care Services in Assam

Dr. Jonali Nath

Introduction

Motherhood is one of the most cherished and important stage in a woman's life. It is a stage where woman require special care, attention, support and nutrition. But the road to a safe motherhood is not a smooth one for every woman across the globe.

The Maternal Mortality Ratio (MMR) is the one of the most important indicator of the health status of a woman in the society. The World Health Organisation (WHO) estimates that over 500,000 women & girls die from complications arising out of pregnancy and childbirth every year, worldwide, with approximately 99% of these deaths occurring in developing countries. As per the National Family Health Survey (NFHS-3, 2005-06) and Sample Registration Survey (SRS) estimation in 2009 the maternal mortality rate in Assam is recoded as highest (390 per 100000 live births) in the country.

In India Maternal Mortality Rate (MMR) declined to 301 in 2001-03 and to 212 in 100000 live births in 2007-09; it is still quite high in Assam (390 in 2009). During 2004-06 MMR in Assam was 480, which fell to 381 in 2010-11 as per annual health survey report Assam; there is a total 99 point drop of MMR during National Rural Health Mission (NRHM) (2005-06 to 2011-12) period which is the

WORKING OF DEMOCRACY IN INDIA

Major Issues

Edited by
Dr Nazmul Hussain Laskar



AUTHORS P R E S S

Dr. Nazmul Hussain Laskar

Preface

"Democracy is more than a social system; it is an attitude of mind, a philosophy of life."

- Dr. B.R. Ambedkar

Democracy stands for full prevalence of rule of law with full accountability and transparency. People's participation in the affairs of the government is an essential aspect of democracy. Democracy must ensure responsible and responsive administration. It must try to guarantee good governance because good governance is the key to development of a nation. In India, in recent times we have new element in our political system that is criminalisation of politics and politicisation of crimes. Previously, we had dedicated bunch of politicians for national cause. But these days they have become rare species. They are more for power and perks. They take help of criminals to win election and then try to maintain their hegemony in the community. Now criminals have moved from periphery to the centre stage in order to grab the political power and authority for themselves. Thus, in order to obtain desired results in the field of development we have to do away with all incoherence and incompetence in the field of good governance. For this, not only strong, viable and vital super structures are needed but strong and dedicated leaders are also needed. With active and effective people's participation, complete and coherent decentralisation of powers, responsible and responsive administration, determined and dedicated political will, democratisation with a spirit of compromise and consensus, we can embrace and embark on efficient and effective governance which is critical and crucial for any vibrant and dynamic democratic political system.

Worldwide Circulation through Authorpress Global Network
First Published in 2020

by

Authorpress

Q-2A Hans Khos Enclave, New Delhi-110 016 (India)

Phone: (011) 8818048852

Email: authorpressgroup@gmail.com

Website: www.authorpressbooks.com

Working of Democracy in India: Major Issues

ISBN 978-93-90193-91-0

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Aswath

10. Women and Sustainable Development: Role of Education Sarith Khosla	106
11. Socio-economic and Political Status of Dalit Women in India: A Hypothetical Study Santipurna Kakshit	116
12. Women Empowerment in India: The Question of Reservation for Women Santipurna Kakshit	126
13. Marginalisation of the Tea Garden Workers with Special Reference to Women Workers Dulmoo Nath	138
14. Honor Killing in India: An Analytical Study Vivek Padak	145
15. Sex Selective Feticide in India: A Socio-Economic Analysis Meerla Jabin	150
16. Women in India: Tradition vs. Modernity Anir Kumar Mondal	162
PART III. HUMAN RIGHTS	
17. Human Rights in India: Role of Right to Education Act, 2009 Krishna Chandra Patra	177
18. Protection of Human Rights in India: Role of NGOs Sandhya Hazra	188
19. State, Civil Society and Human Rights: A Study on the Rights of HIV Infected People Rajagopal P.K.	195
20. Women Rights in India: Challenges and Way Out Manoj Pandit	210
21. Right to Information Movement in India: A Study M. Shafi Bhat	219
22. Globalisation and the LGBT Community in India: Human Rights Perspective Nandini Nayak	226

Dr. Arath

PART IV. GEO-POLITICS

23. Environment Protection and Sustainable Development: Government Initiatives Mukul Pandit	239
24. The Magnitude and Determinants of Deforestation in India: An Economic Analysis Ananta Dutta	251
25. Impact of Education on Sustainable Development: A Study Samim Ara Begum and Md Sarwar Hossain	266
26. The Politics of Climate Change and Indian Foreign Policy Alka Naha	274
27. Environmental Governance and the Issue of Biodiversity Management in Assam Abhishek Baragohata	285
PART V. ETHNIC STUDIES	
28. Ethnic Groups in Assam: An Overview Mukul Pandit	297
29. Traditional Hunting Methods of the Vaiphei Tribe Lalithanandan Nethalal	308
30. Ethnic Conflicts in Bodoland Territorial Area Districts of Assam: Complexities, Causes and Consequences Pragya Basumatary	323
31. Policies and Schemes for Tribal Development in Post-independent India Santipurna Kakshit	331
PART VI. COVID-19 PANDEMIC & INDIA	
32. Covid-19 and the Growing Importance of Digital Library Nandini Nayak	343
33. Covid-19 Pandemic and its Impact Lopay Mohanty Roy	353

Marginalisation of the Tea Garden Workers with Special Reference to Women Workers

Delmoni Nath

Introduction

Marginality is often described on a social process where people are referring to the periphery or margin of the society. It is defined as historical processes, in which individuals or communication are socially excluded and denied access to participate in social, economic, cultural and political processes of Assamese society. Marginalisation stalks a person, a group, a section or a community to enjoy rights privileges opportunities and resources that are normally available to members of society.

This paper is about the women of tea garden. They faced a difficult journey of struggles, conflicts, Acrimony with little support from the centre and population that kept to itself holding its affinity to its own land based practices and cultural norms.

The north eastern region of India was characterised by a low population, poor economy with low production and low output, in the beginning of the 19th century up to the 1920s. The economic backwardness of the region as well as the sense of distrust and reluctance of the peasantry to join the work force resulted in the colonial rules bringing in labour from neighbouring areas of Assam, such as Bengal Orissa and Chottanagpur, the erstwhile east Bengal including the border areas of eastern Bihar and Nepal, to be precise

post-independence brought in a bureaucracy, which had scant understanding of north east region. This was neither too encouraging nor did it incite any sensitive thought of development by administrators and the bureaucracy. Nonetheless witnessed more migration, new encroachments and of course a tremendous increase in population by the beginning of the 20th century.

This paper will factor the lives of adivasis particularly the women who lived and still live lives of deprivation discrimination and extreme vulnerabilities. The tea garden women of Assam have been marginalised in different spheres in the tea gardens in general and house and society in particular. Women's work has traditionally been divided in to the area of production both economic and social and reproduction from time immemorial. The living conditions of tea garden workers are very miserable and pathetic because of the implications of tea garden management, especially for female workers. They are more vulnerable in term of economic and social status.

Objectives of the Study

- a) Assess the tea garden women's livelihood and their efforts towards living life.
- b) The study to evaluate improving condition of tea garden workers of Borduar tea garden Kamrup, Assam.

Methodology of Study

This paper is written based on the primary and secondary sources. The secondary sources include different printed books, journals, articles etc. These sources are also collected from internet these are used as secondary source. Under primary sources included personal interview of tea garden workers to better understand their conditions.

Discussion

Marginality of tea garden women is existing in literature. Many feminist scholars reconstructed their works through the condition

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INTERNATIONAL RELATIONS

Emerging Issues

Edited by
Dr Nazmul Hussain Laskar



AUTHORS P R E S S

Dr. Nazmul Hussain Laskar

Emerging Issues

RELATIONS

Preface

The book is primarily designed to address various dimensions and issues related to International Relations. This volume covers wide range of topics like – India's relations with her neighbors, Foreign Policy of India, Globalisation, Climate Change, Terrorism, Human Rights, UNO, Regional Organisations, Citizenship, UNO and its Agencies, Environmental Issues, Migration, Ethnic Cleansing, Covid-19 & New World Order, Gender Studies etc.

A modest attempt has been made to write in a comprehensive and consolidated form. Special care has been taken to bring facts and figures up to date.

The author is grateful to all the chapter contributors without their valuable contribution this book may not have been the light of the day.

I hope this book will be favorably received at the hands of the students, scholars, teachers as well as the general readers.

Burdwan

11/11/2020

Nazmul Hussain Laskar

Worldwide Circulation through Authorpress Global Network
First Published in 2020

by

Authorpress

Q-2A Hazrat Khana Enclave, New Delhi-110 016 (India)

Phone: (0) 9818049852

E-mail: authorpressgroup@gmail.com

Website: www.authorpressbooks.com

International Relations: Emerging Issues

ISBN 978-93-90659-62-9

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Spnab

Human Rights and Role of Judiciary: Indian Perspective Chitra Hazra	392	58. Migration as an Impediment to Nation Building in India: Evaluating India-Bangladesh Relations Tapan Das	510
INTERNATIONAL ORGANIZATIONS		59. Impact of Migration on Economic and Social Development: Reviewing the Emerging Issues Amrit Kumar Mondal	516
United Nations Organisation: Role of India Anmol Hussain Lohar	403	PART IX: GLOBALISATION	
Non-Alignment Movement: Then and Now Anshu Basak	406	60. Globalisation and its Impact on Tribal Society in North East India Risham Narayan	527
Working of UNO and its Specialised Agencies: At a Glance Anish Das	411	61. Impact of Foreign Direct Investment (FDI) and Export on Economic Growth in India in the Post-Globalisation Era Minhaj Uddin Barbhuiya	535
ARC vs. BIMSTEC: A Comparative Study Anshu Nayak	419	62. Globalisation and Economic Growth: The Case of India Rahul Samanta	546
Non-Alignment Movement: A Study Anmol Nath	428	63. Relevance of Swami Vivekananda's Vision of Rejuvenation of Indian Nation under the Aegis of Globalisation Debarati Das	554
India and the European Union (EU) Merchandise Trade Competing to Each Other: An Empirical Analysis Anamika and Sumati Akhter	436	LIST OF CONTRIBUTORS	561
Gender Politics Anurag Nandy	451	Index	566
Gender Disparity in Education among the Scheduled Tribes of North East India: A Study Anurag Nandy	460		
Honoured Women Rights among Tea Garden Workers of Dooars: A Brief Survey Anurag Nandy	467		
Women Movement and Socio Economic Change Anurag Nandy	475		
Gender-Equality through Gender-Equity: A Philosophical Approach Anurag Nandy	479		
Gender and Gender in India: An Analysis Anurag Nandy	487		
Globalisation and Citizenship Anurag Nandy	492		
Legal Stories of Assam: A Picture of Citizenship Anurag Nandy and Karika Roy	503		
Legal Bangladeshi Migration in India: Factors and Impacts Anurag Nandy			
Citizenship: A Comparative Analysis Anurag Nandy			

Spam

Non Alignment Movement: A Study

DULUMONI NATH

Introduction

The Non alignment Movement (NAM) was created and founded during the collapse of the colonial system and the independence struggles of the peoples of Africa, Asia, Latin America and other region of the world at the height of the cold war. Throughout its history, the movement of non-aligned countries has played a fundamental role in the preservation of world peace and security. The movement of non-aligned countries has waged a ceaseless battle to ensure that peoples being oppressed by foreign occupation and domination can exercise their inalienable right to self-determination and independence.

During its nearly 50 years of existence the movement of non-aligned countries has gathered a growing number of states and liberation movements which, in spite of their ideological, political, economic, social and cultural diversity, have accepted its founding principles and primary objective and shown their readiness to realise them. Historically, the non-aligned countries have shown their ability to overcome their differences and found a common ground for action that leads to mutual cooperation and the upholding of their shared values.

The creation and strengthening of the socialist block after the defeat of fascism in world war II, the collapse of colonial empires, the emergence of a bipolar world and the formation of two military blocks (NATO and the Warsaw Pact) brought about a new international context that led to the necessity of multilateral coordination for a between countries of the south.

In the context the underdeveloped countries, most of them in Asia and Africa, felt the need to join efforts for the common defense of their interests, the strengthening of their independence and sovereignty and the cultural and economic revival or salvation of their peoples and also to express a strong commitment with peace by declaring themselves as "non-aligned" from either of the two nascent military blocks.

Objectives of the Study are

- 1) Analyse on the formation and the role of non-alignment movement.
- 2) Assess the objectives of NAM.
- 3) Evolution in to the movement.

Methodology of Study

The study depends on both of sources primary and secondary. As a primary sources include cotemporary writings of historians, politicians, scholars and so on. Secondary source includes different magazines, articles and newspaper, books.

Discussion

There were certain important events that had taken place before the inception of the NAM. There were the international Brussels congress of 1927 and the first Afro-Asian relations conference of 1947. Brussels congress was an international meet of the representatives of the national liberation movements against imperial domination and was attended by Jawaharlal Nehru. In this meet an anti-imperialist league was formed to unify the national struggle movements and enlarge its base.

In 1947 an internal conference was held in Delhi on the initiative of Nehru. The delegations of 28 Afro-Asian countries had attended it. They were representatives of the freedom movement of their respective countries.

With the independence of India an era of independence had ushered in all Afro-Asian countries. Though their leadership however remained pre occupied with the national problems but the idea furthering co-operations among all the newly independent countries still remained active in determining their policies. India under the leadership of Nehru took initiative in forging a broad based unity of the Afro Asian nation and a comprehensive policy was evolved by him.

The Bandung conference was held in Indonesia on April 1955 and was attended by 29 Afro Asian countries. The five principles of Bandung declaration, which was considered as the birth place of the non-aligned movement. The main objective of Bandung conference was to strive for the world peace and right of nation to determine their own destiny.

The Bandung meeting has been considered as the most immediate antecedent of the founding of the movement of non-aligned countries, which finally came in to being six year later on a wider geographical basis when the first summit conference was held in Belgrade on September 1 to 6,

GENDER, ENVIRONMENT AND GLOBALIZATION

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N. B. PUBLICATIONS

Ghazalabad - 201302, (India)

Chaitanya

Published By:

N. B. PUBLICATIONS

Sole Distributors By:

KUNAL BOOKS

4648/21, 1st Floor, Ansari Road,

Daryaganj, New Delhi - 110002

Phones: 011-23275059, 9811043697

E-mail: kunalbooks@gmail.com

Website: www.kunalbooks.com

Gender, Environment and Globalization

© Author

First Published 2020

ISBN: 978-93-89234-82-4

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Published in India by N. B. Publications, and printed at
Trident Enterprises, Noida, (U.P.).

**In Loving Memory of
My Father
Who Spent his Life for
Education**

Om

by my mother Mrs. Maudira Roy, my sister Banashri Roy, my husband Mr. Debjit Roy, my daughters Srishish Roy, Saisha Roy and son Sriish Roy.

11th October 2020

Jayashri Roy

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Snath

7. MUSLIM WOMEN EDUCATION IN WEST BENGAL 64

Rashmi Shekh

SECTION-2: ENVIRONMENT

8. PERCEPTION SURVEY AND DISASTER PREPAREDNESS
PLAN ON FLOOD RISK IN KATWA SUB DIVISION
LOCATED IN THE HASIN OF AJOY AND
BHAGIRATHI RIVER 83

Tapan Ghosh

9. SOCIO-ECONOMIC STATUS OF TRIBAL COMMUNITIES:
VILLAGE LIVELIHOOD ANALYSIS IN BIRBHUM DISTRICT
OF WEST BENGAL 110

Anurupa Saha

10. GLOBAL EDUCATION DISASTER AND FUTURE 122

Koushik Das

11. COALMINE SUBSIDENCE- AN EVIL OF ENVIRONMENT 135

Tanai Chatterjee

12. FOLK CULTURE OF RAJBHAS SPECIALLY THE RAJBHA
OF KAMRUP DISTRICT (ASSAM) 143

Dulamani Naha

13. HUNGER, HARASSMENT AND CONTEMPT:
A STUDY ON THE PLIGHT OF MIGRANT
WORKERS TO RETURN HOME 151

Kristina Trivedi and Dr Subhash Sharma

14. IMPACTS OF COVID-19 ENVIRONMENT AS
WELL AS IMPORTANCE NEEDS OF ASSISTIVE
TECHNOLOGY FOR DYSNOMIA AND
DYSCALCULIA STUDENTS 167

Dai Haring

15. CURRICULUM PRACTICES AND ATTITUDES FOR TEACHER
EDUCATION ENVIRONMENT IN WEST BENGAL, INDIA:
STUDENTS AS WELL AS TEACHERS RESPONSE 179

Dr. Arun Maity and Mr. SK Sanjay

16. COVID-19 LOCKDOWN ENVIRONMENT AND ITS
ADVERSE EFFECTS ON MIGRANT WORKERS IN INDIA

188 *Mr. Santa Biswas and Dr. Parimal Karbar*

17. A SPATIO TEMPORAL CHANGES OF WETLANDS
SPECIAL REFERENCE TO RAJARHAT
NEWTOWN 196

Mousmita Ghosh

SECTION-3: GLOBALISATION

18. ENVIRONMENTAL DISASTER 209

Shalini Agrawal, Kishalay Raj and Md. Sujat Shikhar

19. THE UNITY OF TRADE AND CULTURAL HARMONY IN
THE INDIAN OCEAN 220

Dipankar Mondal

20. A SOCIOLOGICAL STUDY ON GLOBALIZATION
AS A FACTOR OF CHANGE IN ASSAMESE SOCIETY 226

Alankrita Borahkar

21. A COMPARATIVE STUDY OF THE EARNINGS PER SHARE
AND DIVIDEND PER SHARE OF THREE FREE MOVING
CONSUMER GOODS COMPANIES 235

Dr. Anupam Karanekar

22. TRANSFORMATION OF FOLK CULTURE DUE TO
PROCESS OF GLOBALIZATION: - A CASE STUDY
ON MUNDA COMMUNITY AT DHAMUA MOUZA,
JAGANNI BLOCK, MURSHIDABAD 252

Sudipta Mandal and Subham Kumar Ray

- 263

Index

Sanjay

3. Dhar, B.B. (2009), Environmental impact and abatement of noise pollution. "National Workshop on environmental management of mining operation, Varanasi, India" pp. 168-204
4. SINGH R. P. & R. N. YADAV Subsidence due to coal mining in India • January 1995
5. Singh S.N ECL Article Environment of ECL p 78, 79, 80 81 of book coal Industry in the 20th century Published by BOCL Sept 1999
6. Gangopadhyay, K.P. et al. (2005). "Application of remote sensing to identify coal fires in the Raniganj Coal belt, India" *International Journal of Applied Earth Observation and Geoinformation*, 1-8
7. Geological Survey circular 876 Report, (1983). Subsidence from Underground Mining: Environmental Analysis and Planning Considerations.
8. Goswami, S. (2013) Environment Management in Mining Areas (A Study of Raniganj and Jharia Coal Field in India).
9. Global Journal of Human Social Science (B), XIII(VII). Online ISSN: 2249-460X & Print ISSN: 0975-587X. pp 11-20. G

12

FOLK CULTURE OF RABHAS SPECIALLY THE RABHA OF KAMRUP DISTRICT (ASSAM)

Dulumeni Nath

Abstract

This is an abstract for present a theme of a paper which related with North Eastern region of India. India is a meeting ground of diverse races, cultures, civilization, religions, languages, ethnic groups and societies. Here want to write about tradition, culture and rituals of Rabhas special reference with Rabha of Kamrup district of Assam. They have many special traditions, which are following since very early period of them and Rabhas are culturally very rich. They celebrated some special occasions in some special time of a year. They are basically related with agriculture. Their occasions, cultured, rituals are based on agriculture. Rabhas has so many sub-tribes. In Kamrup district of Assam we found well famous pari rabha. Pari rabha has own traditional background, culture as well as rituals. Rabhas has particular marriage system, burial system and also they have different food habits and dresses are different. But these are looking very beautiful.

Keywords: Rabha, Tradition, Culture, marriage, burial, dress

Introduction

The Rabhas are considered as one of the most important and significant plain tribes of Assam. As one of the aborigines and earliest known inhabitants of Assam, west Bengal and Meghalaya Rabhas are

Studies in Computational Intelligence 863

Oscar Castillo
Dipak Kumar Jana
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ISSN 1860-949X ISSN 1860-9503 (electronic)
Studies in Computational Intelligence
ISBN 978-3-030-34151-0 ISBN 978-3-030-34152-7 (eBook)
<https://doi.org/10.1007/978-3-030-34152-7>

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Integrated-Optimization of Production, Preventive Maintenance and Spare Parts Inventory of Continuous Operating Series Systems . . .	130
Debasis Das Adhikary and Dipak Kumar Jana	
PSO Based H_{∞} PID Controller for a 2nd Order Time Delay System	146
Krishna Kumar and Debasish Mondal	
Realization of Original Quantum Entanglement State from Mixing of Four Entangled Quantum States	159
Kisalaya Chakrabarti	
Sensitivity of the WRF Model to the Parameterized Physical Process	170
Hiren S. Lekhadiya and Ranjan K. Jana	
A Fixed Charge Solid Transportation Problem with Possibility and Expected Value Approaches in Hybrid Uncertain Environment . . .	182
Dipanjana Sengupta, Amrit Das, Anirban Dutta, and Uttam Kumar Bera	
Dynamics of Prey–Predator System in Crisp and Fuzzy Environment with Special Imprecise Growth Rate, Rate of Conversion and Mortality Rate	194
Suklal Tudu, Narayan Mondal, and S. Alam	
On Partial Monotonic Behaviour of Past Entropy and Convolution of Extropy	209
Shilpa Bansal and Nitin Gupta	
FP-Captcha: An Improved Captcha Design Scheme Based on Face Points	218
Palash Ray, Debasis Giri, Salil Kumar, and Priya Sahoo	
Decision Making Under Uncertainty via Generalized Parabolic Intuitionistic Fuzzy Numbers	234
Palash Dutta, Bornali Saikia, and Dhanesh Doley	
An Investigation of Involving Supplier and Manufacturer Based Inventory Models Under Uncertain Fuzzy Constraints	248
R. Das, H. Solanki, and R. K. Jana	
A Decision Making Approach for Finding Cause of Disease Under Hesitant Fuzzy Environment	260
Palash Dutta and Rupjit Saikia	
Optimization of Multi-objective Stochastic Linear Programming Problem in Fuzzy Environment: An Iterative-Interactive Optimization Process	270
Arindam Garai, Sriparna Chowdhury, Suvankar Biswas, and Tapan Kumar Roy	

Advances in Intelligent Systems and Computing 992

Mousumi Gupta
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Computer Vision and Machine Intelligence in Medical Image Analysis

International Symposium, ISCMM
2019

 Springer

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ISSN 2194-5357

ISSN 2194-5365 (electronic)

Advances in Intelligent Systems and Computing

ISBN 978-981-13-8797-5

ISBN 978-981-13-8798-2 (eBook)

<https://doi.org/10.1007/978-981-13-8798-2>

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Automated Segmentation of Cervical Cells Using MSER Algorithm and Gradient Embedded Cost Function-Based Level-Set Method	91
Kaushiki Roy, Debotosh Bhattacharjee and Mita Nasipuri	
Macroscopic Reconstruction for Histopathology Images: A Survey	101
Bijoyeta Roy and Mousumi Gupta	
Likelihood Prediction of Diabetes at Early Stage Using Data Mining Techniques	113
M. M. Faniqul Islam, Rahatara Ferdousi, Sadikur Rahman and Humayra Yasmin Bushra	
Medical Diagnosis Under Uncertain Environment Through Bipolar-Valued Fuzzy Sets	127
Palash Dutta and Dhanesh Doley	
Design and Analysis of Novel Room Temperature T-Ray Source for Biomedical Imaging: Application in Full Body Prosthetics	137
Saikat Adhikari, Singam Jayanthu and Moumita Mukherjee	
Author Index	149

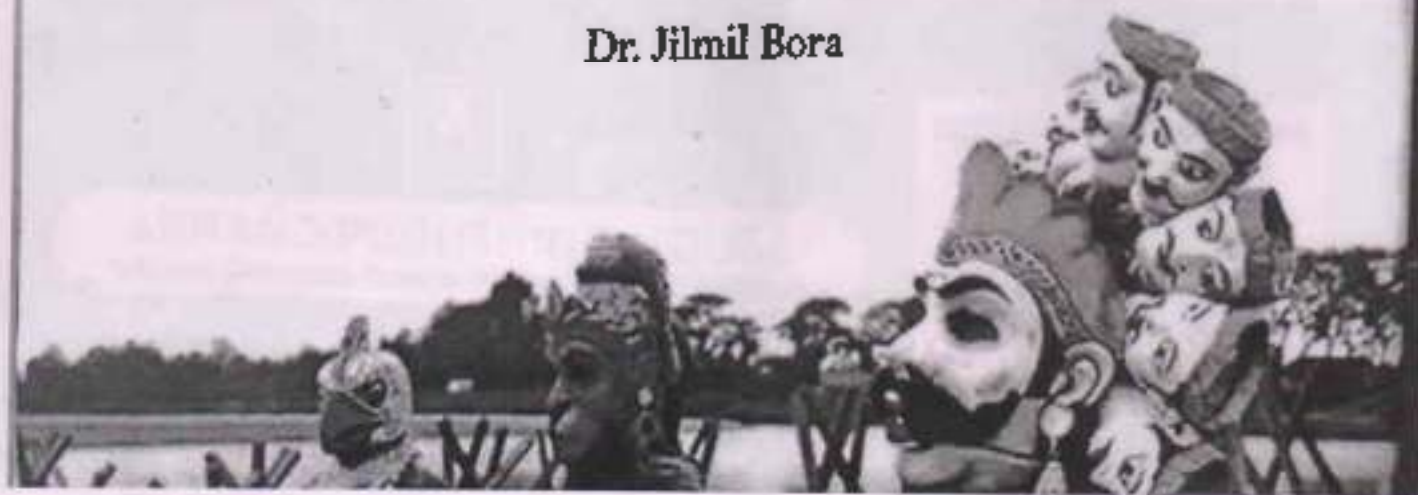


Integrating Diverse Aspects of North East India

Contexts and Perspectives



Dr. Jilmil Bora



"Integrating Diverse Aspects of North East India: Contexts and Perspectives", a collection of twenty six scholarly articles, is a volume which is interdisciplinary in nature with a sociological approach. It covers a wide range of topics concerning politics, economics, sociology, environment, history, literature, law, educational, geography, folklore and women studies pertaining to North East India. The volume focuses mainly on Assam along with other states of the North East. Some articles incorporated in the volume have nationalistic relevance. The articles are empirical, analytical and explorative in perspective keeping the door open for further discussion and research. The contributors' deep insights and variegated perspectives have rendered the much needed distinctiveness to the volume and it will definitely be useful to students, teachers, research scholars, academia and the general readers who nurture a deep interest in North East India.



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Publisher, Distributor, Exporter having an Online Bookstore

E-mail : akhandpublishinghouse@gmail.com

akhandpublishing@yahoo.com

Website : www.akhandbooks.com

ISBN 978-81-948850-1-6



9 788194 885016

₹ 1500 / \$ 115

www.akhandbooks.com

Spiritual Approach to Nature – A Tool for Environmental Protection: Its reflection in the Socio-Religious Beliefs of the Bodos

Dr. Aditi Devi Choudhury

Introduction

Our environment is a matter of great concern for us. The word 'environment' refers to the external conditions or surroundings of both animate and inanimate objects. It is a system in which various living beings as well as non living things can exist with proper relationship. Man being an integral part of environment, influences the environment by his activities whether positive or negative. In the same way man is influenced by the environment. Environment is individual's life space. Our environment can remain in stable condition when all the parts of the environments are in perfect harmony. Organisms can survive, grow and reproduce only in such a stable environment. So it is the moral responsibility of every individual to protect the environment.

Environmental degradation and the notion of spirituality

Our ancestors could fully realize the importance of conserving nature. Their way of life seemed to be more eco-friendly than that of the modern people. However, with the help of science and technology people have been developing a sense of superiority over nature and are trying to make themselves master of the earth. People, being proud of their achievements have destroyed the

Contents

Preface	v
Acknowledgements	vii
Editorial Board	ix
List of Contributors	xv
	xvii
1. Spiritual Approach to Nature - A Tool for Environmental Protection: Its reflection in the Socio-Religious Beliefs of the Bodos —Dr. Aditi Devi Choudhury	1
2. Importance of Women Politics and Status in India and Assam —Dr. Aloko Nijhori	14
3. Attitude of the Nationalist Leaders towards the Tea Garden Workers during Non-Cooperation Movement in Assam —Ananta Goswami	28
4. Tourism Practices in and around Nameri National Park —Anaseta Borah	38
5. Importance of Festivals in the Realm of Culture: A Glimpse of Deori Bihu Celebration of Assam —Arayee Kachiyap	50
6. Flood as a Hazard and its Mitigation Strategies in Assam —Arunuddin Khan, Debashree Borah	63
7. Population Pressure and Deforestation in North East India —Dr. Bhana Hazarika	75

ABD's
B. A. ALTERNATIVE ENGLISH-1

MUSICA

[POETRY]
SEMESTER-III

AS PER CBCS ALT-CC-3016 UNDER
GAUHATI UNIVERSITY

Edited by
Gargee Chakraborty

BA III Semester Musica : A book of TDC English, Edited by Dr. Gargee Chakraborty according to the latest Syllabus (Semester III), Poetry, Under CBCS, Gauhati University.

Published by :
Sairam Publication
Panbazar, Guwahati -1

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Acknowledgements

The Editor & Publisher have made all efforts to obtain permission for all the copyright materials printed in this book and due acknowledgement will be made at the first opportunity.

First Edition : September, 2020

Cover Design : Symal Raha

Dept. of :
Price : Rs.100.00

SPECIMEN COPY FOR
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ISBN : 978-93-87797-68-0

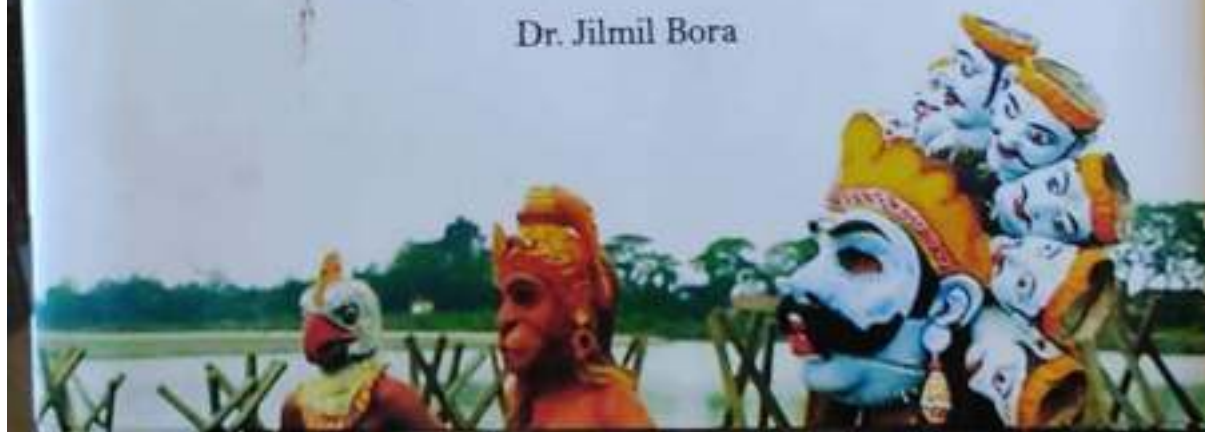
Printed by :
Kali Press
Kolkata-700 009



Integrating Diverse Aspects of
North East India
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**Integrating Diverse Aspects of
North East India
Contexts and Perspectives**

Dr. Jilmil Bora



AKHAND PUBLISHING HOUSE
DELHI (INDIA)

Published by



AKHAND PUBLISHING HOUSE

Publisher, Distributor, Exporter having an Online Bookstore

Head Office : L-9A, First Floor, Street No. 42,
Sadatpur Extension, Delhi-110094 (INDIA)
Phone No.: 9968628081, 9555149955 & 9013387535
E-mail : akhandpublishinghouse@gmail.com,
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Integrating Diverse Aspects of North East India Contexts and Perspectives

© Editor

1st Edition 2020

ISBN 978-81-948850-1-6

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Printed in India

Published by Jhapsu Yadav for Akhand Publishing House. Cover Designed and Laser Typesetting at VM Graphics and Printed at Aarna Enterprises, Delhi.

এ.বি.ডি.ৰ

উচ্চতৰ মাধ্যমিক

ৰাজনীতি বিজ্ঞান

(সমসাময়িক বিশ্ব ৰাজনীতি আৰু স্বাধীনোত্তৰ ভাৰতৰ ৰাজনীতি)

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(দ্বিতীয় বাৰ্ষিকৰ বাবে)



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দক্ষিণ কামৰূপ মহাবিদ্যালয়, মিৰ্জা, কামৰূপ।



প্ৰতিষ্ঠাতা : অৰূপ চন্দ্ৰ গুহ



অসম বুক ডিপো

পাণবজাৰ, গুৱাহাটী- ৭৮১০০১

UCHCHATAR MADHYAMIK RAJNITI BIGYAN (FOR CLASS XII): Aref. book on Political Science, written by Durgakanta Sarma, Rafique Zaman and Manash Pratim Barua, in accordance with the latest Syllabus prescribed by Assam Higher Secondary Education Council and published by Assam Book Depot, Panbazar, Guwahati-781001, Ph. 03612543896, email : aaheedee 25 @ gmail.com)

প্রকাশক :

অসম বুক ডিপো

পানবজাৰ, গুৱাহাটী-১

ফোন : ০৩৬১২৫৪৩৮৯৬

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সপ্তম প্রকাশ : এপ্ৰিল, ২০১৩

অষ্টম প্রকাশ : মাৰ্চ, ২০১৪ (সংশোধিত আৰু পৰিৱৰ্ত্তিত সংস্কৰণ)

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একাদশ প্রকাশ : মাৰ্চ, ২০১৭ (সংশোধিত আৰু পৰিৱৰ্ত্তিত সংস্কৰণ)

দ্বাদশ প্রকাশ : মাৰ্চ, ২০১৮ (সংশোধিত আৰু পৰিৱৰ্ত্তিত সংস্কৰণ)

পুনৰ্মুদ্ৰণ : ২০১৯-২০

মূল্য : ₹ ২৯০.০০

ISBN : 798-81-920160-7-8

অক্ষৰ বিন্যাস :

দিগন্ত শৰ্মা

সহি লেজাৰ, পানবজাৰ, গুৱাহাটী-১

মুদ্ৰক :

শ্ৰী সবয়ু প্ৰিণ্টিং ৱাৰ্কছ

৬১৮/ এ জি.টি. ৰোড (বটতলা)

শ্ৰীবামপুৰ, হুগলী

ফোন : ২৬৫২-১৪২৩

মুকলি বজাৰৰ অত্যধিক
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ভাৰতৰ চৰকাৰ আৰু ৰাজনীতি

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অনুসৰি RC 2016 আৰু HG 2016 দ্বিতীয় মাধ্যমিক (Semester)-ৰ বাবে যুগতোৰা পাঠ্যপুথি

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ভাৰতৰ চৰকাৰ আৰু ৰাজনীতি (INDIAN GOVERNMENT AND POLITICS)

For Second Semester CBCS Regular Course (RC) and Honours Generic (HG)

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মানস প্ৰতিম বৰুৱা

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পূৰ্ণানন্দ পাৰে

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পাৰভিন চুলতানা

সহকাৰী অধ্যাপিকা, ৰাজনীতি বিজ্ঞান বিভাগ
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প্ৰতিষ্ঠাতা : অৰুণ চন্দ্ৰ গুহ



অসম বুক ডিপো

পাণবজাৰ : গুৱাহাটী-৭৮১০০১

ফোন- (০৩৬১) ২৫৪৩৮৯৬, email: aabeedee25@gmail.com

SNATAK MAHALAR BIHARATAR SARKAR ARU RAJNITI : A Text book on Political Science written by Manash Pratim Baruah, Purnanda Pawe, Parvin Sultana and Dr. Juthika Das in accordance with the latest Syllabus (Semester) prescribed by Gauhati University and Published by Assam Book Depot, Panbazar, Guwahati-781001, Ph. 03612543896, email : aabeedee25@gmail.com

প্রকাশক :

অসম বুক ডিপো

পাণবজাৰ, গুৱাহাটী-১

ফোন : ০৩৬১২৫৪৩৮৯৬

Email : aabeedee25@gmail.com)

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প্রথম প্রকাশ : জুলাই, ২০২০

মূল্য : ২৫০.০০ টকা।

ISBN : 978-93-87797-65-9

অঙ্কৰ বিন্যাস :

সাই লেজাৰ, পাণবজাৰ, গুৱাহাটী-১

প্রচ্ছদ : শ্যামল বাহা

মুদ্রক :

শ্রী সবয়ু প্রিন্টিং বার্কছ

৬১৮/এ জি.টি. ৰোড (বটতলা)

শ্রীবামপুৰ, হুগলী

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উচ্চতৰ মাধ্যমিক

ৰাজনীতি বিজ্ঞান

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প্রকাশক :

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নবম প্রকাশ : মে, ২০১২ (সংশোধিত সংস্কৰণ)

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ত্রয়োদশ প্রকাশ : এপ্রিল, ২০১৮

চতুর্দশ প্রকাশ : এপ্রিল, ২০১৯ (সংশোধিত সংস্কৰণ)

পঞ্চদশ প্রকাশ : এপ্রিল, ২০২০ (সংশোধিত সংস্কৰণ)

মূল্য : ৩০০.০০ টকা।

ISBN : 978-93-82384-11-3

ডি. টি. পি :

সাই লেজাৰ, পানবজাৰ গুৱাহাটী-০১

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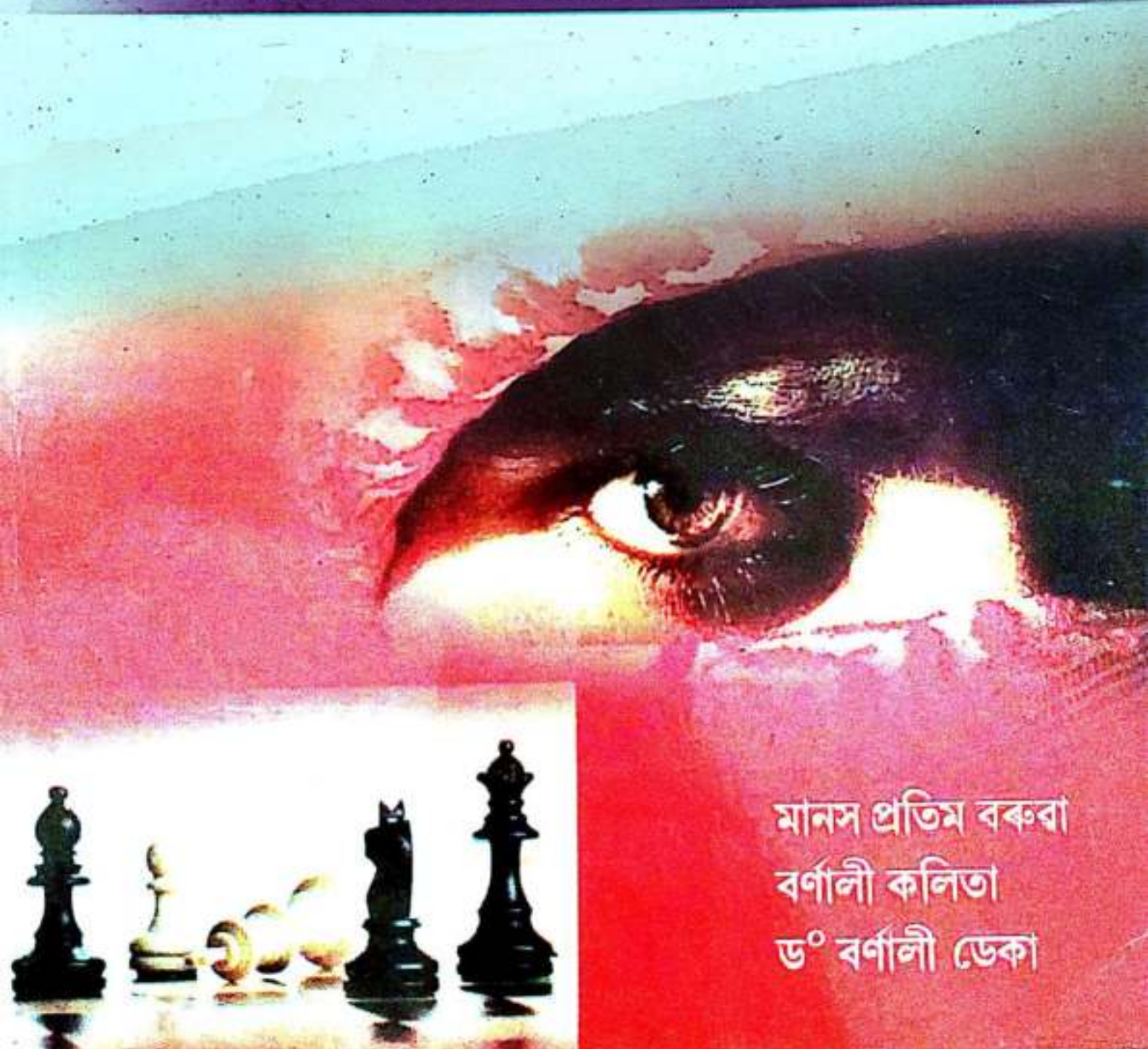
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ফোন : ২৬৫২-১৪২৩

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Text book on Political Science written by Manash Pratim Baruah, Barnli Kalita & Dr. Barnali
Deka in accordance with the latest Syllabus (Semester) prescribed by Gauhati University
and Published by Assam Book Depot, Panbazar, Guwahati-781001, Ph. 03612543896, email
: aabeedee 25 @ gmail.com and abdkolkata 2014@gmail.com

প্রকাশক :

অসম বুক ডিপো

পাণবজাৰ, গুৱাহাটী-১

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পুনৰ্মুদ্রণ : ২০২০

মূল্য : ১৭০.০০ টকা।

ISBN : 978-93-82384-97-7

অক্ষৰ বিন্যাস :

সাই লেজাৰ, পাণবজাৰ, গুৱাহাটী-১

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ABD's H. S. Political Science (Second Year): A book on Political Science, Written by Rafique Zaman, Manash Pratim Baruah and Parvin Sultana according to prescribed syllabus of Assam Higher Secondary Education Council and published by Assam Book Depot, Panbazar, Guwahati-781001, Ph. 03612543896, email : aabeedee25@gmail.com)

Published by :

Assam Book Depot

Panbazar, Guwahati -1

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First edition : April, 2015

Second edition : April, 2016 (Revised & enlarged edision)

Third edition : April, 2017 (Revised & enlarged edision)

Fourth edition : March, 2018 (Revised & enlarged edision)

Reprint : 2019

Fifth edition : April, 2020 (Revised & enlarged edision)

Price : Rs. 300.00

ISBN : 798-93-82384-78-6

Printed by :

Sri Saraju Printing Works

618/A, G.T. Road, (Bottala)

Serampore, Hooghly

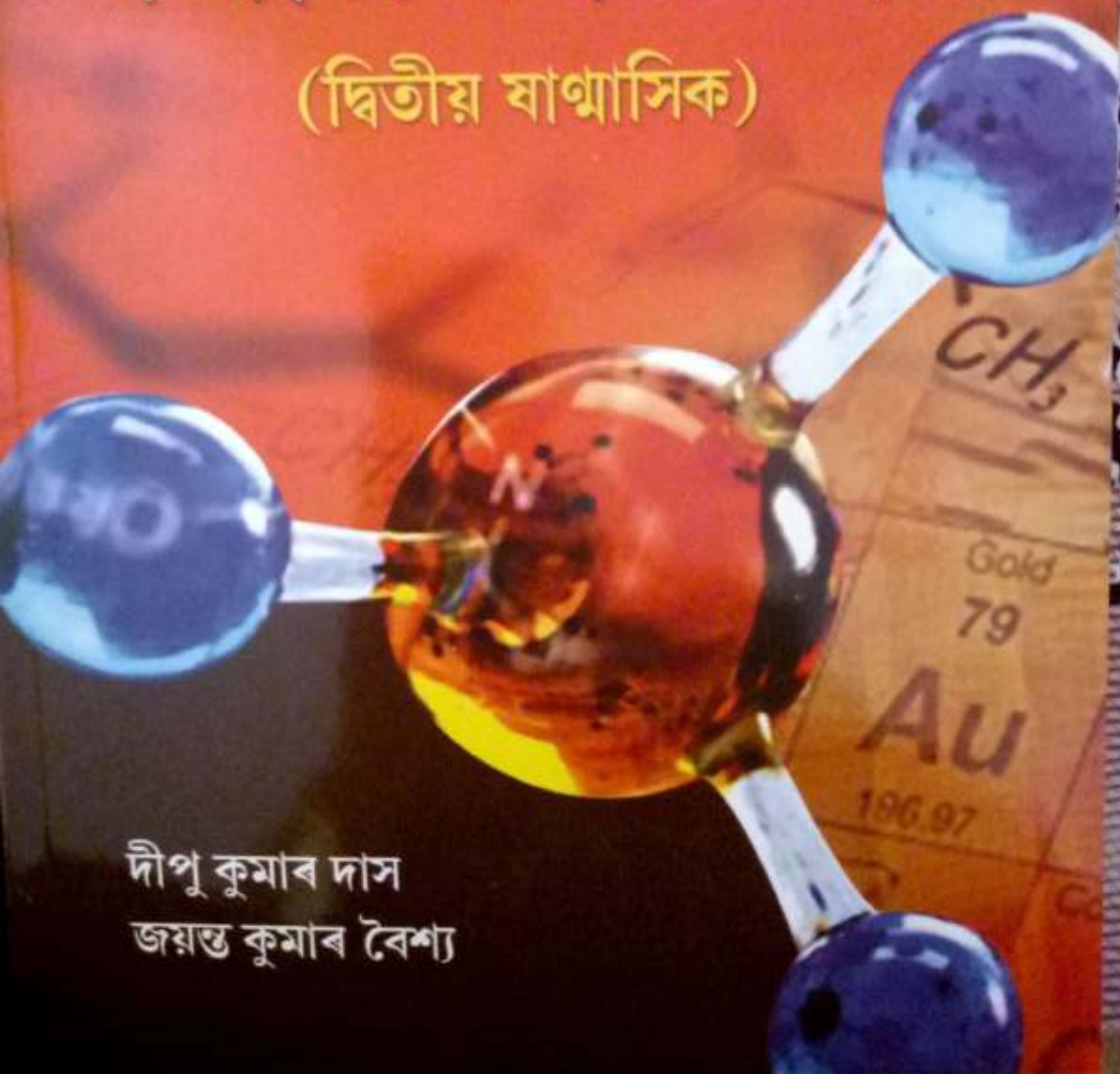
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Price : 240/-.

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মনি-মানিক প্রকাশ

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ISBN : 978-81-85917-03-5

মূল্য : ২৪০.০০ টকা

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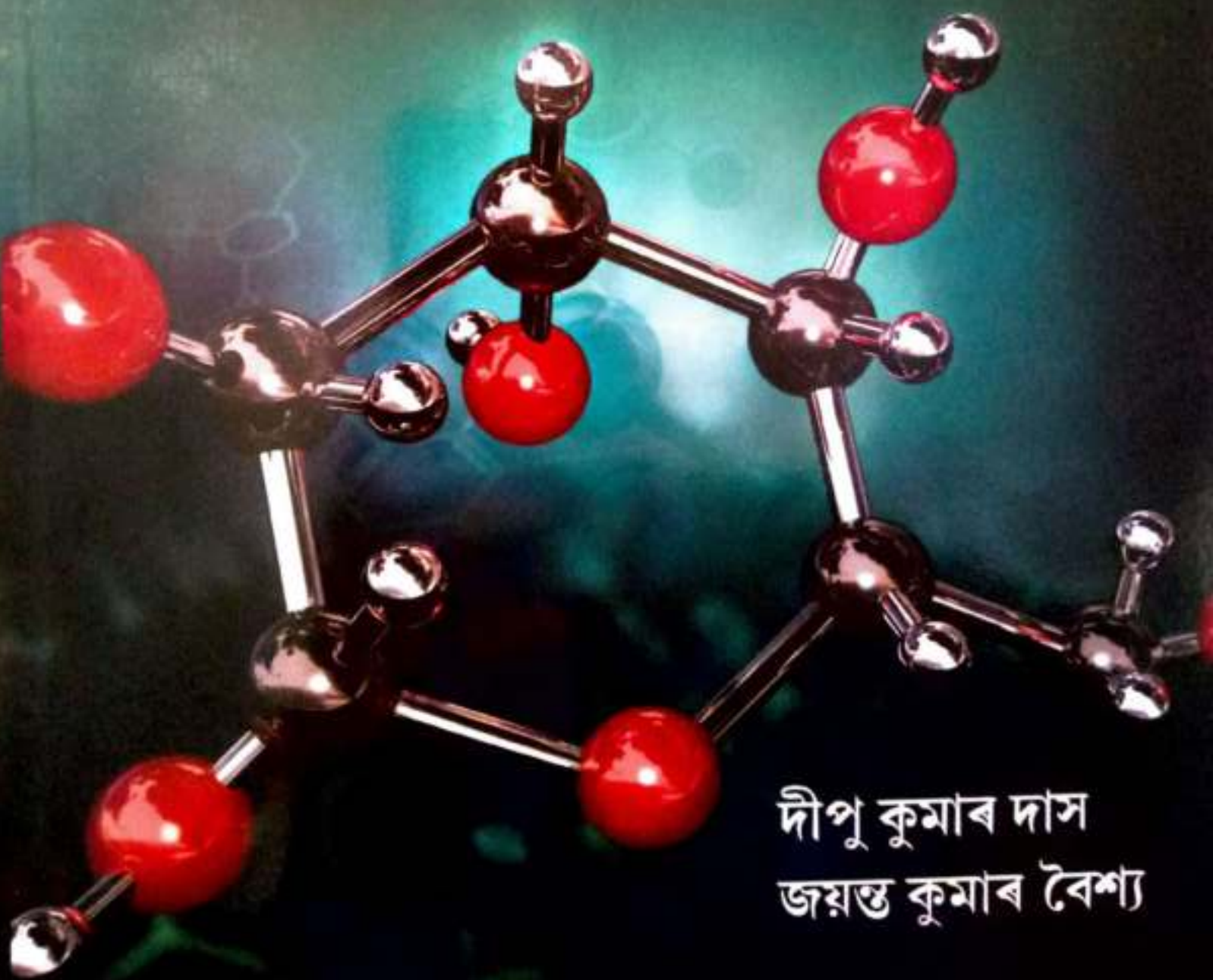
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Price : 325/-

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শ্রীঅনুপম দত্ত

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সপ্তম সংশোধিত আৰু পৰিবৰ্দ্ধিত প্রকাশ : ২০২০

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ISBN: 978-81-85917-28-0

মূল্য : ৩২৫.০০ টকা

মুদ্রক :

চিত্রাচল প্রিন্টার্স

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**Integrating Diverse Aspects of
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Contexts and Perspectives**

Dr. Jilmil Bora



AKHAND PUBLISHING HOUSE
DELHI (INDIA)

Published by



AKHAND PUBLISHING HOUSE

Publisher, Distributor, Exporter having an Online Bookstore

Head Office : L-9A, First Floor, Street No. 42,
Sadatpur Extension, Delhi-110094 (INDIA)
Phone No.: 9968628081, 9555149955 & 9013387535
E-mail : akhandpublishinghouse@gmail.com,
akhandpublishing@yahoo.com
Website : www.akhandbooks.com

Integrating Diverse Aspects of North East India Contexts and Perspectives

© Editor

1st Edition 2020

ISBN 978-81-948850-1-6

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Printed in India

Published by Jhapsu Yadav for Akhand Publishing House. Cover Design
Laser Typesetting at VM Graphics and Printed at Aarna Enterprises.

Contents

<i>Foreword</i>	v
<i>Preface</i>	vii
<i>Acknowledgements</i>	ix
<i>Editorial Board</i>	xv
<i>List of Contributors</i>	xvii
1. Spiritual Approach to Nature – A Tool for Environmental Protection: Its reflection in the Socio-Religious Beliefs of the Bodos	1
<i>—Dr. Aditi Devi Choudhury</i>	
2. Empowerment of Women: Policies and Status in India and Assam	14
<i>Dr. Alaka Hujari</i>	
3. Attitude of the Nationalist Leaders towards the Tea Garden Workers during Non-Cooperation Movement in Assam	28
<i>—Anjana Goswami</i>	
4. Tourism Practises in and around Nameri National Park	38
<i>—Annesha Borah</i>	
5. Importance of Festivals in the Realm of Culture: A Glimpse of Deori Bisu Celebration of Assam	50
<i>—Atrayee Kashyap</i>	
6. Flood as a Hazard and its Mitigation Strategies in Assam	63
<i>—Azruddin Khan, Debashree Borah</i>	
7. Population Pressure and Deforestation in North East India	75
<i>—Dr Bhanu Hazarika</i>	

- | | | |
|-----|--|-----|
| 8. | The Colonial Gaze: Women in Colonial Photography, a North East Indian Perspective
- <i>Dr. Bhaskar Jyoti Gogoi</i> | 88 |
| 9. | Corporate Social Responsibility undertaken by various organizations in Assam with special reference to Environment
- <i>Bidisha Sarmah</i> | 105 |
| 10. | Political Participation of Women is an indispensable need for Women Empowerment: A Meticulous Sketch of Assam
- <i>Dr. Dhiraj Bhuyan Sarmah, Dr. Chandamita Sarma</i> | 117 |
| 11. | Contextualizing Struggle for Survival: Mulk Raj Anand's Two Leaves... and Umakanta Sarma's Ejak Manuh Ekhan Aranya
- <i>Dr. Dipen Bezbaruah</i> | 133 |
| 12. | Assessment of Ecosystem Services and Functions for Human well-being: Current Status and Challenges Ahead
- <i>Durlan Nr. Singha, Gunajit Kalita</i> | 142 |
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- <i>Gargi Chakravarty</i> | 160 |
| 14. | Role of Folk tales in teaching English as a language in Lower Primary Government Schools of Assam: A Study
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- <i>Jayanta Barooah</i> | 181 |
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- <i>Dr. Jonali Nath</i> | 188 |
| 17. | PHYTOREMEDIATION- A cost effective and eco-friendly approach towards a clean environment- With special reference to the North Eastern Region, India
- <i>Lakshmi Rupa Das</i> | 196 |

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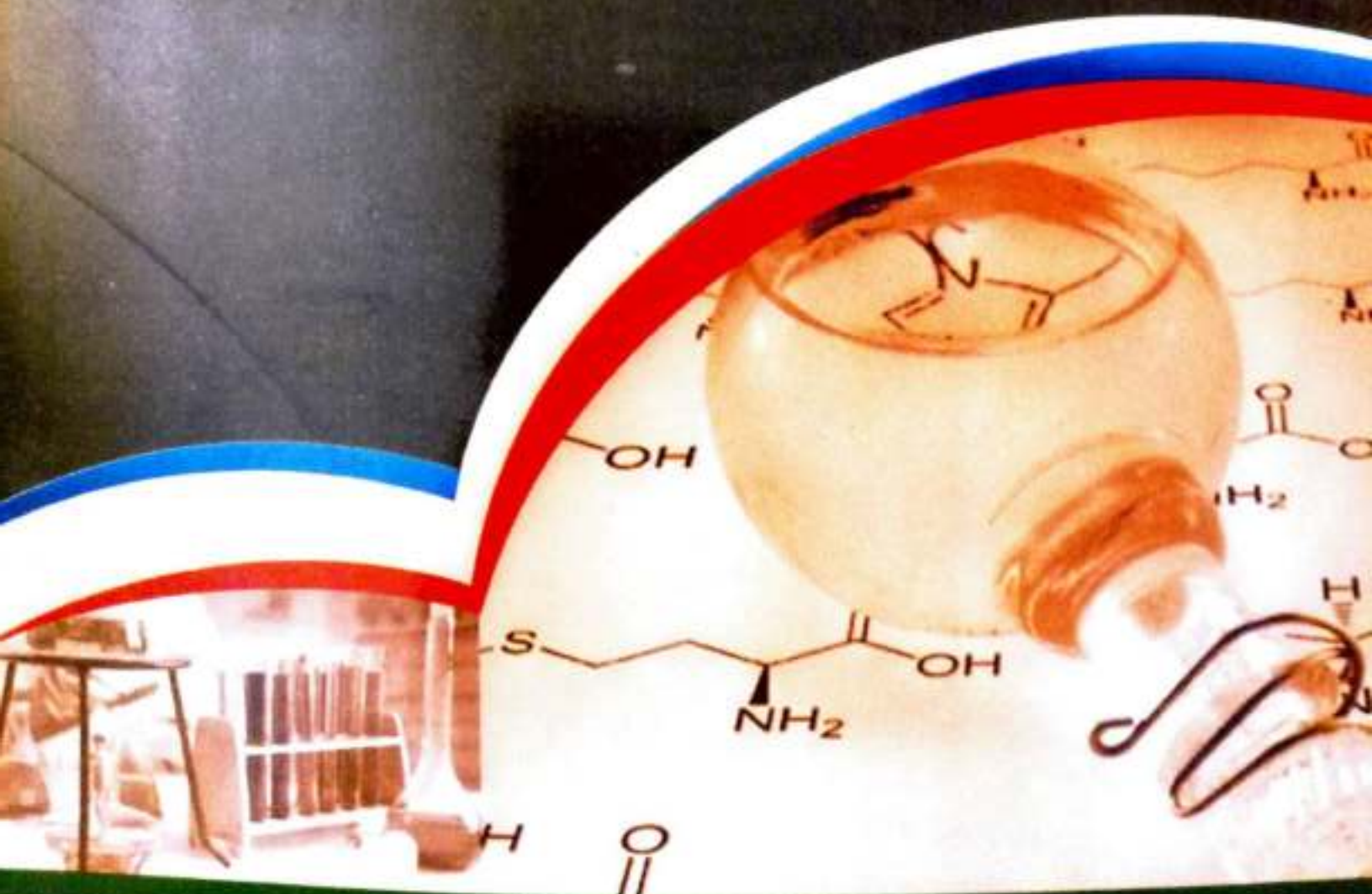
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Published by :
Assam Book Depot
Panbazar, Guwahati-1
Phone: (0361) 2543896
e-mail : aabeedee25@gmail.com

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First Published : May, 2014

Reprint : 2020-21

Price : Rs. 190.00 only

ISBN 978-93-82384-71-7

Type Setting by :
ABD

24 A, Raja Rammohan Roy Sarani
Kolkata - 700 009

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Book publication

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United Book Publications
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E-Mail: unitedbookpublications@juno.com
Phone No.: 9088418540

SALES COUNTER

Urdu Book Publications
S. C. Chowdhury Road, Narayana
Gowdahi-781011
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 B-110C 4th Semester Economics Regular Course (ECN MC 8010) OCEB India
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ISBN : 978-81-911111-1-7
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Registration no. GJ31D0000034

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ISBN: 978-93-90937-21-9

DIP: 18.10.56/951100

Price: ₹ 240/-

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Table of Contents

SR.NO.	CHAPTERS AND AUTHORS	PG.NO.
	Factors Determining Utilization of Health Care Institution among the Pregnant Women: A Case Study <i>Dr Dipanjali Devi</i>	11
2	"Kushan Gaan" as a Performing Art Form in Assam <i>Dr Kulendu Nath</i>	22
3	Application of Eco-friendly Textile Dyes on Cotton and Silk Fabric Extracted from Vegetative Waste <i>Dr Shabnam Hazarika</i>	30
4	Positivism and Writings on Upper Assam and Arunachal Pradesh – an Attempt to Locate Paradigms and Shifts in them <i>Swaswati Borkataki</i>	41
5	Empowerment of Tribal Women : A Study of Rabha Society from Socio-cultural and Political Perspective with Special Reference to Goalpara District of Assam <i>Rumi Nath</i>	49
6	Development of Teacher Education in India : Pre Independence Period <i>Archana Devi</i>	55

7	Religious Ideas and Practices of the Rabha Tribes in Assam : An Analytical Study <i>Dr. Nazrul Islam</i>	63
8	Bagejari Gīt : A Folksong and Dance of the Rabhas in Assam <i>Pranita Mahanta</i>	74
9	Globalization and its Effects on Social Integration <i>Mukul Nath</i>	81
10	Contribution of Krishna Kanta Handiqui towards Educational Development of Assam <i>Swapna Lahan</i>	91
11	Problems and Prospects of Ecotourism in North East India <i>Sarat Kumar Nath and Biswajit Nath</i>	104
12	Women in Jyoti Prasad Agarwala's Play : Special Reference to "Karengor Ligiri" <i>Darpana Choudhary</i>	117
13	Child Language : A Study on Psycholinguistics <i>Dipika Rabha and Tunuka Rabha</i>	129
14	Folk Dance and Festivals of Khasi Tribes of Northeast India <i>Dr Shahnaz Begum</i>	136
15	Role of Community Level Factors Affecting the Utilisation of Maternal Health Care Services in Assam : A Study in Three Selected Districts of Assam <i>Jonali Nath</i>	148

16	Covid 19 and Tourism Industry in India- Problems and Suggestions <i>Arabinda Medhi and Munmun Das</i>	166
17	Earthquake as a Major Geo-environmental Problem in North Eastern India with Special Reference to Goalpara District of Assam <i>Dr. Asraf Ali and Dr. Ratneswar Barman</i>	179
18	Musculoskeletal Disorders among Bamboo Workers of Assam : An Ergonomic Study <i>Dr. Susmita Nath</i>	190
19	Folk performing arts of Lower Assam : Special reference to Goalpara District <i>Asma Easmin</i>	200
20	Tribal Religions of North-East India with special reference to Bathouism, Donyi-Poloism and Sanamahism <i>Nihar Bordoloi and Nayanjyoti Bora</i>	205

CHAPTER 15

Role of Community Level Factors Affecting the Utilisation of Maternal Health Care Services in Assam: A Study in Three Selected Districts of Assam

Jonali Nath

Summary

Most of the public health studies, in developing countries assessing the determinants of maternal health care services focus on household and individual level factors. But, at present, there has been a trend to study the health care services in association of community level factors. Community has great impact on the behaviour of individual and society. Community characters influence individual decision making with respect to various aspects. It is well recognized that disparities of health outcomes may arise not only from differences in the characteristics of families but also from differences in the socio-economic attribute and communities where they live (Fosto and Kuate- Defo, 2005. Kravdal, 2004, Robert, 1999).

It is clear from various studies that maternal health seeking behaviour is not only associated with the individual and household level factors, but also with community level factors, such as place of residence, community poverty, community level education, community mass media exposure among others which may affect the maternal health care behaviour. In this paper an attempt has made to assess the role of community level factors affecting the utilisation of maternal health care services in Assam.

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Paperback ISBN: 978-93-90785-94-0

eBook ISBN: 978-93-90785-77-3

First Published in April 2021

Published by Walnut Publication (an imprint of Vyasta Ventures LLP)
www.walnutpublication.com

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Contents

How Our Childhood Experiences Determine The Overall Health & Wellbeing Of Our Adulthood/	1-7
Dr. Chandana Bhuyan	
Mental Health and Psychosocial Effects of Trauma: A Discussion Related to the COVID -19 situation.....	8-19
Dr. Meenakshi Barthakur	
Aggression in Adolescents: prevalence and management.....	20-28
Dr. Jyomoni Saikia & Arifa Monia Begum	
Gender Wise Study on Mask Users and Non-Mask Users during Lock-II Phase Of COVID-19	
Midnapore town in West Bengal.....	29-44
Dr. Parni Ghosh and Dr. Debabrata Das	
Impact of COVID-19 On Women's Lives.....	45-52
Mr. Sajit Baburao Chavan	
Reviving Sustainable Development Through Women Empowerment: Contemplating Challenges and Opportunities during the COVID-19 Pandemic with special reference to North India.....	53-69
Mr. Karan Das	
Challenges During COVID - 19 Pandemic on Women.....	70-74
Dr. Kamlesh Narsyanlal Gupta	
Impact of Covid-19 On Women and Problems Facing During Lockdown Period - Indian Perspective	75-84
Fazalath Hussain R	
Maternal and Mental Health of Women: A study with Reference to stature	85-91
Edmirekha Phukan	
Challenges on Menstrual health, Hygiene of Women and COVID	92-101

Dr. Kankana Deyi	
COVID-19 Pandemic and Its Impact on Women	102-107
Lohit Nath	
The Impact of COVID-19 on Informal and Migrant Workers in India.....	108-123
Supriyo Haldar	
The Plight of Rural Women during the COVID19 Pandemic: A Gender Reading of the Contemporary Narrative through the Post-colonial Lens.....	124-131
Dr. Rajadudin Ahmed and Ranjan Gogoi	
COVID-19 Pandemic, Women, And The Status Quo'	132-134
Abhisma Phukan	
Weaving Women condition during COVID-19 pandemic	155-168
Dr. Duhumoni Nath	
COVID-19 Pandemic and its Impact on Women.....	166-172
Sanai Seb Rengma	
Exacerbating Impact of COVID 19 Pandemic, Exigency of Gender Equality and Peace: A Study.....	173-186
Rabia Khanam	
Increase of Women Work Participation in Agriculture - A Positive Impact of COVID-19 On Rural Women's with Special Reference To Charaibhidi Brakman Gaon, Jorhat.....	187-196
Dr. Arindam Kumar Borah and Miss. Sumanjita Phukan	
A Study on Mothers of Children with Special Needs and Their Challenges During COVID-19 Pandemic.	197-212
Ms. Aditi Bhowas	
Hidden efforts of women's labour in Tourism & Hospitality sector and the impact of COVID-19.....	213-223
Dr. Abhishek Roy	
Women as Pivotal Figures of Power: Reading Gender and Space in Temsula Ao's Laburnum for My Head	224-234

Dr. Nath

they have no hold of themselves or are weak, but they have certain norms of the society that still persist, their flexibilities, and various conditionings under which they always functioned.

While there is a section of society which tries to stretch capacities into disbelief, there are people who believe in their strengths and capabilities of women.

Furthermore, due to the presence of both announced and unannounced societal pressures women have been able to manage, but chances that they will manage to overcome hindrances, and will rise and contribute in the ways that are greater.

Studies like these are important for proper and knowledge of the on-goings. If taken into account, studies definitely aid in bringing about much needed changes on the psychological or any other level possible.

In this research, I have tried to utilise the best of my scope and time to study and present the given topic. The further scope of study on this given topic by taking into account other factors or by placing more emphasis at specific

References

- Burki, T. (2015). The indirect impact of COVID-19 pandemic on women. *The Lancet, News Desk* |, [https://doi.org/10.1016/S1473-3099\(20\)30568-5](https://doi.org/10.1016/S1473-3099(20)30568-5)
- Crenshaw, K. 3rd ITUC World Women's Conference/ Women's Organising Assembly "Economic and Social Justice for Women".
- "In Focus: Women peace and security" <https://www.unwomen.org/en/in-focus/women-and-security>
- "Why Women, Peace and Security" <https://www.peacewomen.org/>

The purpose of this paper is to delimitate involvement of women in handloom industry in Assam, India and its impact on socio-economic life. During the pandemic Covid-19 and weaving women's condition is going to very bad. The handloom industry constitutes a timeless facet of the rich cultural heritage of Assam. Highest proportion of weavers in India can be found in Assam and around 99 percent of them are women.

As in almost every assamese family have at least one weaving woman and some place we find weaving men also.

Handloom is the area of Assam famous for handloom; for example: that industry has been badly affected during Covid-19 pandemic.

The analysis clearly shows that such as income and livelihood positively correlate with involvement of women

Handloom, involvement, women, condition,

Handloom: The handloom sector plays a very important role in India's economy. It is a part of our culture and heritage and one of the largest economic activities after agriculture

Women Law and Remedies

Editor

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ISBN : 978-93-87229-81-5 Overseas Branches

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Edition 2021



Published by

ABS Books

Publisher and Exporter

1st, 2nd and 3rd Floors, Bhubi Vihar

Phase-2, Delhi - 110056

+919999980875, +919999802474

absbooksindia@gmail.com

Website : www.absbooksindia.com

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Yueai Garden, Yuhua Vixun

Community, Chenggong

District, Kunming City,

Yunnan Province - 6501500

China

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PRINTED AT

Print Enterprises, Noida (U.P.)

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Women Law and Remedies

: *Anjali Dixit*

PREFACE

The woman who follows the crowd will usually go no further than the crowd. The woman who walks alone is likely to find herself in places no one has ever been before. The story of women's struggle for equality belongs to no single feminist nor to any one organization but to the collective efforts of all who care about human rights.

Across this globe, policymakers and activists are working to empower women in areas of peace and to help address the challenges they face in areas of conflict. When women are involved in peace negotiations, they raise important issues that might be otherwise overlooked. When women are educated and enabled to participate in every aspect of their societies—from growing the economy to strengthening the security sector—communities are more stable and less prone to conflict. Every moment of every day our world is becoming more interconnected, and we are wise to engage all stakeholders in finding solutions to our most difficult challenges. Acknowledging the barriers many societies still impose on women's participation and recognizing the potential of women to promote peace in their own countries and around the world—are parts of this process.

Women's law and knowledge is an edited book, this collection of essays by eminent professors, activists and research scholars seeks to map the field of women and law from an interdisciplinary perspective and, in the process, puts forth on paper the continuing demand of justice to women under the Indian legal system. By

Anjali

10. Effect of Mental and Physical Violence on the Life of Women	99
Dr. Archana Vashishth	
11. Economic Empowerment of Rural Women Through Entrepreneurship Development: An Overview	109
Pulavi Sarma	
12. The Sexual Harassment of Women at Workplace: Detailed Analysis and A Brief Overview of the PoSH Act, 2013	116
Dr. Maria Gerold Simoes	
13. A Study on Causes and Types of Domestic Violence Against Women	125
Dr. Sarupa Datta	
14. Violence Against Women and its Remedies	134
Dulamsani Nishi	
15. Effect of Victim Precipitation Theory on Female Victims	141
Vasundhara Kaushik	
16. Time to Unlock Domestic Violence in COVID-19	151
Nidhi Singh	
17. A Study on India's Legislative Approach Towards Offence of Acid Attack	165
Priyanka Singh	
18. Women and Cyber World	178
Arshi S	
Yashwanth A S	
19. Muslim Girls Education and Academic Achievements: An Overview	187
Fadma B.	
Puspanjali Samantary	
Index	196

1. Superstitious Belief and Witchcraft in India : A Legal Study

Anjali Dixit*

Introduction

Superstition has persisted throughout human history, and has been present in virtually every human society throughout history. In scientific era superstition belief exists worldwide. Although, many scientific discoveries and inventions try to vanish this black magic belief.

Superstitions are self-imposed selfish imaginary beliefs. Witchcraft or witch hunting is one of them. Worldwide developing non-developing and poor countries are victim of this superstitious belief. According to Shakespeare's Macbeth witches were those persons who had made a spiritual pact with devil in exchange for supernatural powers.

Witchcraft and Witch Hunt

Witchcraft is a multifaceted religious, cultural phenomenon with its nature, causes and outcomes worldwide. Most of literate or illiterate, urban or rural residents in India even in 21st century would still consult a witch Doctors (tantric or an astrologer) to cure their

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- ❖ Straus, M.A; R.J.Gelles and S. Steinmetz. 1990. *Behind Closed Doors: Violence in the American Family*. Garden City, New York: Anchor Press.
- ❖ Swain, Sivkant. 2002. *Understanding The linkage of Employment, Autonomy and Domestic Violence among Married Women*. A comparative study of Uttar Pradesh and TamilNadu. IIPS, Seminar Paper (Unpublished).
- ❖ Traversa, J.1997. *Domestic Violence in Cultural Context: A Response to Frederick Schiavone*. Department of History, Stony Brook University.
- ❖ United Nations Children's Fund (Unicef). 2000. *Domestic Violence against Women and Girls*. Innocenti Digest Number 6, Innocenti Research Centre, Florence, Italy.
- ❖ Vidushy, V. and Sethu, V. 2016. *Domestic violence in India- An analysis*, *International Journal of Applied Research*, 2, 5, 451-455.
- ❖ Visaria, J. . 1998. *Violence against Women in India: Evidence from Rural Gujarat*, in *Domestic Violence in India 1: A Summary Report of Three Studies*. Washington DC: International Centre for Research on Woman and The Centre for Development and Population Activities.



14.

Violence Against Women and its Remedies

Dulmoni Nath*

Introduction

The world has entered into a new millennium but from the dawn of civilization till date the women of the patriarchal society of India continues to be oppressed and ill treated. She is dependent weak exploited and faces gender discrimination in every sphere of threatens the well being, dignity and rights of women, extends across social, cultural, economic and regional boundaries.

Instances of violence against women in ancient India are mentioned. Mahabharata cites the violence meted out to Dropodi. Yudhishtir staked his wife Dropodi in gambling and lost her following which Duryadhana ordered his brother to do strip her in the royal palace and he attempt to do so, but lord Krishna came to her rescue. Kans killed seven new born babies of his sister Devaki. In modern societies also violence against women is a major public health affecting women and children.

Violence against women is a grave violence of the fundamental

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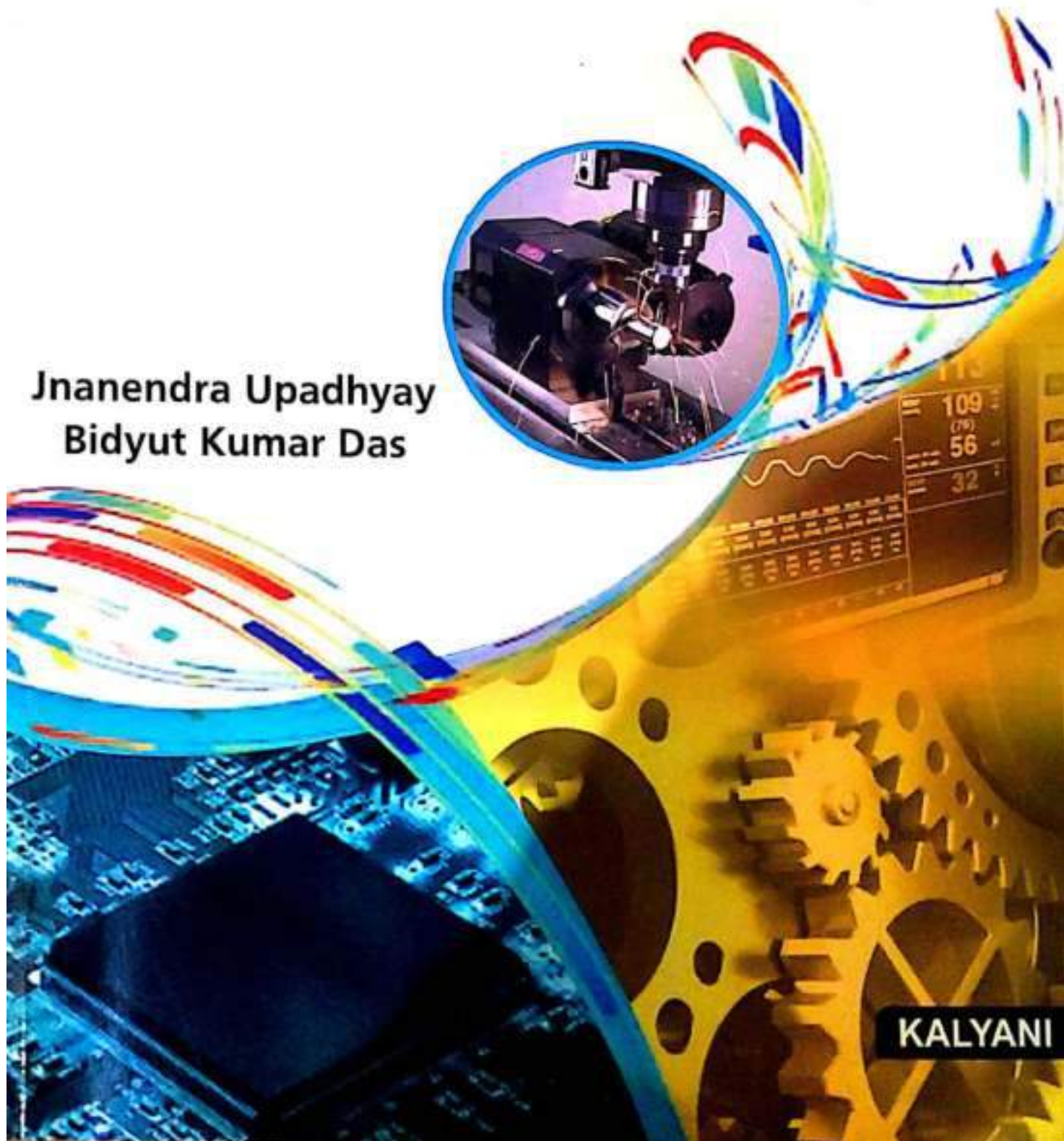
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₹ 140.00

ISBN: 978-93-5540-064-2



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Trends in Stimuli Responsive Biomaterials in Tissue Engineering

9

Rajiv Borah, Jnanendra Upadhyay, and Birru Bhaskar

Abstract

Native tissues and organs coordinate and execute their activities via dynamic, interlinked clusters of biochemical and biophysical attributes, which are differed throughout biological processes spatiotemporally. Passive biomaterials, developed with tunable structural, mechanical and biochemical properties, cannot mimic the dynamic features of the cellular environment and therefore, often lack of efficiency in tissue regeneration to restore full functionality. With the perspective to address this notion, stimuli responsive biomaterials have evolved as effective tool that replicate essential static and dynamic features of native tissues due to their capacity to alter physicochemical characteristics in response to physical/chemical/biological stimuli compatible to tissues and organs, facilitating on demand cell microenvironmental manipulation. The current chapter focuses on trends of stimuli responsive biomaterials explored for tissue engineering (TE) applications. Special emphasize has been devoted to those stimuli responsive biomaterials (e.g. electroactive biomaterials), which are sensitive to the stimuli that match with the native biophysical cues of tissues and can regulate those biophysical cues to modulate the regeneration associated cellular processes for faster and efficient tissue regeneration. Each category of stimuli responsive biomaterials has been discussed with a brief introduction and the mechanism of

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functionality followed by its applications in various TE applications. Biomaterials that respond to chemical and biological stimuli, have also been briefly addressed in the light of TE potential. The chapter also highlights the advantages-limitations and future directions of stimuli responsive biomaterials at the end.

Keywords

Tissue engineering · Stimuli responsive biomaterials · Electroactive biomaterials · Tissue regeneration

Abbreviations

0D	Zero dimensional
1D	One dimensional
2D	Two dimensional
3D	Three dimensional
5-FU	5-fluorouracil
ADSCs	Adipose derived stem cells
Alg	Alginate
BaTiO ₃	Barium Titanate
BT	Barium titanate
C	Cellulose
Ch	Chitosan
CNFs	Carbon nanofibers
CNTs	Carbon nanotubes
Co	Cobalt
Col	Collagen
CPs	Conducting polymers
CS	Chondroitin sulfate
DDF	Dermal fibroblasts
DLC	Diamond-like carbon
DMAEMA	Dimethylaminoethyl methacrylate
DNA	Deoxyribonucleic acid
ECM	Extracellular matrix
ES	Electrical stimulation
Fe	Iron
G	Graphene
Gel	Gelatin
GelMA	Gelatin methacryloyl
GO	Graphene oxide
HA	Hydroxyapatite
HEMA	2-hydroxyethyl methacrylate
LCEs	Liquid crystalline elastomers

LCST	Lower critical solution temperature
MAP	Microporous annealed particle
MEH-PPV	Poly(2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene)
MS	Magnetic stimulation
MWCNT	Multiwall carbon nanotube
NB	Nitrobenzene
NCD	Nanocrystalline diamond
Ni	Nickel
P3HT	Poly-3-hexyl-thiophene
PAN	Polyacrylonitrile
PAni	Polyaniline
PAs	Peptide amphiphiles
PCBM	Phenyl-C61-butyric acid methyl ester
PCL	Polycaprolactone
PCLF	Polycaprolactone fumarate
PDMS	Polydimethylsiloxane
PEDOT	Poly(3,4-ethylenedioxythiophene)
PEG	Poly(ethylene glycol)
PEGS	Poly(ethylene glycol)-co-poly(glycerol-sebacate)
PEO-PPO-PEO	Poly(ethylene oxide)-poly(propylene oxide)-poly (ethylene oxide)
PGA	Polyglycolide
PGS	Poly(glycerol-sebacate)
PHBV	Poly(3-hydroxybutyric acid-co-3-hydroxy valeric acid)
PHEMA	Poly(2-hydroxyethyl methacrylate)
PLA	Poly(lactide)
PLGA	Poly(lactic-co-glycolic)
PLGA/HA	Poly(lactic-co-glycolic acid)/hyaluronic acid
PLLA	Poly-L-lactic acid
PLLA-PEG-PLLA	Poly (L-lactic acid)-poly(ethylene glycol)-poly(L-lactic acid)
PNiPAAm	Poly(N-isopropylacrylamide)
PNVC	Poly(N-vinylcaprolactam)
POxs	Poly(2-oxazoline)s
PP	Polypropylene
PPy	Polypyrrole
PSS	Poly(4-styrene sulfonate)
PT	Polythiophene
PTCDI-C8	N,N'-dioctyl-3,4,9,10-perylenedicarboximide
PTFE	Polytetrafluoroethylene
PVA	Poly(vinyl alcohol)
PVDF	Polyvinylidene fluoride
PZT	Lead Zirconate titanate
RGCs	Retinal ganglion cells
rGO	Reduced graphene oxide
SF	Silk fibroin

Si	Silicon
SMPs	Shape-memory polymers
TCP	β -tricalcium phosphate
TE	Tissue engineering
TrFE	Trifluoro ethylene
UCST	Upper critical solution temperature
UV	Ultraviolet

9.1 Introduction

Tissue engineering (TE) has evolved as a realistic alternative to donor-dependent organ transplantation or autografting and allografting to repair a damaged organ or tissue. It is meant to develop living, functional tissues that can be employed to substitute, or repair tissues impaired because of disease, aging, congenital defects or physical damage by integrating biomaterial scaffold, cells and bioactive compounds (Vacanti and Langer 1999). Therefore, the choice and design of biomaterial is essential for the regeneration of new cells in vitro and in vivo, while ensuring its biocompatibility, bioactivity, durability, degradability, porosity, and flexibility at the same time. In TE, the biomaterial scaffold should act as the artificial extracellular matrix (ECM) capable to mimic the native cellular microenvironment of the particular cell type, which is needed to be regenerated. Hence, the spatiotemporal modulation of the physical and chemical properties of biomaterial scaffold is necessary to support favorable tissue regeneration. The native ECM interacts with cells dynamically through close co-ordination with the biophysical and/or biochemical cues for normal tissue function including regeneration. A biomaterial scaffold is also required to function in a dynamic fashion for effective and efficient tissue regeneration, which paved the way for “smart” or “stimuli responsive” functional materials in TE applications.

Throughout the designing and creation of new materials that are able to respond to particular stimuli, nature provides countless touchstones that are configurable, reliable, and replicable. In reality, many living system substances vary spontaneously as per the environmental circumstances and their processes and actions to maintain and regulate normal functions. It involves alteration in form, dimensions, appearance or rigidity and depends on complicated models for feedback. Over the last decade academic and industrial research has thus been inspired to create new functional materials that imitate the sensitivity of natural living systems. Subsequently, the understanding of endogenous physiological behavior of cells and tissues along with the existence of several important physical and chemical cues, inspired researchers to develop a new generation of biomaterials, termed as “Smart” or “Stimuli responsive” biomaterials. Prior to this new generation of biomaterials, most of the biomaterials were used in a passive way, just as support for the cells and tissues through their bioactivity and suitable physiochemical properties such as

biodegradability, mechanical stability, and porosity. Therefore, there is a growing interest in stimuli responsive materials for TE and regenerative medicine with the capacity to communicate and interact with cells.

Stimuli responsive materials, also termed as “smart” or “intelligent” materials, are those, which can sense and respond to external stimuli or any alternation in the external environment (Cardoso et al. 2017). In rebuttal to single or multiple external stimuli, this exceptional category of materials exhibits variations in one or more of their physicochemical properties, i.e., size, shape, solubility, permeability, hydrophilicity, surface charge, electrical, magnetic, mechanical, and optical, etc. These external stimuli can be classified as physical (temperature, electrical, magnetic, mechanical stress, light, ultrasound, etc.), chemical (pH, ionic strength, electrochemical, etc.) and biological (enzymes, glucose, antigen, growth factors, receptors etc.) stimuli (Fig. 9.1). Physical stimuli can induce modifications in the energy dynamics of the materials, whereas the chemical stimuli modulate molecular interaction within the material or between the material and the surrounding environment. Biological stimuli associate with the specific biological functions such as enzymatic reactions, receptor recognition, activating regeneration associated processes, etc. Additionally, there are dual and multi-stimulus-responsive materials that respond to more than one stimulus concurrently.

In regard to TE applications, stimuli responsive materials hold potential to elicit beneficial effect at cellular level through changes in their physiochemical properties upon any change in external stimuli, which can activate regeneration associated processes by modulating various important biochemical or biophysical events at cellular and molecular level. Therefore, it is important that the stimulus dependent behavior of a potential stimuli responsive biomaterial should be able to induce the beneficial effect during in vitro cell culture or in vivo to enhance the tissue regeneration and function. Although, there are a range of stimuli responsive biomaterials with respect to their sensitivity towards specific stimulus type, the real time cellular response is significantly observable and therefore, well explored with the stimuli responsive biomaterials, which can respond to electrical stimulation (ES) and magnetic stimulation (MS). The concept of these biomaterials is based on the intrinsic biophysical cues already present in the tissue. In fact, there are two approaches of using stimuli responsive biomaterials for tissue repair purposes. In the first case, the stimulus is used during fabrication of the biomaterials and there is hardly any or rare evidence of utilizing that particular stimulus in real time during in vitro cell culture or in vivo. In the latter's scenario, the stimulus, which matches with the intrinsic biophysical/biochemical cues of tissues, is utilized to mimic the dynamic cell microenvironment. The present chapter mainly focuses on the stimuli responsive biomaterials of the second category with their underlying mechanisms of stimuli dependent actions in the light of cellular processes, and hence, a detailed discussion on electroactive and magnetoresponsive biomaterials, followed by thermoresponsive and photoresponsive biomaterials, has been presented. The chapter also summarizes the TE applications of chemical and biological stimuli responsive biomaterials along with dual and multi-stimuli responsive biomaterials. Notwithstanding, most of the stimuli responsive biomaterials were explored largely in diagnostic applications and

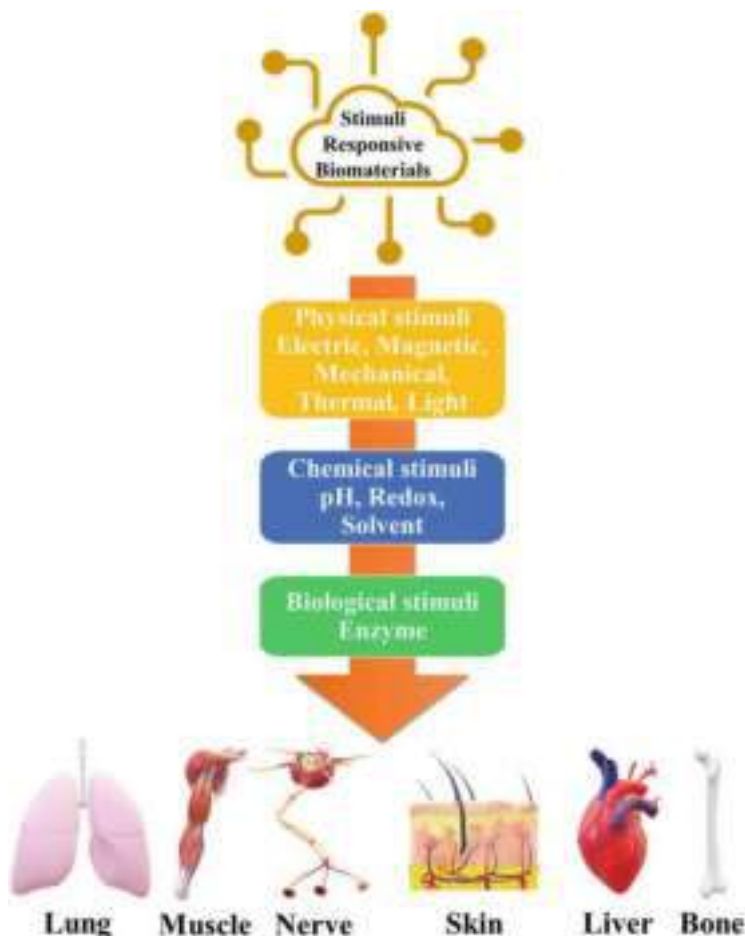


Fig. 9.1 Concept of stimuli responsive biomaterials for effective tissue regeneration and functional recovery in combination of physical/chemical/biological stimuli

on demand delivery of drugs, protein, gene, and cell (Cabane et al. 2012), which are not within the scope of the present chapter.

9.2 Stimuli Responsive Biomaterials in Tissue Engineering

9.2.1 Electroactive Biomaterials

Bioelectricity holds a pivotal role in our body's normal operation including movement, thinking, sensation, visualization with eyes, blood transportation through our circulatory system and healing of an injury (Ghasemi-Mobarakeh et al. 2011). Cargo

phenomena including movement of ions through the plasma membranes and electrons along biomolecules regulate all the biological processes in the body. Electrical potentials (-60 mV to -100 mV) exist inside and outside cells. The changes in the transmembrane potential influence cellular functions as depicted in Fig. 9.2 (Qian et al. 2019). Biological tissues, particularly heart, neural, skin, bone, and muscles, are used to regulate their physiological behaviors and to propagate electrical potential by means of their electrical conductivity mechanisms such as accumulation and flow of charge (Balint et al. 2014). Electrical activities are associated in modulation of range of molecular events in these tissues, engaged in the development, adaptation, repair, and regeneration of tissues. There are growing evidences of significant positive contribution of ES in a range of important biological processes relevant to TE, viz. angiogenesis, cell division, cell signaling, nerve sprouting, prenatal development, and wound healing (Balint et al. 2013). This inspired the development of electroactive biomaterials, because of their excellent contact with bioelectric fields in cells and tissues, for a faster pace than traditional non-conductive biomaterials, for improving regenerations, differentiation or function of both in vitro and in vivo.

Electroactive biomaterials enable cells to obtain direct electrical, electrochemical, and electromechanical stimulation. Possible clinical uses of ES include wound care, bone regeneration, nervous repair, and ulcer care of the diabetic and bedridden patients with pressure sores. Some of the electroactive biomaterials were clinically translated as non-biodegradable cardiac pacemakers, cochlear implants, electrodes for deep brain stimulation, etc. These smart biomaterials simultaneously can be stimulatory to the tissues as well as can trigger controlled/responsive release of therapeutics loaded into them. Such systems offer an effective delivery method for physicians and scientists in wound care, making it easier for patients to implement

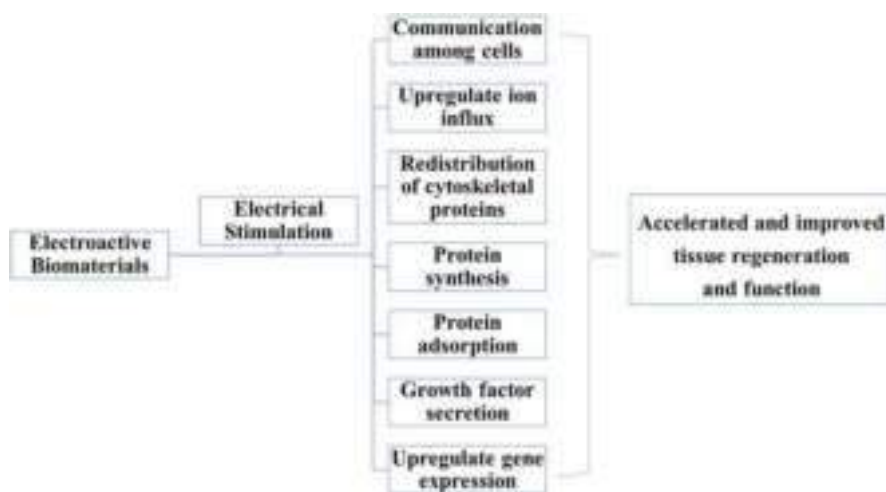


Fig. 9.2 Scheme of cellular response elicited by electrical stimulation (ES) through electroactive biomaterials based scaffolds for improved tissue regeneration and function (Qian et al. 2019)

new therapeutic approaches. Electroactive biomaterials can adapt their chemical, electrical, and physical properties to the specific needs of their application. The electroactive biomaterials family includes conducting polymers (CPs), piezoelectrics, electrets, and photovoltaics, which are discussed in the following subsections.

9.2.1.1 Conducting Polymers

CPs are the latest class of organic polymers integrating the electrical, magnetic, and optical properties of metals and inorganic semiconductors with conventional polymers' mechanical properties, processability, etc. (Shimano and MacDiamid 2001). This fourth generation polymers are completely distinct structurally from conventional polymers or mixture of insulating polymer with a conductive material such as a metal or carbon powder. Alternating single and double bonds along the strongly conjugated backbone of CPs enable electron mobility and charge movement within and between polymer chains, which results in strong electrical conductivity (Shirakawa et al. 1977). While the electrical conductivities of insulating polymers are much weaker (10^{-20} – 10^{-6} S/cm), CPs possess much greater conductivities in the range of 1 – 10^3 S/cm (Le et al. 2017). Essentially, electrical conductivity in CPs is aided by two important features, which are its intrinsic conjugated alternation of single and double bonds and doping (Heeger 2001). Fundamentally, the electronic configuration CP's backbone is unique from other insulating polymers due to the former's conjugated alternating single-double carbon-carbon or carbon-nitrogen bonds (Skotheim et al. 1997). The CP backbone contains a strongly localized "sigma" (σ) bond and a weakly localized "pi" (π) bond with sp^2 hybridized carbon atom. This sp^2 hybridized carbon atom with a single s and two p orbitals, facilitates one non-bonded electron (π electron) as shown in Fig. 9.3. Electron delocalization occurs due to the formation of π -band by the overlapping of the unpaired out-of-plane p_z orbitals. Usually, two of the $2p$ orbitals (p_x and p_y) hybridize with $2s$ orbital to form three sp^2 hybridized orbitals leaving one p_z orbital unhybridized (Fig. 9.3). These sp^2 hybridized orbitals are arranged at an angle of 120° among them in a same plane, while the unhybridized orbital remains perpendicular to the plane. The head-

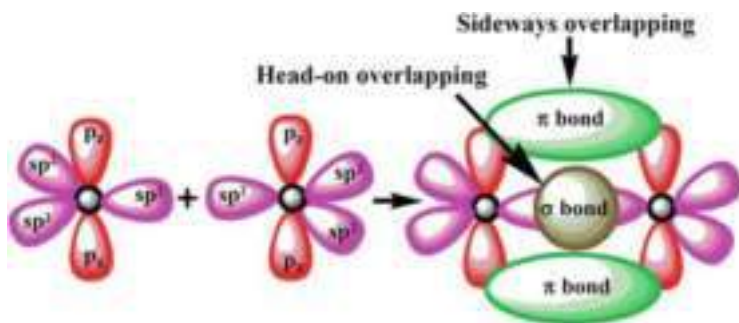


Fig. 9.3 Formation of σ and π molecular orbitals from two sp^2 hybridized carbon atoms in conducting polymers (CPs)

on overlapping of the hybridized orbitals gives rise to strong σ (sigma) bonds contributing to the polymer chain configuration. On the other hand, the unhybridized p_z orbitals of two carbon atoms undergo sideways overlapping and form π (pi) bonds. The electron cloud in the π bond are highly delocalized, which enables charge mobility along the polymer chain and between the neighboring chains. Therefore, the charge delocalization in π -band has vital role in defining the semi-conducting or sometimes, metal like electrically conductive nature of CPs.

Besides the single-double bond alteration in CPs, they are naturally non-conducting. Doping is the second essential requirement to impart electrical conductivity in CPs, which can be done by using anionic or cationic chemical species. However, the doping mechanisms in CPs are unique. Contrary to the substitutional doping in inorganic semiconductors, the process of doping in CPs is interstitial (Macdiarmid et al. 1985). Doping in CPs is nothing more than a charge transfer reaction, resulting in the partial reversible oxidation or less often reduction of the polymer. Doping can modify an insulating or semi-conducting polymer into a polymer with conductivity in the metallic regime. During doping, the loosely organized electrons hop along the polymer chain in the conjugated network. The peculiar conjugation of bonds in CP's backbone allows the electrons to delocalize, culminating them being shared by several atoms. The delocalized electrons, therefore, serve as charge carriers, which render conductivity. Actually, such delocalization of charge modifies the band structure of CPs creating localized defects such as polarons, bipolarons, solitons, and defect bands. When electrons are extracted or added from a polymer chain, cations or anions are formed. These cations or anions under the influence of an electrical field can hop from one position to another leading to higher electrical conductivity.

9.2.1.1.1 Conducting Polymers in Tissue Engineering

The increasing popularity of electrical and electromagnetic stimulation in medical field stems from the perception of the inherent bioelectric features of body tissues. Living tissues create electromotive forces, preserve the necessary potential difference, and turn the current on and off by regulating current flow and storing charge (Ghasemi-Mobarakeh et al. 2011). With this understanding, application of ES externally was well explored to various cellular activities including cell adhesion (Li et al. 2017), proliferation (Enayati et al. 2020), cell migration (Tai et al. 2018), and protein synthesis for tissue regeneration (Wake et al. 2011). The utilization of electrical signals to regulate the local cell microenvironment is, therefore, essential in activating specific cell behavior to particular phenotypes in order to achieve tissue functionality for longer run. CP-based biomaterials bring outstanding scaffolding features by assisting ES to cells, which are needed to promote regenerating mechanisms in the case of specific stimuli responsive cells (i.e., neurons, myotubes, cardiomyocytes) (Balint et al. 2014). CPs have many benefits in terms of excellent extent and period regulation of electrical stimuli, formidable electrical and optical properties, a high conductivity/weight ratio, and the ability to catch and controllably release biological molecules through reversible doping, to alter charges from a biochemical reaction and to easily alter their electrical, chemical, physical, and

other properties necessary for intended application. In addition, CPs can be rendered biocompatibility, biodegradability, and porosity, which can be further altered and regulated even after synthesis by stimulation (e.g., electricity, light, pH) or various chemical based material modification techniques. Thus, several CPs such as polypyrrole (PPy), polyaniline (PAni), poly(3,4-ethylenedioxythiophene) (PEDOT), polythiophene (PT), and poly(2-methoxy-5-(2-ethylhexyloxy)-1,4-phenylenevinylene) (MEH-PPV) were shown to effect positively various cellular activities including cell adhesion, proliferation and migration, DNA synthesis and protein secretion both in vitro and in vivo. Given the potential advantages, CPs were explored for various TE applications including neural, cardiac, bone, muscle, and wound healing, which are summarized in Table 9.1.

9.2.1.2 Piezoelectric Material

Piezoelectricity refers to the phenomenon of surface charge accumulation on a material exhibiting a net dipole moment and no center of symmetry under a mechanical stress, which was first discovered by Pierre and Jacques Curie in 1880 (Jacob et al. 2018). Materials displaying such property are termed as piezoelectric materials. This unique category of materials can convert mechanical energy acting on it into electrical energy and vice versa. The generation of transient surface charges in presence of mechanical deformation (e.g. compression, tension) is known as direct piezoelectric effect and the deformation due to externally applied electrical signal (e.g. applied voltage, reversed polarity) is known as indirect or converse piezoelectric effect, as shown in Fig. 9.4 (Tandon et al. 2018). They can be categorized as piezoelectric polymers and piezoelectric ceramics, which may be natural materials or hydrogel systems. The dipoles are randomly oriented in a piezoelectric material and in order to fully utilize its piezoelectric feature, the dipoles should be rearranged so as to yield a net electric dipole moment through a dipole alignment process, called poling. This can be achieved by application of a strong electric field at a temperature above the glass transition temperature of the material followed by cooling under the same electric field.

9.2.1.2.1 Piezoelectric Materials in Tissue Engineering

The piezoelectric property has gained significant attention in the evolving TE strategies to provide in vivo microenvironment for enhanced cell-biomaterial interaction and modulating the cellular response towards desired tissue or organ regeneration. Mechanical deformation induced transient electrical stimuli within piezoelectric biomaterial makes it one of the best approaches in delivering ES to cells without any external power source and devising any external electrical connections. Tissues like bone, cartilage, tendon, dentin, and keratin, have the piezoelectric property. Mostly, all these tissues composed with collagen, it is the fibril structure responsible for piezoelectric behavior (Halperin et al. 2004). The significance of piezoelectric behavior on cell behavior, tissue regeneration, and remodeling was explored, which has driven the research towards the development of novel piezoelectric biomaterials for TE.

Table 9.1 TE applications of various CP-based biomaterials

CP-based biomaterial	Fabrication technique	Application	Outcome	References
Graphene oxide/polypyrrole/poly-L-lactic acid (GO/PPy/PLLA)	Electrospinning and electrochemical deposition	Neural TE	<ul style="list-style-type: none">• GO/PPy/PLLA conduit in conjunction with ES successfully repaired 10 mm rat sciatic nerve defect with improved re-innervated gastrocnemius muscle and nerve conduction velocity.• In addition, myelin sheath thickness and axon diameter in GO/PPy/PLLA conduit with ES was comparable to autograft.	Chen et al. (2019)
Aligned polypyrrole/graphene (PPy/G) nanofibers	Polymerization-enhanced ball milling method	Neural TE	<ul style="list-style-type: none">• Aligned PPy/G nanofibers with ES supported enhanced viability, neurite outgrowth and anti-aging ability of retinal ganglion cells (RGCs) suggesting possibilities for regeneration of optic nerve via ES on these electroconductive nanofibers.	Yan et al. (2016)
Poly (3,4-ethylenedioxythiophene) (PEDOT)	Electrochemical polymerization	Neural TE	<ul style="list-style-type: none">• ES through PEDOT significantly improved viability, morphology and neural differentiation of PC12 cells.	Molino et al. (2018)
Poly[2-methoxy-5-(2-ethyl-hexyloxy)-1,4-phenylene vinylene]/polycaprolactone (MEH-PPV/PCL) nanofibers	Electrospinning	Neural TE	<ul style="list-style-type: none">• MEH-PPV/PCL nanofibers with ES offered significant enhancement in neurite formation and neurite outgrowth of PC12 cells.	Borah et al. (2018)
Polyaniline/poly(glycerol-sebacate) (PAni/PGS)	Solvent casting method	Cardiac TE	<ul style="list-style-type: none">• Electrically conductive PAni/PGS films offered.• Good attachment, growth and proliferation of C2C12 myoblasts, while invoking no harmful effect on cells through its acidic leachants.	Qazi et al. (2014)
Poly (3,4-ethylenedioxythiophene)/alginate (PEDOT/Alg)	In situ polymerization of PEDOT in chemically cross-linked Alg matrix followed by freeze drying	Cardiac TE	<ul style="list-style-type: none">• Macroporous PEDOT/Alg scaffolds supported good attachment and proliferation of adipose derived stem cells (ADSCs).• Under ES through these conductive scaffolds promoted cardiomyogenic differentiation of ADSCs.	Yang et al. (2020)

(continued)

Table 9.1 (continued)

CP-based biomaterial	Fabrication technique	Application	Outcome	References
Silk fibroin/polypyrrole (SF/PPy)	In situ polymerization of PPy over nanopatterned silk Fibroin films fabricated by capillary force lithography technique	Cardiac TE	<ul style="list-style-type: none"> Nanopatterned SF/PPy scaffolds mimicking the native myocardial ECM topography, maintained viability of cardiomyocytes for 21 days leading to increased cellular organization and sarcomere development with upregulated expression and polarization of connexin 43, a critical regulator of cell-cell electrical coupling. 	Tsui et al. (2018)
Poly (3,4-ethylenedioxythiophene; poly(4-styrene sulfonate) (PEDOT:PSS)	Freeze drying	Bone TE	<ul style="list-style-type: none"> Osteogenic precursor cells differentiated into osteogenic phenotype on porous PEDOT:PSS scaffolds with elevated expression of bone regeneration associated genes. The electrically conductive porous scaffolds also facilitated cell infiltration, increased ECM mineralization, and osteocalcin deposition. 	Guex et al. (2017)
Polypyrrole/alginate/chitosan (PPy/Alg/Ch)	Lyophilization and oxidative polymerization	Bone TE	<ul style="list-style-type: none"> PPy/Alg/CS scaffolds were cytocompatible as assessed with MG-63 cells and facilitated biomineralization. 	Sajesh et al. (2013)
Polyaniline/polyacrylonitrile (PAni/PAN) nanofibers	Electrospinning	Muscle TE	<ul style="list-style-type: none"> PAni/PAN electrospun nanofibrous showed higher proliferation of primary myosatellite cells and myogenic differentiation as compared to PAN nanofibers. 	Hosseinizadeh et al. (2016)
Polypyrrole/collagen/chondroitin sulfate (PPy/Col/CS)	Directional lyophilization	Muscle TE	<ul style="list-style-type: none"> Aligned and 3D PPy/Col/CS scaffolds provided guided myoblast growth and organization with enhanced myotube formation and maturation. 	Basurto et al. (2019)
Poly(3,4-ethylene-dioxythiophene); polystyrene-sulfonate/gelatin (PEDOT:PSS/Gel)	Ink-jet printing	Muscle TE	<ul style="list-style-type: none"> PEDOT:PSS/Gel scaffold demonstrated good metabolic activity, adhesion, differentiation, and alignment C2C12 myoblast cells than those on pure Gel scaffold. The conductive scaffold along with ES promoted cell alignment and enhance myotubes differentiation. 	Fortunato et al. (2018)

Poly(2-hydroxyethyl methacrylate)/polypyrrole (PHEMA/PPy) hydrogel	Photo-polymerization and sol-gel technique for PHEMA hydrogel formation followed by oxidative polymerization of PPy	Wound healing	<ul style="list-style-type: none"> • The conductive hydrogel was found to be superior to the commercial Hydrosorb® dressing in terms of anti-bacterial activity and protein absorption. • In vitro ES through the hydrogel promoted fibroblast migration, while faster healing was observed in rat diabetic wound model with in vivo ES. 	Lu et al. (2019)
Polypyrrole/poly(L-lactic acid) (PPy/PLLA) conductive membranes	Oxidative polymerization of PPy followed by sol-gel and solvent casting technique	Wound healing	<ul style="list-style-type: none"> • ES through the PPy/PLLA conductive membranes to primary human fibroblasts demonstrated upregulation of various genes associated with cell adhesion, remodeling and spreading, cytoskeletal activity, extracellular matrix metabolism, while repressed production of inflammatory cytokines/chemokines and improved growth factor secretion and signal transduction. 	Park et al. (2015)
Chitosan/polyaniline/poly(ethylene glycol)-co-poly(glycerol-sebacate) (Ch/PAni/PEGs) hydrogel	Sol-gel technique	Wound healing	<ul style="list-style-type: none"> • The electroactive and self-healable hydrogels showed good free radical scavenging capacity, biocompatibility, and anti-bacterial activity. • The hydrogel demonstrated promotion of tissue granulation thickness and collagen deposition in a full thickness skin defect model with enhanced healing efficacy and blood clotting capacity as compared to commercial dressing through elevation of various growth factor associated genes. 	Zhao et al. (2017)

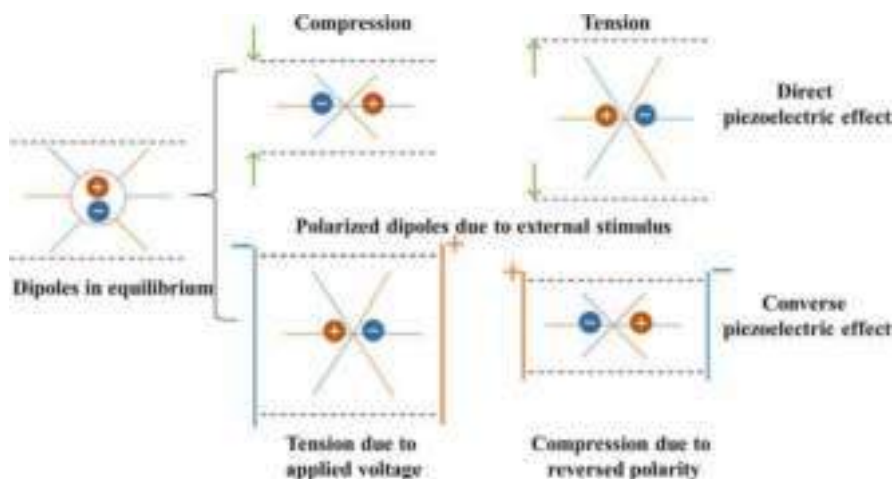


Fig. 9.4 Mechanisms of direct and converse piezoelectric effect. [Redrawn from Tandon et al. 2018]

All the tissues in human body are subjected to mechanical stimuli, and the mechanical forces via gated channels responsible for the activation of signaling cascades augments for tissue repair and regeneration. The conversion of mechanical stimuli into biological signal, called as mechanotransduction, is exerted in physiological functions like muscle and bone homeostasis, regulation of blood flow, respiratory and kidney systems. The mechanical forces including compression, torsion, tension, and shear stress exerted on cells cause changes in voltage and ion concentrations, which result in change in gene expression. Several membrane associated molecules such as cell junction molecules, ion channels, G-Protein coupled receptors, and cytoskeleton proteins are involved under mechanical stimuli and initiate the biological response by activation of signaling cascades (Zaszczyńska et al. 2020). In particular, ion channels contribute for piezoelectric response. The cationic channels including monovalent (Na^+ and K^+) and divalent (Ca^{+2} and Mg^{+2}) channels are activated immediately after activation of piezo channels. The advances in the material science, physiology, and stimuli responses in tissue repair and regeneration has developed the strategies to develop synthetic, natural or composite biomaterials, which are appropriate to facilitate the physical niche to stimulate the cell proliferation and differentiation. The inherent piezoelectric property exerted in various tissues of human body augmented to develop a variety of composite biomaterials having piezoelectricity and tested for their suitability in various tissue engineering applications depicted in Table 9.2. The characteristic features of ideal biomaterials for specific tissue application also have been considered while developing the piezoelectric biomaterials. For example, the mechanical property varies depending on the tissue type. The mechanical strength of the composites modulated with enhanced piezoelectric property is the adopted strategy for the development of piezoelectric biomaterials for bone TE application. Likewise, the low mechanical

Table 9.2 TE applications of various piezoelectric biomaterials.

Piezoelectric biomaterial	Fabrication technique	Application	Outcome	References
Polyvinylidene fluoride (PVDF)	Scaffolds synthesized by electrospinning at different voltages (12–30 kV)	Bone TE	Higher alkaline phosphatase activity and mineralization was observed on PVDF-25 kV scaffolds.	Damaraju et al. (2013)
Hydroxyapatite (HA)-barium titanate (BT) composite implant	Press sintering	Bone TE	Bone formation was noticed on the implant surface, exhibited direction dependent growth.	Jianqing et al. (1997)
Ormocomp-BT nanoparticles composite scaffold	Two-photon lithography	Bone TE	Piezoelectric and topographic cues improved the bone regeneration, herein BT nanoparticles induced piezoelectric cues.	Marino et al. (2015)
Poly(3-hydroxybutyric acid-co-3-hydroxy valeric acid) (PHBV)- BT composite scaffold	Electrospinning	Cartilage TE	Improved chondrocyte activity, gene expression of collagen-II higher. Piezoelectric cues supports cartilage regeneration.	Jacob et al. (2019)
PVDF-trifluoro ethylene (TrFE) scaffolds	Electrospinning	Neural TE	Human neural progenitor stem cells differentiated into β -III tubulin cells and enhanced neurite extension exhibited in micron-aligned- annealed scaffolds.	Lee and Arinze (2012)
PVDF/graphene oxide (GO)	Non-solvent induced phase separation method	Neural TE	GO addition improved piezoelectric and mechanical properties supported cell adhesion, proliferation and differentiation of PC12 cell. This scaffold served as nerve conduit channel and stimulated cell function.	Abzan et al. (2019)
Gold nanoparticles/PVDF	Electrospinning	Neural TE	Addition of au nanoparticles improved piezoelectric properties in the composite fibrous scaffold and supported enhanced cell adhesion and growth.	Motamedi et al. (2017)

strength is required for soft tissue, wherein the attainment of improved piezoelectric property in the composite material is the vital factor to be considered. The piezoelectric ceramics include barium titanate (BaTiO_3), lead zirconate titanate (PZT), and lead metaniobate have already been studied for biomedical applications, while toxicity and brittle nature of these materials limited their application in biomedical field (Nguyen et al. 2014). Piezoelectric polymers have gained the attention over piezo ceramics owing to the biocompatibility, easy fabrication, tunable mechanical properties, etc. and therefore, found extensive applications in various TE areas such as bone, cartilage, neural, etc.

9.2.1.3 Electrets

Unlike the transient surface charges in piezoelectric materials, electrets are dielectrics possessing quasi-permanent electric charges or molecular dipoles capable to generate electric fields within and outside. The concept of electrets was first proposed by Oliver Heaviside in 1885, while the first electret was first fabricated by Mototaro Eguchi in 1919 (Mascarenhas 1980). Electrets are considered as electrostatic equivalent of a permanent magnet owing to their ability to store charges for extended periods of time. Depending on the situation, however, the amount of charges decays over time. The electrets fabrication process is similar to the poling process of piezoelectric materials. For that, a dielectric material is electrically polarized by applying a high electric field and heating to softening temperature followed by cooling to room temperature. While maintaining the same field strength (Goswami and Sen 2018). The externally applied high electric field induces ordered charge accumulation inside the dielectric substrate as shown in Fig. 9.5. The induced charge accumulation process involves displacement of internal and external charges, which ultimately get trapped inside and prevents internal charge relaxation resulting in prolonged electrization. Figure 9.5 depicts the four ways of electric polarization of a dielectric material to form electrets according to Kohlrausch (Jefimenko and Walker 1980). He asserted that polarization due to alignment of molecular dipoles in the dielectric is more stable than the polarization due to internal charge migration to surface or various layers within the dielectric and atomic charge migration to the opposite ends of the molecules in the dielectric. Examples of electrets include organic materials such as ebonite, naphthalene, polymethyl-methacrylate, and many polymers, and inorganic materials such as sulfur, quartz, glasses, steatite, and some ceramics.

9.2.1.3.1 Electrets in Tissue Engineering

The role of electret based materials in TE has gained considerable attention due to the ability of delivering ES to tissues without the need of external power source as in the case of piezoelectric materials. However, electrets have a static charge storage mechanism in contrast to dynamic charge generation in piezoelectric materials, which offers prolonged stability of the electret effect. The electret state has been used as a basis for understanding membranes, neural signals, biological memory in regeneration, electrically mediated tissue growth, and other phenomena in different biophysical models. Now more than 50 years of knowledge of bioelectrets, electret

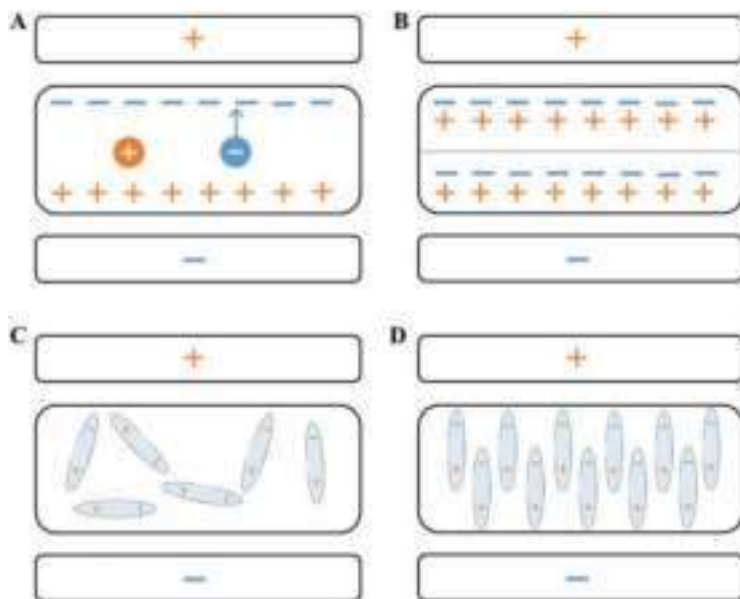


Fig. 9.5 Electric polarization in dielectric as suggested by Kohlrausch through (a) internal charge migration to dielectric surface, (b) charge migration within different layers of dielectric, (c) charge migration at molecular level, and (d) orientation of molecular dipoles within the dielectric. [Redrawn from Goswami and Sen 2018]

effect was found in various biologically important molecules or polymers, viz., proteins, polysaccharides, polynucleotides, collagen, hemoglobin, DNA, and chitin (Mascarenhas 1980). The electret effect was observed in hydroxyapatite (HA), which forms about 60–70% of the bone mass of humans and animals. HA is thought to modulate bone formation and resorption, as well as promotes the regeneration of endothelial tissue (Bauer 2011). Depending on the amount of surface charges retained, electret based materials may deliver specific electrical signals to the tissue, giving rise to electrostatic fields and microcurrents to facilitate tissue regeneration processes. Therefore, various electret based biomaterials including natural and synthetic polymers were explored for range of TE applications such as bone, skin, artificial muscles and neural nerve, which are summarized in Table 9.3.

9.2.1.4 Photovoltaics

Photovoltaic material is another class of electroactive materials, which can convert solar energy into electrical energy through photovoltaic effect and was demonstrated first in 1839 by Edmond Becquerel (Goetzberger et al. 2003). A photovoltaic material, semi-conducting in nature with two regions, namely n-type and p-type separated by pn junction (Fig. 9.6), is able to absorb a large spectrum of solar energy. Upon light absorption, electron–hole pairs are created. They migrate towards opposite directions towards each other and reach the pn junction, where an electric field is

Table 9.3 TE applications of various electret based biomaterials

Electret based biomaterial	Fabrication technique	Application	Outcome	References
Polytetrafluoroethylene (PTFE)	Extrusion based method; Corona poling at 14 kV	Neural TE	<ul style="list-style-type: none">• After 4 weeks of implantation in a 4 mm mice sciatic nerve gap model, the cable area, blood vessel area and myelinated axons were significantly more in the regenerated nerves on positively and negatively charged PTFE tubes as compared to the uncharged PTFE tubes (diameter = 0.9 mm).• PTFE tubes elicited minimal immune response.	Valentini et al. (1989)
Poly(lactic-co-glycolic) (PLGA)	Solution casting method (films) and lyophilization (channels); Corona poling at 8, 20 and 24 kV	Neural TE	<ul style="list-style-type: none">• Enhanced neurite outgrowth in mouse neuroblastoma cells grown on poled PLGA film compared to unpoled control film.• PLGA guidance channels with outer diameter 4 mm and internal diameter 2 mm, were implanted in 1 cm rat sciatic nerve gap models, which after 4 weeks demonstrated poled channels displayed regenerated nerves with greater conduction velocity and numbers of axons as compared to the unpoled guidance channel.	Bryan et al. (2004)
Chitosan/hydroxyapatite (Ch/HA) nanocomposites	Hydrothermal & Freeze drying method; grid controlled corona charging at 8 kV	Bone TE	<ul style="list-style-type: none">• Improved primary rat cranial osteoblasts adhesion, proliferation, and differentiation capacity on composite electret membranes when compared to those on the uncharged membranes.	Qu et al. (2014)
Hydroxyapatite/ β -tricalcium phosphate (HA/TCP) nanocomposites	Commercial nanocrystalline HAP/TCP; Corona poling at 5 kV	Bone TE	<ul style="list-style-type: none">• Improved osteoblast-cell adhesion, proliferation, and ECM formation on negatively poled nanocomposites.	Tarafder et al. (2011)
Hydroxyapatite/silk fibroin (HA/SF) composite	Lyophilization; poling at 4 kV	Wound healing	<ul style="list-style-type: none">• Accelerated closure of a full thickness wound in porcine with poled HAP/SF gel.• Poled HAP/SF gel showed enhanced wound healing, re-epithelization, and matrix formation than the unpoled and pure SF gel.• Poled HAP/SF promoted maturation of fibroblast cells.	Okabayashi et al. (2009)

Polypropylene/5-fluorouracil (PP/5-FU) patches	Gridcontrolled corona charging of PP film of thickness 13 µm at 15 kV; 5-FU patches were fabricated over the poled PP film	Wound healing	<ul style="list-style-type: none">• In vitro scar permeation study showed PP/5-FU patch promoted higher permeation and retention of 5-FU through and in scar skin for hypertrophic scar (HS) inhibition.• In vivo study demonstrated significant reduction in collagen type I, collagen type III, TGF-β1 and HSP47 when PP/5-FU patches were applied onto the wound.	Yuan et al. (2018)
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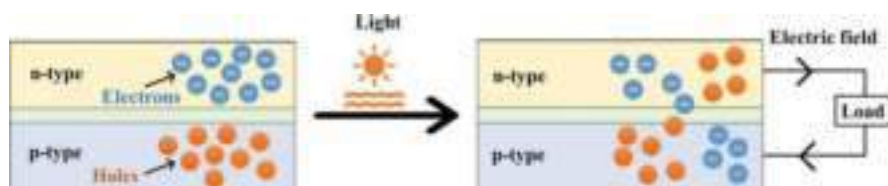


Fig. 9.6 Photovoltaic mechanism depicting light mediated migration of electron–hole pairs to opposite polarities in a traditional photovoltaic cell leading to production of electric current. [Redrawn from Tandon et al. 2018]

generated (Fig. 9.6). Photovoltaic devices consist usually of composite mixtures of semiconductor nanoparticles with conjugated polymers, wherein one component acts as electron donor and the other as electron acceptor (Goetzberger and Hebling 2000).

9.2.1.4.1 Photovoltaic Materials in Tissue Engineering

Various semi-conducting materials showing photovoltaic activity are found to possess important features of an ideal biomaterial and hence, emerging TE strategies also include photovoltaic biomaterials for providing ES for tissue regeneration. The light absorption generated electric field, as described above, modulates the bioelectrical environment of cells or tissue, which controls ion influx processes through the plasma membrane. In a particular report, it was stated that the generated electric field induces Ca^{2+} ion translocation through voltage-gated calcium channels, which upregulates of cystolic Ca^{2+} leading to elevated activation of calmodulin (Jin et al. 2011). The elevated activation of calmodulin drives the nucleotide synthesis and cell proliferation.

Photovoltaic polymer poly-3-hexyl-thiophene (P3HT) with phenyl-C61-butyric-acid-methyl ester (PCBM) was assessed successfully to light mediated ES of neuronal activity of primary hippocampal neurons (Ghezzi et al. 2011). Similarly, P3HT based photovoltaic implants were reported to stimulate action potentials in explanted rat retinas (Ghezzi et al. 2013) and embryonic chick retinas (Gautam et al. 2014) through photoelectric stimulation. The light induced electrical energy generation was demonstrated by subcutaneous implantation of commercially available nonresorbable solar cells for powering pacemakers in vivo (Haeberlin et al. 2014, 2015). Subsequently, a bioresorbable and biocompatible silicon and magnesium based thin film solar cell was demonstrated for in vivo power supply (Kang et al. 2015). A group of researchers of USA in a breakthrough attempt used photovoltaic subretinal implants with 70 μm pixels for localized ES of retinal neurons when illuminated by near-infrared light (Lorach et al. 2015). This paved away the potential of photovoltaic biomaterials for stimulation of other tissues. However, photovoltaic biomaterials as TE scaffolds were scarcely explored for regeneration of nerve, bone, skin, and wound healing. Some of the interesting studies involving photovoltaics-based biomaterials are summarized in Table 9.4.

Table 9.4 TE applications of various photovoltaics-based biomaterials

Photovoltaics-based biomaterial	Fabrication technique	Application	Outcome	References
β -Carotene/ N,N' -dioctyl-3,4,9,10-peryleneedicarboximide (β -carotene/PTCDI-C8) and poly(3-hexylthiophene)/phenyl-C61-butyric acid methyl ester (P3HT/PCBM)	Spin coating	Neural TE	<ul style="list-style-type: none">• The fabricated photovoltaics devices were able to provide NIR light induced electric field of 220–980 mV/mm.• Enhanced neurite extension by 64% and also effected direction of extension.	Hsiao et al. (2016)
Poly(3-hexylthiophene) (P3HT) and the phenyl-C61-butyric acid methyl ester (PCBM) based organic photovoltaic patch	Patterning technique	Wound healing	<ul style="list-style-type: none">• The disposable photovoltaic patches delivered visible light induced ES to skin wound in mice.• In vivo study showed that the patch promoted.• Cutaneous wound healing via enhanced host-inductive cell proliferation, cytokine secretion, and protein synthesis.	Jang et al. (2018)
Silicon (Si) microcell	Photolithography	Bone TE	<ul style="list-style-type: none">• Visible light induced photocurrent was successfully used to stimulate the intracellular calcium transients in osteoblast cells.	Vargas-Estevez et al. (2018)
Poly(3-hexylthiophene)/Polycaprolactone (P3HT/PCL)	Electrospinning	Skin TE	<ul style="list-style-type: none">• Under light induced ES, P3HT/PCL nanofibers demonstrated enhanced proliferation and healthier morphology of human dermal fibroblasts.	Jin et al. (2011)
Monocrystalline silicon (Si)	Photolithography	Wireless power supply for implantable medical devices	<ul style="list-style-type: none">• The Si based photovoltaic energy harvesting device was bioresorbable and induce no immune response, while capable to generate 60 μW in vivo.	Lu et al. (2018)

9.2.1.5 Carbon Based Nanomaterials

Carbon based nanomaterials possess highest electrical conductivity in the family of electroactive materials. Based on their structures, carbon based nanomaterials can be 0D (fullerenes, particulate diamonds, and carbon blacks), 1D (carbon nanotubes (CNTs), carbon nanofibers (CNFs) and diamond nanorods), 2D (graphene, graphite sheets, and diamond nanoplatelets), and 3D (nanocrystalline diamond (NCD) films, nanostructured diamond-like carbon (DLC) films, and fullerite (Lin et al. 2016). Among all, CNTs and graphene are the most attractive carbon allotropes for various technological applications due to their unique mechanical, thermal, and exceptional electrical properties. Graphene with single layer of a polycyclic aromatic hydrocarbon network sheet is the basic structural origin of other carbon allotropes, where sp^2 hybridized carbon atoms are arranged in a honeycomb grid sheet (Fig. 9.7). Three of the four outermost valence electrons ($2s$, $2p_x$, $2p_y$, and $2p_z$ orbitals) in carbon atoms form covalent bonds with three neighboring carbon atoms, while the remaining electron in p_z orbital (perpendicular to the sheet) forms pi (π) bond through sideways overlapping, which is highly mobile and this gives rise to high electrical conductivity (Wang and Weng 2018). Graphene sheet can be rolled up into a hollow cylindrical structure to get 1D CNT with the hexagonally arranged carbon atoms remains unchanged. The electrical conductivity of graphene and CNTs are comparable to the metallic conductors such as silver and copper, which are of order 10^7 .

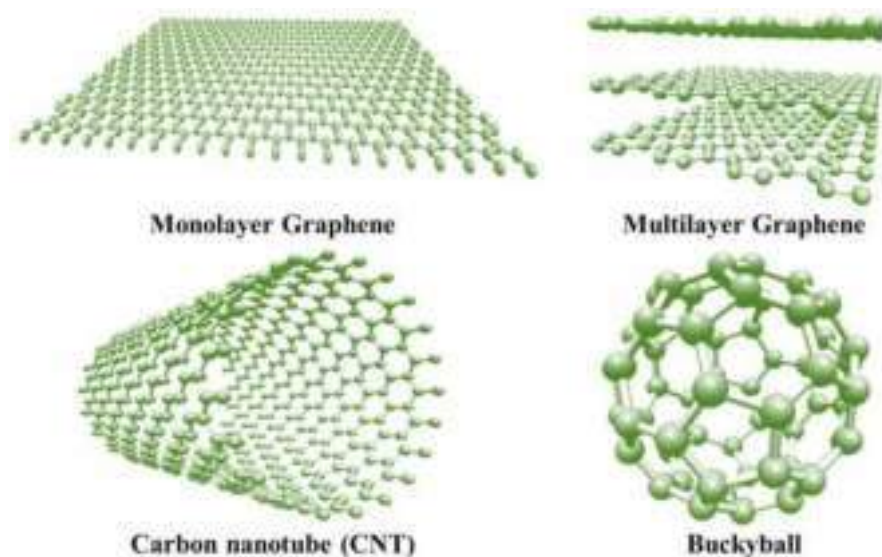


Fig. 9.7 Structures of different carbon based nanomaterials as indicated. [Redrawn from Lloyd-Hughes and Jeon 2012]

9.2.1.5.1 Carbon Based Nanomaterials in Tissue Engineering

Carbon based nanobiomaterials have some unique characteristics in regard to their potential use as TE scaffold. These include their size resembling with several biological components such as collagen, ultrahigh mechanical strength, and electrical conductivity. Nanotopography and electrical conductivity of CNTs mimic the native ECM (Eivazzadeh-Keihan et al. 2019). Carbon based nanobiomaterials offer the strongest material on earth till date and hence, they can be used for development of mechanically robust and durable biomaterial scaffolds. Thus, TE applications of carbon based nanobiomaterials are focused on exploring their mechanical strength and stiffness, high electrical conductivity, and complex physical properties. For instance, nanotopography and stiffness of carbon based nanobiomaterials are capable of modulating cellular activities including cell adhesion, proliferation, migration and differentiation. Likewise, these nanobiomaterials induce favorable cell-biomaterial interactions owing to their intrinsic electrical conductivity and were shown to boost cellular communication among electrically excitable cells such as neurons (Huang et al. 2012). Moreover, they can be modified with desired functional groups or molecules to improve desired cell-biomaterial interactions and also be tethered with other natural/synthetic biomaterials to boost their biocompatibility, biodegradability, bioactivity for TE applications. Researchers across the world explored various techniques such as coating, hydrogel blending, wet/dry-spinning procedures, and 3D printing to make 2D or 3D carbon nanobiomaterials based scaffolds for wound healing, neural, cardiac, bone, and cartilage TE. Few salient studies of carbon based nanobiomaterials in diverse TE areas are summarized in Table 9.5.

9.2.2 Magneto-responsive Biomaterials

Similar to ES, magnetic stimulation (MS) has proved to positively effect biological functions at cellular and molecular level (Qian et al. 2019). Pulsed MS induces increased blood flow in capillary bed, serum ceruloplasmin expression, and improves angiogenesis. It has been established that MS effects ion influx through plasma membrane, various important protein and growth factor synthesis/secretion related to tissue regeneration (Fig. 9.8) (Qian et al. 2019). For example, low level electromagnetic field was shown to modulate cellular activities by influencing ionic transport across cellular membrane and action potential (Lacy-hulbert et al. 1998). Another study showed increased intracellular calcium concentration mediated tissue regeneration (Grassi et al. 2004).

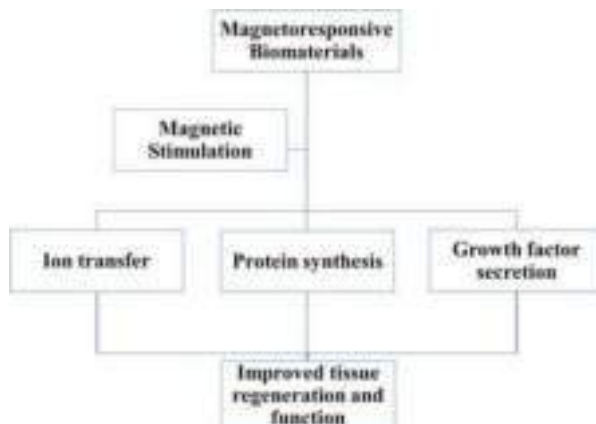
Magneto-responsive biomaterials contains active magnetic component within biomaterial network that can be manipulated spatiotemporally via an external magnetic field. This class of smart materials rely mostly on composites constituted by magnetic particles whose size allows them to become embedded into a polymer matrix to confer a magnetic response. The magneto-responsive behavior of scaffolds is especially controlled with magnetic nanoparticles of iron (Fe), nickel (Ni), cobalt (Co), and their oxides having a size less than 100 nm. The incorporation of magnetic

Table 9.5 TE applications of various carbon based nanobiomaterials

Carbon nanomaterial based biomaterial	Fabrication technique	Application	Outcome	References
Carbon nanotubes (CNTs) ropes	Chemical vapor deposition; ropelike structure with a diameter of 1 mm was prepared	Neural TE	<ul style="list-style-type: none">• As a viable substrate, CNT rope supported neural stem cell (NSC) growth and neurite outgrowth occurred favorably in the direction of the spiral topography on the CNT rope.• Electrical stimulation through CNT ropes accelerated the neurite outgrowth and early differentiation of NSCs into mature neurons.	Huang et al. (2012)
Polycaprolactone fumarate/carbon nanotubes (PCLF/CNTs)	UV cross-linking	Neural TE	<ul style="list-style-type: none">• Enhanced PC12 cell proliferation, neural differentiation, neurite outgrowth, cell migration, and intracellular connections on PCLF/CNT sheets upon ES (100 mV/mm and 20 Hz for 2 h/day).	Zhou et al. (2018)
Silk fibroin/reduced graphene oxide (SF/rGO) microfibers	Electrospinning	Neural TE	<ul style="list-style-type: none">• SF/rGO microfibers supported PC12 cell viability and adhesion.• Electrical stimulation through SF/rGO promoted faster neural differentiation than those obtained by using nerve growth factor (NGF).	Aznar-Cervantes et al. (2017)
Carbon nanotube/gelatin methacryloyl (CNT/GelMA) hydrogels	Dielectrophoresis and UV cross-linking	Cardiac TE	<ul style="list-style-type: none">• Aligned CNT/GelMA hydrogels offered enhanced the cardiac differentiation of the mouse embryoid bodies (EBs) compared with the pure GelMA and GelMA-random CNT hydrogels.• EBs activity was further enhanced under application of ES through aligned CNT/GelMA hydrogels.	Ahadian et al. (2016)
Polydimethylsiloxane/multiwall carbon nanotubes (PDMS/MWCNTs) 3D composites	Template assisted method	Cardiac TE	<ul style="list-style-type: none">• 3D PDMS/MWCNT scaffold exhibited mechanical and conductive properties similar to the native heart muscle.• Further, it provided a suitable environment for enhanced viability, structural, and electrophysiological maturation, and proliferation of cardiomyocytes.	Martinelli et al. (2018)
Carbon nanofibers (CNFs)	Electrospinning of polyacrylonitrile (PAN) followed by carbonization at a 1000 °C	Bone TE	<ul style="list-style-type: none">• The fabricated electrospun CNFs is cytocompatible and suitable for cell culture and proliferation.• ES significantly enhanced the proliferation and the osteogenic activity of the bone cells.	Samadian et al. (2020)

Graphene/cellulose (G/C) scaffold	Graphene oxide (GO) synthesized by modified Hummers method followed by deposition over cellulose paper	Bone TE	<ul style="list-style-type: none"> • G/C electrodes possessed lower impedance and higher charge injection capacity than gold (au) electrodes, with high stability. • G/C scaffolds combined with ES supported enhanced ADSC proliferation, mineral deposition and ALP. • Expression compared to control samples without ES. 	Li et al. (2020)
Spider silk/carbon nanotubes (silk/CNTs)	Electrospinning	Wound healing	<ul style="list-style-type: none"> • Silk/CNTs electrospun fibers combined with ES demonstrated elevated activity of diabetic dermal fibroblasts (D4F) for enhanced production of collagen with low COL1/ COL3 ratio and inhibited synthesis of matrix metalloproteinases (MMPs) leading to accelerated wound healing. 	Chi et al. (2019)
Reduced graphene oxide/ chitosan/silk fibroin (rGO/Ch/SF)	Freeze drying	Wound healing	<ul style="list-style-type: none"> • rGO/Ch/SF scaffold demonstrated radical scavenging ability, intracellular anti-oxidant activity in vitro and in vivo. • ES through rGO/Ch/SF offered improved adhesion and proliferation of C2C12 cells. • rGO/Ch/SF demonstrated improved in vivo wound regeneration. 	Tang et al. (2019)
Chitosan/poly(vinyl alcohol)/graphene oxide (Ch/PV A/GO) composite nanofibers	Electrospinning	Cartilage TE	<ul style="list-style-type: none"> • Incorporation of GO increased the tensile strength of the nanofibers. • Ch/PV A/GO nanofibers promoted growth of mouse chondrogenic cells indicating the potential for cartilage TE applications. 	Cao et al. (2017)
Polycaprolactone/gelatin/ multi-walled carbon nanotubes (PCL/Ge/ MWCNTs)	Electrospinning	Cartilage TE	<ul style="list-style-type: none"> • Addition of MWNTs led to an increase in the hydrophilicity and tensile strength of the electrospun nanofibers along with the bioactivity. • Offered enhanced viability of adult chondrocytes. 	Zadehnajjar et al. (2020)

Fig. 9.8 Scheme of cellular response elicited by magnetic stimulation (MS) through electroactive biomaterials based scaffolds for improved tissue regeneration and function (Qian et al. 2019)



nanoparticles in cells/tissues/scaffolds allows for magnetic force-based manipulation of these components to build more complex systems. In addition, integration of magnetic nanoparticles in scaffolds followed by the application of tensile or compressive forces using a magnetic field has been shown to induce functionality in certain cells. In contrast to ES, MS enables actuation at a distance on nanoscale and cell level. Furthermore, the magnetic field can penetrate deep into tissues, reaching a single cell and acting directly on its organelles; unlike the electric field, which is shielded by the membrane potential. For these reasons MS is gaining importance and intensively investigated in applications including tissue regeneration, targeted drug delivery, cancer therapy agent, etc. Among these different possible applications, this article mainly emphasizes on the applications of magneto-responsive scaffolds for different types of TE including bone, cardiac, cartilage, neural, etc.

Different magneto-responsive scaffolds were prominently investigated in recent years for TE due to its ability to deliver direct mechanical stimulation to individual cells. Scaffolds based on the biological components such as bacterial cellulose, chitosan, or silk fibroins were proven to enhance cell proliferation, and differentiation under appropriate MS. These scaffolds not only provide a biocompatible environment for cell growth but also trigger desired cellular activities under MS. Hydroxyapatite (HA) due to its excellent biological activity, good biocompatibility, and bone conductivity has been considered as an obvious choice for bone replacement material. HA-based magnetic composites have also been investigated for bone (Torgbo and Sukyai 2019), cartilage (Huang et al. 2018) TE as well as for growth of human mesenchymal stem cells (D'Amora et al. 2017). Studies show that the combined effect of HA-based magnetic substrate and magnetic field exposure enhances cell proliferation, cell viability, and stimulates gene expression. In addition, magneto-active three-dimensional (3D) porous scaffold possessing a proper bone mimicking morphology has also been investigated for the adhesion and proliferation of preosteoblasts. It has been found that the application of magnetic stimuli increases the cell viability on the scaffolds, inducing a solid spiderlike network of cells, with the growth of cells on the scaffolds (Fernandes et al. 2019).

Similar studies have also been conducted by developing 3D matrix of collagen hydrogel with magnetic nanoparticles to promote neural growth and cartilage TE. Investigation shows that these magnetically responsive 3D scaffolds can effectively induce the growth of neural cells and directed to form neural networks. Table 9.6 summarizes some of the recent findings in the field of TE using magneto-responsive scaffolds.

9.2.3 Thermoresponsive Biomaterials

One of the important/notable physical stimuli of which a relatively broad variation in its intensity can be withstood by body physiology is temperature (Doberenz et al. 2020). Interestingly, a small variation in temperature is able to cause alteration in size or shape of a unique class of materials, mainly polymers, which are known as thermoresponsive materials or polymers (Cabane et al. 2012). These polymers undergo a change in their miscibility or solubility at a critical temperature through a dramatic transition in the hydrophobic and hydrophilic interactions between their chains and the aqueous media (Cardoso et al. 2017). It leads to the dislocation of intra- and intermolecular hydrophobic and electrostatic interactions, causing the polymer chains to collapse, shrink, or expand. Intermolecular forces such as hydrogen bonding and hydrophobic forces in aqueous solution play a major role in the formation of micelle, hydrogel shrinking, and the physical cross-linking of thermoresponsive polymers. At critical temperature, thermoresponsive polymers change from monophasic (become completely soluble) to biphasic or vice versa. Thermoresponsive polymers, which dissolve completely to become monophasic above the critical temperature and show a phase separation below the critical temperature, are classified as thermoresponsive polymers with upper critical solution temperature (UCST). While polymers, which exhibit opposite behavior are regarded as thermoresponsive polymers with lower critical solution temperature (LCST). Another class of thermoresponsive polymers has been reported, known as thermally induced shape-memory polymers (SMPs) with non-UCST and non-LCST features but undergo changes in their shape and size under temperature fluctuations (Kim and Matsunaga 2017). Some common examples of thermoresponsive polymers are poly (N-isopropylacrylamide) (PNiPAAm), poly(N-vinylcaprolactam) (PNVC), poly (2-oxazoline)s (POxs), poly (L-lactic acid)-poly(ethylene glycol)-poly(L-lactic acid) (PLLA-PEG-PLLA), poly(ethylene oxide)-poly(propylene oxide)-poly (ethylene oxide) (PEO-PPO-PEO), etc.

Applications of thermoresponsive polymers in TE applications are motivated by their thermally induced hydrophobic/hydrophilic properties to induce controlled cell attachment and detachment (Nagase et al. 2018). Compatibility of thermoresponsive polymers in TE is encouraged by another important fact that there is no harmful effect on cells and proteins over a temperature variation of 0–42 °C (Doberenz et al. 2020). PNiPAAm is the most widely investigated thermoresponsive biomaterial with LCST behavior at 32°C, which is close to physiological condition (Yamada et al. 1990). PNiPAAm was explored as coating on cell culture dishes for collecting

Table 9.6 TE applications of various magnetoresponsive biomaterials

Magnetoresponsive biomaterial	Fabrication technique	Application	Outcome	Reference
Chitosan/ glycerophosphate/iron oxide nanoparticles	Oxidative hydrolysis synthesis of magnetic nanoparticles followed by lyophilization and mixing	Neural TE	<ul style="list-style-type: none">• Nanocomposites able to support cell adhesion and spreading and further promote proliferation of SCs under magnetic field exposure.• Moreover, a magnetic field applied through the scaffold significantly increases the gene expression and protein secretion.	Liu et al. (2014)
Collagen hydrogel/ magnetic nanoparticles	Embedding magnetic particles in collagen followed by solidification under magnetic field	Neural TE	<ul style="list-style-type: none">• The magnetic elements have aggregated into magnetic particle strings along the magnetic lines within the gel.• These lines served as physical cues for neurons that developed in close proximity to the particles, leading to elongated and directed growth pattern.	Antman-Passig and Shefi (2016)
Bacterial cellulose/ Fe ₃ O ₄ /hydroxyapatite	Co-precipitation method followed by ultrasonic irradiation	Bone TE	<ul style="list-style-type: none">• Biocompatible and promote osteoblast attachment and proliferation.	Torgbo and Sukyai (2019)
Silk fibrion/Fe ₃ O ₄	Co-precipitation synthesis of magnetic nanoparticles followed by electro-gelation	Bone TE	<ul style="list-style-type: none">• Physical conjugation of basic fibroblast growth factor (bFGF) to Fe₃O₄ nanoparticles significantly enhanced the viability and growth of SaOS-2 cells on the scaffold.• Both human serum albumin coating and bFGF conjugation improves alkaline phosphate activity, total protein synthesis, and collagen synthesis.	Karahalioglu et al. (2017)
Collagen/hyaluronic acid/polyethylene glycol/magnetic nanoparticles	Co-precipitation	Cartilage TE	<ul style="list-style-type: none">• The synthesized matrix exhibits similar microstructure and chemistry as hyaline cartilage and is cytocompatible with BMSCs in vitro after 24 h of culture period.	Zhang et al. (2015)
Poly(vinyl alcohol)/ nano hydroxyapatite/ Fe ₂ O ₃ nanoparticles	Ultrasonic dispersion freeze-thawing cross-linking molding process	Cartilage TE	<ul style="list-style-type: none">• BMSCs show uniform growth on the surface of the magnetic nanocomposite hydrogel and high rates of proliferation.• BMSC growth is also enhanced by the addition of Fe₂O₃ and also significant stimulated chondrocyte-related gene expression.	Huang et al. (2018)

seeded cells and layers of cells just by regulating the temperature without using enzymes like trypsin. Traditional enzymatic degradation methods for cell separation reduce the cell function by affecting receptors, transport proteins and ECM and thus, integrity between confluent cell layers becomes weak leading to reduced efficiency for therapeutic applications. In the contrary, thermoresponsive biomaterials can provide intact cell sheet through non-enzymatic cell separation with retention cellular structure and function (Cooperstein et al. 2015). These intact cell sheets can be used as a fresh cell culture dish, applied to wound sites and host tissues, without requiring any sutures (Matsuda et al. 2007). Therefore, thermoresponsive biomaterials give spatial distribution of cells by layering sheets derived from various cell types or by layering monolayer cell sheets, creating 3D tissue constructs. Thermoresponsive biomaterials may be used as hydrogel, injectable gelling material, 3D printing or cell layer development by biomaterial surface modification.

9.2.4 Photoresponsive Biomaterials

Inspired by natural phenomena such as photosynthesis, researchers have been using light driven reactions to control biological functions and as a result, clinical implication of phototherapy using low level lasers, light-emitting diodes, and natural light, has increased in the last few years (Jin et al. 2011). Light, which is an electromagnetic radiation, is found to induce various regeneration associated molecular biology reactions such as increase in the cytosolic Ca^{2+} level in cells. Phototherapy has been proven to reduce inflammatory reactions, promote cell proliferation, and growth factor secretion (Desmet et al. 2006). Several researchers demonstrated light stimulation mediated accelerated wound healing, axonal regeneration, and spinal cord repair (Rochkind et al. 2002). These findings motivated scientists and researchers to explore photoresponsive biomaterials for various TE applications.

Photoresponsive biomaterials, with light-sensitive molecules (chromophores) in them, when irradiated by light, are able to reversibly and frequently switch their physical and/or chemical properties, such as geometrical structure, refractive index, dielectric constant, conformation, solubility, and surface hydrophilicity, etc. in real time and spatiotemporal manner. Light stimulation through a photoresponsive biomaterial is a relatively straightforward, non-invasive technique to modulate dynamic cell microenvironment. Progress of such biomaterials in TE areas are summarized in this section.

A photoresponsive culture surface composed of poly(N-isopropylacrylamide) (PNIPPAAM) with spiropyran chromophores as side chains was demonstrated to promote cell adhesion, when irradiated by ultraviolet (UV) light (wavelength: 365 nm) (Eda Hiro et al. 2005). Cells remained attached to the irradiated surface even after subsequent cooling and washing indicating better cell attachment due to UV irradiation. Acrylate based light-sensitive liquid crystalline elastomers (LCEs) were developed to assist cardiac muscle contraction (Ferrantini et al. 2019). The contraction was modulated in terms of light intensity, stimulation frequency, and time to on/off ratio in order to fit different contraction amplitude/time courses,

including those of the human heart. Furthermore, LCE strips were successfully mounted in parallel with cardiac trabeculae, to improve muscular systolic function, with no impact on diastolic properties. Photoresponsive polysaccharide-based hydrogels obtained from radical polymerization was assessed for cartilage TE (Giammanco et al. 2016). These hydrogels become softer and more porous upon irradiation, presenting changes in their swelling and transport properties. Moreover, chondrogenic ATDC5 cells grown on the hydrogels showed a greater than two-fold increase in the production of sulfated glycosaminoglycans in the gels irradiated for 90 min compared to the dark controls. Poly(ethylene glycol) (PEG) hydrogel based micropatterned smart template was developed by spin coating method for culture of epithelial cells offering good cell adhesion and extended cell morphology (Gong et al. 2013). The study described the photoresponsive PEG hydrogel micropatterned smart template, which displayed transparency based photolithography to induce reversible control of cell adhesion with UV irradiation in defined areas. A 3D printable UV responsive cross-linking system based on polypeptides incorporating glutamic acid, isoleucine, and nitrobenzene (NB) protected cysteine groups in a random and block copolymer was reported (Murphy et al. 2019). According to the report, the polypeptide with block architecture was more desired mechanical properties, gelled at lower concentration (3.0 wt %), and could easily deposit more than ten layered structures with high fidelity and resolution through 3D extrusion printing. In vitro cytotoxicity evaluated with human dermal fibroblasts cells revealed no toxic effect with fibroblasts.

9.2.5 Chemical Stimuli Responsive Biomaterials

Chemical stimuli responsive biomaterials respond to external chemical triggers such as pH, redox, and solvent. Since, these chemical stimuli are some important features of body physiology, chemical stimuli responsive biomaterials were also explored for various TE applications, which has been discussed in brief in this section.

pH responsive materials contain ionizable groups for which they are able to accept or donate protons under any change in pH in the environment (Cardoso et al. 2017). Any pH change generate charges, which induces ionic interactions through electrostatic repulsion among them and ultimately causes physical or chemical changes in the material such as swelling, shrinking, dissociation, degradation, or membrane fusion and disruption (Gil and Hudson 2004). Researchers are motivated by the intrinsic pH variations present in living tissues to develop pH responsive biomaterial scaffold for various TE applications. For example, an injectable tissue scaffold based on branched nanofibers of peptide amphiphiles (PAs) with serine and histidine peptides conjugated to a single fatty acid tail, were shown to switch from solution state to hydrogel form at a pH above 6.5, which is within the physiological pH range (Lin et al. 2012). Another study demonstrated pH responsive C₂-cyclohexane based low molecular weight hydrogels guided cell detachment with mild reduction in pH of the culture medium (Dou et al. 2012). Subsequently, a series of pH responsive tissue scaffolds composed of dimethylaminoethyl

methacrylate (DMAEMA) and 2-hydroxyethyl methacrylate (HEMA) were shown to improve the oxygen and nutrient transport through expansion in response to a local pH change (You et al. 2015). The DMAEMA/HEMA composite scaffolds supported enhanced cell deposition and survival in vitro and subcutaneous implantation in rats showed upregulation of pro-healing genes indicating enhanced angiogenesis, granulation tissue formation, and tissue remodeling.

Redox responsive materials possess redox sensitive group and they respond to any change in redox gradient of their surrounding environment by changing the oxidation state of the redox sensitive group (Cardoso et al. 2017). Application of redox responsive biomaterials in TE applications is inspired by the natural existence of redox potential in living tissues and glutathione/glutathione disulfide couple are the reducing agents available in abundance in animal cells. Redox responsive biomaterials under varying redox environment undergo changes in structure and shape. Therefore, TE applications of redox responsive biomaterials are mainly focused on utilizing the redox mediated degradation and drug/growth factor release properties. For instance, poly(ethylene glycol) (PEG) based cryogel containing disulfide-containing building blocks displayed the characteristics of a potential tissue scaffold such as biocompatibility and porosity (Dispinar et al. 2012). The cryogel demonstrated stability in physiological condition, but it degraded within few hours in presence of a reducing agent (glutathione), while the degraded by products did not affect cell viability. PEG based scaffold with redox mediated degradability and growth factor release features, was evaluated successfully in a rabbit radius critical defect for bone TE application (Yang et al. 2013). Same group also reported redox mediated degradable PEG based injectable hydrogel for bone regeneration (Yang et al. 2014).

9.2.6 Biological Stimuli Responsive Biomaterials

Biomaterials responsive to stimuli inherent to living tissues or cells are always advantageous. It is highly favorable for biomaterials to possess specific adaptive behavior in vivo. Alterations in conformation and degree of self-assembly of several important biomacromolecules in presence of specific chemical species in their surroundings, inspired scientists to develop innovative biomaterials that are responsive to biomacromolecules present in living systems. For that biomaterials are designed in such a way that it contains a functional group, which specifically interacts with biomacromolecules or sometimes, in conjugation with specific biological components. Although biological stimuli responsive biomaterials have not been studied extensively for TE applications, there are few evidences of using enzyme or glucose responsive biomaterials as potential tissue scaffolds. For example, an injectable self-healing hydrogel composed of phenylboronic acid and cis-diol modified PEG was demonstrated to release protein therapeutics in response to glucose, while also evoking no immune response in vivo (Yesilyurt et al. 2016). In another report, kartogenin, a chondrocyte differentiation inducing agent, was loaded into poly(lactic-co-glycolic acid)/hyaluronic acid (PLGA/HA) hydrogel for

inducing differentiation of mesenchymal stem cells into chondrocytes (Shi et al. 2016). The kartogenin loaded hydrogel was demonstrated to play a major role in cell homing including recruitment of host's endogenous cells in vivo without needing any cell transplantation. An injectable microporous annealed particle (MAP) gel based on PEG/vinyl sulphone for accelerated wound healing was demonstrated, wherein the microgel was cross-linked to cysteine-terminated matrix metalloprotease-sensitive peptide sequences for cell controlled biodegradability and resorption (Griffin et al. 2015).

9.3 Conclusions and Future Outlook

The current chapter provides a discussion on various types of stimuli responsive biomaterials in regard to their exploitation as potential tissue scaffolds with a special emphasize on physical stimuli responsive biomaterials such as electroactive and magnetoresponsive biomaterials. These biomaterials were explored extensively due to their potential to manipulate the intrinsic bioelectrical cues of the native tissue. TE is a more complex process and biomaterials are required to mimic the dynamic environment of the native tissue to support the natural regeneration processes. Hence, electroactive or magneto-responsive biomaterials discussed in the present chapter, have greater evidences as potential smart tissue scaffolds as compared to the chemical and biological stimuli responsive biomaterials including photoresponsive and thermoresponsive biomaterials. Moreover, CP and carbon based nanobiomaterials have emerged as superior smart biomaterial scaffolds among other electroactive biomaterials due to their intrinsic electrical conductivity, which is an important bioelectrical cue present in tissues and ES through such scaffolds were demonstrated for faster tissue regrowth and effective functional recovery both in vitro and in vivo. One of the major limitations of piezoelectric and electret based biomaterials is the requirement of poling the scaffold for dipole alignment sometimes for several hours above their glass transition temperature in presence of a high electric field of the order of kV (Shastri et al. 2000). It is only after the poling process for which piezoelectric and electret based biomaterials are usable for ES for finite length of time. Additionally, the electromagnetic signal, which is utilized by the systems such as photovoltaic, magnetoresponsive, and photoresponsive biomaterials, does not remain localized on the damaged area but gets penetrated to the surrounding areas of the injury site. In contrast, electroactive CP and carbon based nanobiomaterials offer focused ES with remarkable control over the level and duration of the stimulation. Chemical (pH and redox) and biological (glucose and enzyme) responsive biomaterials were scarcely explored as TE scaffold as compared to the formers.

Besides the stimuli responsive feature, smart biomaterials should be flexible enough to be integrated with advanced biofabrication techniques such as photolithography, microcontact printing, 3D bioprinting, micromolding, and microfluidic-assisted patterning etc., to be precisely mimic structure and other physical properties of the natural tissues (Mohamed et al. 2019). Future research should also focus to

optimize the biophysical signal parameters within safe limit for living tissues to modulate the cell microenvironment. A successful technology to reach the end user needs to demonstrate robust clinical safety and efficacy for acquiring regulatory approval. Although, CP and carbon based biomaterials have demonstrated minimal immune response and biocompatibility, their one of the major constraints for use in TE is their non-degradability. Therefore, it is important to undertake strategies such as blending with natural or synthetic FDA approved other biomaterials to regulate the degradability feature.

Acknowledgement RB gratefully acknowledges DST, Govt. of India, for the financial support through the Inspire Faculty Project (DST/INSPIRE/04/2018/000402). JU is extremely grateful to SERB for the financial support (ECR/2017/000628). BBR thankful to DBT, Government of India for financial assistance (BT/PR31908/MED/29/1401/2019) and LV Prasad Eye Institute, Hyderabad.

References

- Abzan N, Kharaziha M, Labbaf S (2019) Development of three-dimensional piezoelectric polyvinylidene fluoride-graphene oxide scaffold by non-solvent induced phase separation method for nerve tissue engineering. *Mater Des* 167:107636. <https://doi.org/10.1016/j.matdes.2019.107636>
- Ahadian S, Yamada S, Ramón-Azcón J et al (2016) Hybrid hydrogel-aligned carbon nanotube scaffolds to enhance cardiac differentiation of embryoid bodies. *Acta Biomater* 31:134–143. <https://doi.org/10.1016/j.actbio.2015.11.047>
- Antman-Passig M, Shefi O (2016) Remote magnetic orientation of 3D collagen hydrogels for directed neuronal regeneration. *Nano Lett* 16:2567–2573. <https://doi.org/10.1021/acs.nanolett.6b00131>
- Aznar-Cervantes S, Pagán A, Martínez JG et al (2017) Electrospun silk fibroin scaffolds coated with reduced graphene promote neurite outgrowth of PC-12 cells under electrical stimulation. *Mater Sci Eng C* 79:315–325. <https://doi.org/10.1016/j.msec.2017.05.055>
- Balint R, Cassidy NJ, Cartmell SH (2013) Electrical stimulation: a novel tool for tissue engineering. *Tissue Eng - Part B Rev* 19:48–57. <https://doi.org/10.1089/ten.teb.2012.0183>
- Balint R, Cassidy NJ, Cartmell SH (2014) Conductive polymers: towards a smart biomaterial for tissue engineering. *Acta Biomater* 10:2341–2353. <https://doi.org/10.1016/j.actbio.2014.02.015>
- Basurto IM, Mora MA, Christ GJ, Caliarì SR (2019) Aligned and conductive 3D collagen scaffolds for skeletal muscle tissue engineering. *Trans Annu Meet Soc Biomater Annu Int Biomater Symp* 40:370
- Bauer S (2011) Electrets for biomedical applications. *Proceedings International Symposium on Electrets* 229–230. doi:<https://doi.org/10.1109/ISE.2011.6085066>
- Borah R, Ingavle GC, Sandeman SR et al (2018) Electrically conductive MEH-PPV:PCL electrospun nanofibres for electrical stimulation of rat PC12 pheochromocytoma cells. *Biomater Sci* 6:2342–2359. <https://doi.org/10.1039/c8bm00559a>
- Bryan DJ, Jin BT, Doherty SA et al (2004) Enhanced peripheral nerve regeneration through a poled bioresorbable poly(lactic-co-glycolic acid) guidance channel. *J Neural Eng* 1:91–98. <https://doi.org/10.1088/1741-2560/1/2/004>
- Cabane E, Zhang X, Langowska K et al (2012) Stimuli-responsive polymers and their applications in nanomedicine. *Biointerphases* 7:1–27. <https://doi.org/10.1007/s13758-011-0009-3>
- Cao L, Zhang F, Wang Q, Wu X (2017) Fabrication of chitosan/graphene oxide polymer nanofiber and its biocompatibility for cartilage tissue engineering. *Mater Sci Eng C* 79:697–701. <https://doi.org/10.1016/j.msec.2017.05.056>

- Cardoso VF, Ribeiro C, Lanceros-Mendez S (2017) *Metamorphic biomaterials*. Elsevier, Amsterdam
- Chen X, Liu C, Huang Z et al (2019) Preparation of carboxylic graphene oxide-composited polypyrrole conduits and their effect on sciatic nerve repair under electrical stimulation. *J Biomed Mater Res Part A* 107:2784–2795. <https://doi.org/10.1002/jbm.a.36781>
- Chi N, Zheng S, Clutter E, Wang R (2019) Silk-CNT mediated fibroblast stimulation toward chronic wound repair. *Recent Prog Mater* 1:1–1. <https://doi.org/10.21926/rpm.1904007>
- Cooperstein MA, Bluestein BM, Canavan HE (2015) Synthesis and optimization of fluorescent poly(N- isopropyl acrylamide)-coated surfaces by atom transfer radical polymerization for cell culture and detachment. *Biointerphases* 10:019001. <https://doi.org/10.1116/1.4894530>
- D'Amora U, Russo T, Gloria A et al (2017) 3D additive-manufactured nanocomposite magnetic scaffolds: effect of the application mode of a time-dependent magnetic field on hMSCs behavior. *Bioact Mater* 2:138–145. <https://doi.org/10.1016/j.bioactmat.2017.04.003>
- Damaraju SM, Wu S, Jaffe M, Arinze TL (2013) Structural changes in PVDF fibers due to electrospinning and its effect on biological function. *Biomed Mater* 8(4):045007. <https://doi.org/10.1088/1748-6041/8/4/045007>
- Desmet KD, Paz DA, Corry JJ et al (2006) Clinical and experimental applications of NIR-LED Photobiomodulation. *Photomed Laser Surg* 24:121–128. <https://doi.org/10.1089/pho.2006.24.121>
- Dispinar T, Van Camp W, De Cock LJ et al (2012) Redox-responsive degradable PEG Cryogels as potential cell scaffolds in tissue engineering. *Macromol Biosci* 12:383–394. <https://doi.org/10.1002/mabi.201100396>
- Doberenz F, Zeng K, Willems C et al (2020) Thermoresponsive polymers and their biomedical application in tissue engineering-a review. *J Mater Chem B* 8:607–628. <https://doi.org/10.1039/c9tb02052g>
- Dou XQ, Yang XM, Li P et al (2012) Novel pH responsive hydrogels for controlled cell adhesion and triggered surface detachment. *Soft Matter* 8:9539–9544. <https://doi.org/10.1039/c2sm26442k>
- Edahiro JI, Sumaru K, Tada Y et al (2005) In situ control of cell adhesion using photoresponsive culture surface. *Biomacromolecules* 6:970–974. <https://doi.org/10.1021/bm0493382>
- Eivazzadeh-Keihan R, Maleki A, de la Guardia M et al (2019) Carbon based nanomaterials for tissue engineering of bone: building new bone on small black scaffolds: a review. *J Adv Res* 18:185–201. <https://doi.org/10.1016/j.jare.2019.03.011>
- Enayati S, Chang K, Achour H et al (2020) Electrical stimulation induces retinal Müller cell proliferation and their progenitor cell potential. *Cell* 9:781. <https://doi.org/10.3390/cells9030781>
- Fernandes MM, Correia DM, Ribeiro C et al (2019) Bioinspired three-dimensional Magnetoactive scaffolds for bone tissue engineering. *ACS Appl Mater Interfaces* 11:45265–45275. <https://doi.org/10.1021/acsami.9b14001>
- Ferrantini C, Pioner JM, Martella D et al (2019) Development of light-responsive liquid crystalline elastomers to assist cardiac contraction. *Circ Res* 124:e44–e54. <https://doi.org/10.1161/CIRCRESAHA.118.313889>
- Fortunato GM, De Maria C, Eglín D et al (2018) An ink-jet printed electrical stimulation platform for muscle tissue regeneration. *Bioprinting* 11:e00035. <https://doi.org/10.1016/j.bprint.2018.e00035>
- Gautam V, Rand D, Hanein Y, Narayan KS (2014) A polymer optoelectronic interface provides visual cues to a blind retina. *Adv Mater* 26:1751–1756. <https://doi.org/10.1002/adma.201304368>
- Ghasemi-Mobarakeh L, Prabhakaran MP, Morshed M, Nasr-Esfahani MH, Baharvand H, Kiani S et al (2011) Application of conductive polymers, scaffolds and electrical stimulation for nerve tissue engineering. *J Tissue Eng Regen Med* 5:e17–e35. <https://doi.org/10.1002/term>
- Ghezzi D, Antognazza MR, Dal Maschio M et al (2011) A hybrid bioorganic interface for neuronal photoactivation. *Nat Commun* 2:166. <https://doi.org/10.1038/ncomms1164>

- Ghezzi D, Antognazza MR, Maccarone R et al (2013) A polymer optoelectronic interface restores light sensitivity in blind rat retinas. *Nat Photonics* 7:400–406. <https://doi.org/10.1038/nphoton.2013.34>
- Giammanco GE, Carrion B, Coleman RM, Ostrowski AD (2016) Photoresponsive polysaccharide-based hydrogels with tunable mechanical properties for cartilage tissue engineering. *ACS Appl Mater Interfaces* 8:14423–14429. <https://doi.org/10.1021/acsami.6b03834>
- Gil ES, Hudson SM (2004) Stimuli-responsive polymers and their bioconjugates. *Prog Polym Sci* 29:1173–1222. <https://doi.org/10.1016/j.progpolymsci.2004.08.003>
- Goetzberger A, Hebling C (2000) Photovoltaic materials, past, present, future. *Sol Energy Mater Sol Cells* 62:1–19. [https://doi.org/10.1016/S0927-0248\(99\)00131-2](https://doi.org/10.1016/S0927-0248(99)00131-2)
- Goetzberger A, Hebling C, Schock HW (2003) Photovoltaic materials, history, status and outlook. *Mater Sci Eng R Reports* 40:1–46. [https://doi.org/10.1016/S0927-796X\(02\)00092-X](https://doi.org/10.1016/S0927-796X(02)00092-X)
- Gong YH, Yang J, Cao FY et al (2013) Photoresponsive smart template for reversible cell micropatterning. *J Mater Chem B* 1:2013–2017. <https://doi.org/10.1039/c3tb20073f>
- Goswami A, Sen P (2018) Energy harvesting using droplet. Elsevier, Amsterdam
- Grassi C, D'Ascenzo M, Torsello A et al (2004) Effects of 50 Hz electromagnetic fields on voltage-gated Ca²⁺ channels and their role in modulation of neuroendocrine cell proliferation and death. *Cell Calcium* 35:307–315. <https://doi.org/10.1016/j.ceca.2003.09.001>
- Griffin DR, Weaver WM, Scumpia PO et al (2015) Accelerated wound healing by injectable microporous gel scaffolds assembled from annealed building blocks. *Nat Mater* 14:737–744. <https://doi.org/10.1038/nmat4294>
- Guex AG, Puetzer JL, Armgarth A et al (2017) Highly porous scaffolds of PEDOT:PSS for bone tissue engineering. *Acta Biomater* 62:91–101. <https://doi.org/10.1016/j.actbio.2017.08.045>
- Haeblerlin A, Zurbuchen A, Schaerer J et al (2014) Successful pacing using a batteryless sunlightpowered pacemaker. *Europace* 16:1534–1539. <https://doi.org/10.1093/europace/euu127>
- Haeblerlin A, Zurbuchen A, Walpen S et al (2015) The first batteryless, solar-powered cardiac pacemaker. *Hear Rhythm* 12:1317–1323. <https://doi.org/10.1016/j.hrthm.2015.02.032>
- Halperin C, Mutchnik S, Agronin A et al (2004) Piezoelectric effect in human bones studied in nanometer scale. *Nano Lett* 4:1253–1256. <https://doi.org/10.1021/nl049453i>
- Heeger AJ (2001) Nobel lecture: semiconducting and metallic polymers: the fourth generation of polymeric materials. *Rev Mod Phys* 73:681–700. <https://doi.org/10.1103/RevModPhys.73.681>
- Hosseinzadeh S, Mahmoudifard M, Mohamadyar-Toupkanlou F et al (2016) The nanofibrous PAN-PANi scaffold as an efficient substrate for skeletal muscle differentiation using satellite cells. *Bioprocess Biosyst Eng* 39:1163–1172. <https://doi.org/10.1007/s00449-016-1592-y>
- Hsiao YS, Liao YH, Chen HL et al (2016) Organic Photovoltaics and bioelectrodes providing electrical stimulation for PC12 cell differentiation and Neurite outgrowth. *ACS Appl Mater Interfaces* 8:9275–9284. <https://doi.org/10.1021/acsami.6b00916>
- Huang YJ, Wu HC, Tai NH, Wang TW (2012) Carbon nanotube rope with electrical stimulation promotes the differentiation and maturity of neural stem cells. *Small* 8:2869–2877. <https://doi.org/10.1002/sml.201200715>
- Huang J, Liang Y, Jia Z et al (2018) Development of magnetic Nanocomposite hydrogel with potential cartilage tissue engineering. *ACS Omega* 3:6182–6189. <https://doi.org/10.1021/acsomega.8b00291>
- Jacob J, More N, Kalia K, Kapusetti G (2018) Piezoelectric smart biomaterials for bone and cartilage tissue engineering. *Inflamm Regen* 38:1–11. <https://doi.org/10.1186/s41232-018-0059-8>
- Jacob J, More N, Mounika C et al (2019) Smart piezoelectric Nanohybrid of poly (3-hydroxybutyrate-co-3-hydroxyvalerate) and barium Titanate for stimulated cartilage regeneration. *ACS Appl Bio Mater* 2:4922–4931. <https://doi.org/10.1021/acsabm.9b00667>
- Jang HK, Oh JY, Jeong GJ et al (2018) A disposable photovoltaic patch controlling cellular microenvironment for wound healing. *Int J Mol Sci* 19(10):3025. <https://doi.org/10.3390/ijms19103025>

- Jefimenko OD, Walker DK (1980) Electrets. *Phys Teach* 18:651–659. <https://doi.org/10.1119/1.2340651>
- Jianqing F, Huipin Y, Xingdong Z (1997) Promotion of osteogenesis by a piezoelectric biological ceramic. *Biomaterials* 18:1531–1534
- Jin G, Prabhakaran MP, Liao S, Ramakrishna S (2011) Photosensitive materials and potential of photocurrent mediated tissue regeneration. *J Photochem Photobiol B Biol* 102:93–101. <https://doi.org/10.1016/j.jphotobiol.2010.09.010>
- Kang SK, Park G, Kim K et al (2015) Dissolution chemistry and biocompatibility of silicon- and germanium-based semiconductors for transient electronics. *ACS Appl Mater Interfaces* 7:9297–9305. <https://doi.org/10.1021/acsami.5b02526>
- Karahaliloglu Z, Yalçın E, Demirbilek M, Denkbaz EB (2017) Magnetic silk fibroin e-gel scaffolds for bone tissue engineering applications. *J Bioact Compat Polym* 32:596–614. <https://doi.org/10.1177/0883911517693635>
- Kim YJ, Matsunaga YT (2017) Thermo-responsive polymers and their application as smart biomaterials. *J Mater Chem B* 5:4307–4321. <https://doi.org/10.1039/c7tb00157f>
- Lacy-hulbert A, Metcalfe JC, Hesketh R (1998) Biological responses to electromagnetic fields 1. *FASEB J* 12:395–420. <https://doi.org/10.1096/fasebj.12.6.395>
- Le TH, Kim Y, Yoon H (2017) Electrical and electrochemical properties of conducting polymers. *Polymers* 9(4):150. <https://doi.org/10.3390/polym9040150>
- Lee YS, Arinze TL (2012) The influence of piezoelectric scaffolds on neural differentiation of human neural stem/progenitor cells. *Tissue Eng - Part A* 18:2063–2072. <https://doi.org/10.1089/ten.tea.2011.0540>
- Li Y, Li X, Zhao R et al (2017) Enhanced adhesion and proliferation of human umbilical vein endothelial cells on conductive PANI-PCL fiber scaffold by electrical stimulation. *Mater Sci Eng C* 72:106–112. <https://doi.org/10.1016/j.msec.2016.11.052>
- Li J, Liu X, Crook JM, Wallace GG (2020) Electrical stimulation-induced osteogenesis of human adipose derived stem cells using a conductive graphene-cellulose scaffold. *Mater Sci Eng C* 107:110312. <https://doi.org/10.1016/j.msec.2019.110312>
- Lin BF, Megley KA, Viswanathan N et al (2012) pH-responsive branched peptide amphiphile hydrogel designed for applications in regenerative medicine with potential as injectable tissue scaffolds. *J Mater Chem* 22:19447–19454. <https://doi.org/10.1039/c2jm31745a>
- Lin X, Clasky A, Lai K, Yang L (2016) Carbon-based nano biomaterials: design. In: *Biomedical nanomaterials: from design to implementation*. Institution of Engineering and Technology, London, pp 49–91
- Liu Z, Huang L, Liu L et al (2014) Activation of schwann cells in vitro by magnetic nanocomposites via applied magnetic field. *Int J Nanomedicine* 10:43–61. <https://doi.org/10.2147/IJN.S74332>
- Lloyd-Hughes J, Jeon TI (2012) A review of the terahertz conductivity of bulk and nano-materials. *J Infrared Millimeter Terahertz Waves* 33:871–925. <https://doi.org/10.1007/s10762-012-9905-y>
- Lorach H, Goetz G, Smith R et al (2015) Photovoltaic restoration of sight with high visual acuity. *Nat Med* 21:476–482. <https://doi.org/10.1038/nm.3851>
- Lu L, Yang Z, Meacham K et al (2018) Biodegradable Monocrystalline silicon photovoltaic microcells as power supplies for transient biomedical implants. *Adv Energy Mater* 8:1–8. <https://doi.org/10.1002/aenm.201703035>
- Lu Y, Wang Y, Zhang J et al (2019) In-situ doping of a conductive hydrogel with low protein absorption and bacterial adhesion for electrical stimulation of chronic wounds. *Acta Biomater* 89:217–226. <https://doi.org/10.1016/j.actbio.2019.03.018>
- Macdiarmid AG, Mammone RJ, Kaner RB et al (1985) The concept of ‘doping’ of conducting polymers: the role of reduction potentials. *Philos Trans R Soc London Ser A* 314:3–15. <https://doi.org/10.1098/rsta.1985.0004>
- Marino A, Barsotti J, De Vito G et al (2015) Two-photon lithography of 3D Nanocomposite piezoelectric scaffolds for cell stimulation. *ACS Appl Mater Interfaces* 7:25574–25579. <https://doi.org/10.1021/acsami.5b08764>

- Martinelli V, Bosi S, Penã B et al (2018) 3D carbon-nanotube-based composites for cardiac tissue engineering. *ACS Appl Bio Mater* 1:1530–1537. <https://doi.org/10.1021/acsabm.8b00440>
- Mascarenhas S (1980) Bioelectrets: electrets in biomaterials and biopolymers. In: *Electrets*. Springer, Berlin, pp 321–346
- Matsuda N, Shimizu T, Yamato M, Okano T (2007) Tissue engineering based on cell sheet technology. *Adv Mater* 19:3089–3099. <https://doi.org/10.1002/adma.200701978>
- Mohamed MA, Fallahi A, El-Sokkary AMA et al (2019) Stimuli-responsive hydrogels for manipulation of cell microenvironment: from chemistry to biofabrication technology. *Prog Polym Sci* 98:101147. <https://doi.org/10.1016/j.progpolymsci.2019.101147>
- Molino PJ, Garcia L, Stewart EM et al (2018) PEDOT doped with algal, mammalian and synthetic dopants: polymer properties, protein and cell interactions, and influence of electrical stimulation on neuronal cell differentiation. *Biomater Sci* 6:1250–1261. <https://doi.org/10.1039/c7bm01156c>
- Motamedi AS, Mirzadeh H, Hajiesmaeilbaigi F et al (2017) Piezoelectric electrospun nanocomposite comprising au NPs/PVDF for nerve tissue engineering. *J Biomed Mater Res Part A* 105:1984–1993. <https://doi.org/10.1002/jbm.a.36050>
- Murphy RD, Kimmins S, Hibbitts AJ, Heise A (2019) 3D-extrusion printing of stable constructs composed of photoresponsive polypeptide hydrogels. *Polym Chem* 10:4675–4682. <https://doi.org/10.1039/c9py00796b>
- Nagase K, Yamato M, Kanazawa H, Okano T (2018) Poly(N-isopropylacrylamide)-based thermoresponsive surfaces provide new types of biomedical applications. *Biomaterials* 153:27–48. <https://doi.org/10.1016/j.biomaterials.2017.10.026>
- Nguyen V, Zhu R, Yang R (2014) Environmental effects on nanogenerators. *Nano Energy* 14:49–61. <https://doi.org/10.1016/j.nanoen.2014.11.049>
- Okabayashi R, Nakamura M, Okabayashi T et al (2009) Efficacy of polarized hydroxyapatite and silk fibroin composite dressing gel on epidermal recovery from full-thickness skin wounds. *J Biomed Mater Res Part B Appl Biomater* 90(B):641–646. <https://doi.org/10.1002/jbm.b.31329>
- Park HJ, Rouabhia M, Lavertu D, Zhang Z (2015) Electrical stimulation modulates the expression of multiple wound healing genes in primary human dermal fibroblasts. *Tissue Eng Part A* 21:1982–1990. <https://doi.org/10.1089/ten.tea.2014.0687>
- Qazi TH, Rai R, Dippold D et al (2014) Development and characterization of novel electrically conductive PANI-PGS composites for cardiac tissue engineering applications. *Acta Biomater* 10:2434–2445. <https://doi.org/10.1016/j.actbio.2014.02.023>
- Qian Y, Cheng Y, Cai J et al (2019) Advances in electrical and magnetic stimulation on nerve regeneration. *Regen Med* 14:969–979. <https://doi.org/10.2217/rme-2018-0079>
- Qu Y, Ao D, Wang P et al (2014) Chitosan/nano-hydroxyapatite composite electret membranes enhance cell proliferation and osteoblastic expression in vitro. *J Bioact Compat Polym* 29:3–14. <https://doi.org/10.1177/0883911513513094>
- Rochkind S, Shahar A, Alon M, Nevo Z (2002) Transplantation of embryonal spinal cord nerve cells cultured on biodegradable microcarriers followed by low power laser irradiation for the treatment of traumatic paraplegia in rats. *Neurol Res* 24:355–360. <https://doi.org/10.1179/016164102101200131>
- Sajesh KM, Jayakumar R, Nair SV, Chennazhi KP (2013) Biocompatible conducting chitosan/polypyrrole-alginate composite scaffold for bone tissue engineering. *Int J Biol Macromol* 62:465–471. <https://doi.org/10.1016/j.ijbiomac.2013.09.028>
- Samadian H, Mobasheri H, Hasanpour S et al (2020) Electro-conductive carbon nanofibers as the promising interfacial biomaterials for bone tissue engineering. *J Mol Liq* 298:112021. <https://doi.org/10.1016/j.molliq.2019.112021>
- Shastri VR, Schmidt CE, Langer RS, Vacanti JP (2000) Neuronal stimulation using electrically conducting polymers
- Shi D, Xu X, Ye Y et al (2016) Photo-cross-linked scaffold with kartogenin-encapsulated nanoparticles for cartilage regeneration. *ACS Nano* 10:1292–1299. <https://doi.org/10.1021/acsnano.5b06663>

- Shimano JY, Mac Diarmid AG (2001) Polyaniline, a dynamic block copolymer: key to attaining its intrinsic conductivity? *Synth Met* 123:251–262. [https://doi.org/10.1016/S0379-6779\(01\)00293-4](https://doi.org/10.1016/S0379-6779(01)00293-4)
- Shirakawa H, Louis EJ, MacDiarmid AG et al (1977) Synthesis of electrically conducting organic polymers: halogen derivatives of polyacetylene, (CH)_x. *J Chem Soc Chem Commun* 16:578–580. <https://doi.org/10.1039/C39770000578>
- Skotheim TA, Elsenbaumer RL, Reynolds JR (eds) (1997) *Handbook of conducting polymers*, vol 227, 2nd edn. Wiley, New York, p 1112
- Tai G, Tai M, Zhao M (2018) Electrically stimulated cell migration and its contribution to wound healing. *Burn Trauma* 6:1–7. <https://doi.org/10.1186/s41038-018-0123-2>
- Tandon B, Magaz A, Balint R et al (2018) Electroactive biomaterials: vehicles for controlled delivery of therapeutic agents for drug delivery and tissue regeneration. *Adv Drug Deliv Rev* 129:148–168. <https://doi.org/10.1016/j.addr.2017.12.012>
- Tang P, Han L, Li P et al (2019) Mussel-inspired electroactive and antioxidative scaffolds with incorporation of polydopamine-reduced graphene oxide for enhancing skin wound healing. *ACS Appl Mater Interfaces* 11(8):7703–7714
- Tarafder S, Bodhak S, Bandyopadhyay A, Bose S (2011) Effect of electrical polarization and composition of biphasic calcium phosphates on early stage osteoblast interactions. *J Biomed Mater Res Part B* 97(B):306–314. <https://doi.org/10.1002/jbm.b.31816>
- Torgbo S, Sukyai P (2019) Fabrication of microporous bacterial cellulose embedded with magnetite and hydroxyapatite nanocomposite scaffold for bone tissue engineering. *Mater Chem Phys* 237:121868. <https://doi.org/10.1016/j.matchemphys.2019.121868>
- Tsui JH, Ostrovsky-Snider NA, Yama DMP et al (2018) Conductive silk-polypyrrole composite scaffolds with bioinspired nanotopographic cues for cardiac tissue engineering. *J Mater Chem B* 6:7185–7196. <https://doi.org/10.1039/C8TB01116H>
- Vacanti JP, Langer R (1999) Tissue engineering: the design and fabrication of living replacement devices for surgical reconstruction and transplantation. *Lancet* 354:32–34. [https://doi.org/10.1016/s0140-6736\(99\)90247-7](https://doi.org/10.1016/s0140-6736(99)90247-7)
- Valentini RF, Sabatini AM, Dario P, Aebischer P (1989) Polymer electret guidance channels enhance peripheral nerve regeneration in mice. *Brain Res* 480:300–304. [https://doi.org/10.1016/0006-8993\(89\)90196-0](https://doi.org/10.1016/0006-8993(89)90196-0)
- Vargas-Estevez C, Blanquer A, Murillo G et al (2018) Electrical stimulation of cells through photovoltaic microcell arrays. *Nano Energy* 51:571–578. <https://doi.org/10.1016/j.nanoen.2018.07.012>
- Wake H, Lee PR, Fields RD (2011) Control of local protein synthesis and initial events in myelination by action potentials. *Science* 333(6049):1647–1651. <https://doi.org/10.1126/science.1206998>
- Wang Y, Weng GJ (2018) Electrical conductivity of carbon nanotube- and Graphene-based nanocomposites. In: *Micromechanics and Nanomechanics of composite solids*. Springer, Cham, pp 123–156
- Yamada N, Okano T, Sakai H et al (1990) Thermo-responsive polymeric surfaces; control of attachment and detachment of cultured cells. *Die Makromol Chemie Rapid Commun* 11:571–576. <https://doi.org/10.1002/marc.1990.030111109>
- Yan L, Zhao B, Liu X et al (2016) Aligned Nanofibers from Polypyrrole/Graphene as electrodes for regeneration of optic nerve via electrical stimulation. *ACS Appl Mater Interfaces* 8:6834–6840. <https://doi.org/10.1021/acsami.5b12843>
- Yang F, Wang J, Hou J et al (2013) Bone regeneration using cell-mediated responsive degradable PEG-based scaffolds incorporating with rhBMP-2. *Biomaterials* 34:1514–1528. <https://doi.org/10.1016/j.biomaterials.2012.10.058>
- Yang F, Wang J, Cao L et al (2014) Injectable and redox-responsive hydrogel with adaptive degradation rate for bone regeneration. *J Mater Chem B* 2:295–304. <https://doi.org/10.1039/c3tb21103g>

- Yang B, Yao F, Ye L et al (2020) A conductive PEDOT/alginate porous scaffold as a platform to modulate the biological behaviors of brown adipose-derived stem cells. *Biomater Sci* 8:3173–3185. <https://doi.org/10.1039/c9bm02012h>
- Yesilyurt V, Webber MJ, Appel EA et al (2016) Injectable self-healing glucose-responsive hydrogels with pH-regulated mechanical properties. *Adv Mater* 28:86–91. <https://doi.org/10.1002/adma.201502902>
- You JO, Rafat M, Almeda D et al (2015) pH-responsive scaffolds generate a pro-healing response. *Biomaterials* 57:22–32. <https://doi.org/10.1016/j.biomaterials.2015.04.011>
- Yuan W, Xu L, Huang P et al (2018) Inhibition effects of a negative electret 5-FU patch on the growth of a hypertrophic scar. *Plasma Sci Technol* 20(5):054011. <https://doi.org/10.1088/2058-6272/aaa88b>
- Zadehnajar P, Akbari B, Karbasi S, Mirmusavi MH (2020) Preparation and characterization of poly ε-caprolactone-gelatin/multi-walled carbon nanotubes electrospun scaffolds for cartilage tissue engineering applications. *Int J Polym Mater Polym Biomater* 69:326–337. <https://doi.org/10.1080/00914037.2018.1563088>
- Zaszczyńska A, Sajkiewicz P, Gradys A (2020) Piezoelectric scaffolds as smart materials for neural tissue engineering. *Polymers* 12(1):161. <https://doi.org/10.3390/polym12010161>
- Zhang N, Lock J, Sallee A, Liu H (2015) Magnetic Nanocomposite hydrogel for potential cartilage tissue engineering: synthesis, characterization, and Cytocompatibility with bone marrow derived Mesenchymal stem cells. *ACS Appl Mater Interfaces* 7:20987–20998. <https://doi.org/10.1021/acsami.5b06939>
- Zhao X, Wu H, Guo B et al (2017) Antibacterial anti-oxidant electroactive injectable hydrogel as self-healing wound dressing with hemostasis and adhesiveness for cutaneous wound healing. *Biomaterials* 122:34–47. <https://doi.org/10.1016/j.biomaterials.2017.01.011>
- Zhou Z, Liu X, Wu W et al (2018) Effective nerve cell modulation by electrical stimulation of carbon nanotube embedded conductive polymeric scaffolds. *Biomater Sci* 6:2375–2385. <https://doi.org/10.1039/c8bm00553b>

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ISSN 0930-8989

ISSN 1867-4941 (electronic)

Springer Proceedings in Physics

ISBN 978-981-33-4407-5

ISBN 978-981-33-4408-2 (eBook)

<https://doi.org/10.1007/978-981-33-4408-2>

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63	Effect of Sterile Neutrinos on Degeneracy Resolution Capacities of NOvA and DUNE	453
	Akshay Chatla, Sahithi Rudrabhatla, and Bindu A. Bambah	
64	Current Status for the Inclusive Neutral Current π^0 Production Cross-Section Measurement with the NOvA Near Detector	459
	D. Kalra	
65	Exploring Partial μ-τ Reflection Symmetry in DUNE and Hyper-Kamiokande	467
	K. N. Deepthi, Kaustav Chakraborty, Srubabati Goswami, Anjan S. Joshipura, and Newton Nath	
66	Effect of Event-By-Event Reconstruction and Low Event Statistics on the Sensitivity of Oscillation Parameters in the INO-ICAL Detector	475
	Karaparambil Rajan Rebin, James F. Libby, D. Indumathi, and Lakshmi S. Mohan	
67	Constraints on Millicharged Particles and Bosonic Dark Matter Using Germanium Detectors With Sub-keV Sensitivity	481
	Lakhwinder Singh	
68	Probing Leptonic δ_{CP} Using Low Energy Atmospheric Neutrinos	487
	D. Indumathi, S. M. Lakshmi, and M. V. N. Murthy	
69	Probing the Effects of Unparticle Decay of Neutrinos on the Possible Ultrahigh Energy Neutrino Signals at a Km^2 Detector for 4-Flavour Scenario	497
	Madhurima Pandey	
70	Phenomenological Study of Two-Zero Textures of Neutrino Mass Matrices in Minimal Extended Seesaw Mechanism	505
	Priyanka Kumar and Mahadev Patgiri	
71	Consequences of a CP-Transformed $\mu\tau$-Flavored Friedberg-Lee Symmetry in a Neutrino Mass Model	513
	Roopam Sinha, Sukannya Bhattacharya, and Rome Samanta	
72	Physics Potential of Long-Baseline Neutrino Oscillation Experiments in Presence of Sterile Neutrino	521
	Rudra Majhi, C. Soumya, and Rukmani Mohanta	
73	Using A4 to Ameliorate Popular Lepton Mixings: A Model for Realistic Neutrino Masses and Mixing Based on Seesaw	529
	Soumita Pramanick	



Priyanka Kumar and Mahadev Patgiri

Abstract In this chapter, we study the phenomenology of two-zero textures of 4×4 neutrino mass matrices $M_\nu^{4 \times 4}$ in the context of the Minimal Extended Seesaw (MES) mechanism. The MES mechanism is an extension to the canonical type-I seesaw mechanism which incorporates an extra gauge singlet field 'S' apart from the three right-handed neutrinos. The MES mechanism deals with 3×3 forms of Dirac neutrino mass matrix (M_D), right-handed Majorana mass matrix (M_R) and 1×3 row matrix (M_S) which couples the right-handed neutrinos and the sterile singlet 'S'. In our work, we realize the two-zero textures of $M_\nu^{4 \times 4}$ within the context of the MES mechanism by considering a $(5 + 4)$ scheme, where the digits in the pair represent the number of zeros of M_D and M_R , along with a one-zero texture of M_S . We find that out of 15 allowed two-zero textures, only 6 two-zero textures can be realized under the $(5 + 4)$ scheme. On enforcing zeros, the neutrino mass matrix $M_\nu^{4 \times 4}$ yields a number of correlations. We check the viability of each texture by scanning their correlations under recent neutrino oscillation data. We find that certain textures are allowed only for some selected ranges of values of $\sin \theta_{34}$. We present scatter plots as a viability check for each of the textures.

70.1 Introduction

From the proposition of massless neutrinos by Wolfgang Pauli to massive neutrinos confirmed by a number of solar, atmospheric and reactor experiments, neutrino physics have appreciably progressed with time. Untiring efforts from experimentalists have succeeded in providing solid and precise information about the mass-squared differences ($\Delta m_{21}^2, \Delta m_{31}^2$) and mixing angles ($\theta_{12}, \theta_{23}, \theta_{13}$) in case of the three active neutrinos. There are, however, a number of problems which are still

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P. K. Behera et al. (eds.), *XXIII DAE High Energy Physics Symposium*,

Springer Proceedings in Physics 261,

https://doi.org/10.1007/978-981-33-4408-2_70

Performing Arts of Assam

Editors
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Assam College Teachers' Association

Performing Arts of Assam : a bilingual collection of Research Papers and Articles (in English and in Assamese) on different Performing Arts of Assam, edited by Biren Baruah, Ajit Konwar and Bhupen Rabha & Published by Sri Himangshu Maral, General Secretary, Assam College Teachers' Association in association with Panchajanya Books, Bamunimaidan, Guwahati.

ISBN : 978-93-90626-97-7

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Published by Sri Himangshu Maral, General Secretary, Assam College Teachers' Association, ACTA House, Solapar, Guwahati-78 1008, Assam

and

Panchajanya Books, Bamunimaidan, Guwahati.

Year of Publication: December, 2021

Copyright : Assam College Teachers' Association

Price: 450/- (Rupees Four hundred fifty) only.

Printed at :

Shri Ganesh Printers, Sankardev Market,
Noonmati, Guwahati-20, Phone: 9707010889

Contents :

- Relocating ~~Assamese~~ Folklore in the Contemporary Cultural Landscape: A Study on Dr. Bhupen Hazarika's Art of Music-Making *Dr. Moushmi Bhatnagar & Dr. Anil Kumar Boro* - 9
- Two Performing Art Forms: *Ojapali* of Assam and *Keertan* of Maharashtra *Dr. Aparna Goswami & Dr. Mrinal Medhi* - 24
- The Dances, Songs, Instruments and *Abhinaya* of Kamalabari Sattri *Jadah Borah* - 44
- Role of *Ankita Naut Bhaona* in the Formation of Greater *Oxamiya* Society *Dr. Bhaskar Kumar Kakati* - 58
- Folk Songs Associated with Spinning and Weavings of the Bodos *Dr. Pramod Ch. Brahma* - 76
- Reflections on Performing Art: Assamese Drama in the Context *Dr. Monami Porasor* - 83
- Treatment of *Vatsalya Rasa* as a Dramatic Ethos in Madhavadeva's Plays *Anamika Mahanta* - 90
- The *Ramayana* Tradition in the Performing Arts of Assam *Saswati Bordoloi* - 100
- Storytelling: A Means to Revitalize a Disappearing Language and Culture in Northeast Thailand (Isan) *Dr. Wajuppa Tansa* - 119
- Tiwa Social Custom, Tradition and Life Style *Ashim Hazarika* - 126
- মংগল-চিন্তা ৰূপে পৰিৱেশ্য কলা ড° কৰবী ডেকা হাজৰিকা - 138
- তিৱা ঊনগোষ্ঠীৰ লোক পৰিৱেশ্য কলা 'লালিলাং গীত' আৰু 'গদাগীশৰীয়া গীত'ৰ ঐতিহ্য আৰু বিৱৰ্তন ড° জ্যোতিৰ্ময় বৰদলৈ - 144
- মিচিংসকলৰ ধৰ্মীয় লোককৃত 'সিবু দাপ্‌নাম্' : এটি আলোচনা তৰুণ লই - 159
- মধ্য ভাৰতীয় নাট্যানুষ্ঠান আৰু অসমীয়া নাট ভৱজিৎ বাহন - 165

Two Performing Art Forms: *Ojapali* of Assam and *Keertan* of Maharashtra

Dr. Aparna Goswami³
Dr. Mrinal Medhi⁴

Abstract :

Performing art forms, to a large extent contain in their dynamics the identity of the community that they represent. The socio-cultural communication that takes place through the art forms reveals not only the way of life of a community but also showcases their worldview and the evolutionary process through which they have passed. Present paper attempts to juxtapose two performing art forms representing two distant regions of India namely Assam in the East and Maharashtra in the West. The performing art forms selected in the purview of discussion are *Ojapali* of Assam and *Keertan* of Maharashtra. Both the art forms trace their origin from the Vedic tradition and have performed an important role in the oral tradition of their respective societies. Their presentation is based on the plots selected from the epics: *Ramayana* and *Mahabharata* as well as on different Puranas and popular legends. The performers take resort to multimodal way of presentation leading to incorporation of dance, songs, dialogues and narratives structured on the above mentioned plots. Audiences can be gauged as active participants in the communication

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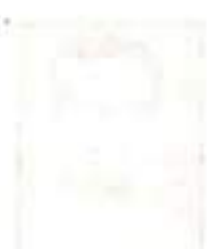
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Current Research in Biology

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**AkiNik Publications
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Published By: AkiNik Publications

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169, C-11, Sector - 3,
Rohini, Delhi-110085, India
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Phone No. – 9711224068, 9911215212
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Publications Year: 2021

Pages: 110

ISBN: 978-93-90846-73-3

Book DOI: <https://doi.org/10.22271/ed.book.1133>

Price: ₹ 682/-

Contents

Chapters	Page No.
1. Bioinformatics (Dr. Deepak Rawal)	01-15
2. Introduction to Types of Statins (Prabhakar Mujagond, Sandhya Gajare and Shivaprasad Kumbhar)	17-33
3. Biotechnological Production of Lovastatin and Its Potential Applications (Prabhakar Mujagond and Sandhya Gajare)	35-50
4. Antifungal and Insecticidal Activity of Leaf Extracts of Some Citrus species (Manjunatha H.K, Manjunatha M.E, Basavanagowda B.N, Basavanagowda V.S, Mohammed Faizun and Prashith Kekuda T.R)	51-63
5. Cyanotoxins (Ahmed S. Dwaish, Raghad J. Fayyad and Noor T. Hamdan)	65-80
6. Planctomycetes, a Promising Source for Pharma Industry: A Review (Ridhaaya J, Priyadharshini J and Setti Sudharsan Meenambiga)	81-92
7. Prospects of Algal Bioresources in Carbon Mitigation and Green Technology (Dr. Gargi Chakravarty)	93-110

Chapter - 7
**Prospects of Algal Bioresources in Carbon
Mitigation and Green Technology**

Author

Dr. Gargi Chakravarty

Assistant Professor, Department of Botany, Dakshin Kamrup
College, Mirza, Kamrup, Assam, India

Chapter - 7

Prospects of Algal Bioresources in Carbon Mitigation and Green Technology

Dr. Gargi Chakravarty

Abstract

Alteration in the global carbon cycle has been a subject of worldwide attention and potential research in the present times. In these alarming scenario microalgae seems to be an attractive medium for capturing the excess CO₂ present in the atmosphere generated from different sources such as power plants, automobiles, volcanic eruption, decomposition of organic matters and forest fires. This chapter gives an overview of the prospect of biomitigation of carbon by algal resources. Due to their efficient CO₂ fixation mechanism as compared to terrestrial plants, these are of immense utility in green technology. Strain selection, mass cultivation and harvesting of algal bioresources are pre requisites for carbon mitigation and further processing. Carbon fixed by microalgae is incorporated into carbohydrates and lipids which can be used for the production of chemicals, foods, or biofuel. The chapter establishes the tremendous potential of microalgae in green house gas abatement and reaffirms its added benefits as a bio-refinery that could produce an array of coproducts including oils, protein and carbohydrates along with biofuel.

Keywords: algae, climate change, carbon mitigation, green technology

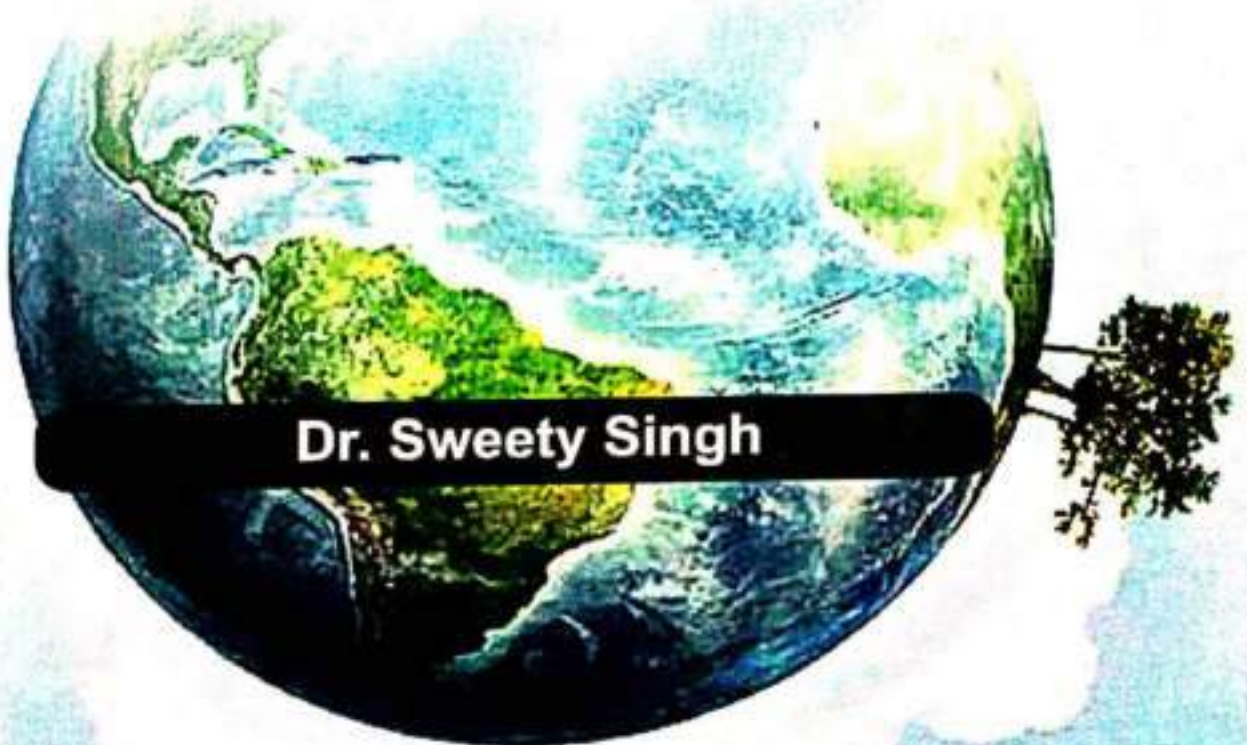
Introduction

Climate Change is the core issue among the global environmental problems and has manifold negative ramifications. Greenhouse gases occur naturally in the atmosphere and keep the sun's warmth from reflecting back into space and making the Earth habitable. But after more than a century and a half of industrialization, deforestation and large scale agriculture, quantities of greenhouse gases in the atmosphere have risen to record levels not seen in three million years. With the growth of population and economies the concentration of green house gases has risen steadily and the mean global temperature along with it. The Intergovernmental Panel on

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About the Author



Dr Sweety Singh has completed her M.Sc. M. Phil. and PhD in Botany from Dr Bhimrao Ambedkar University Agra. She got selection through UP Higher Education Service Commission, Allahabad and got appointment in Narain College, Shikohabad in the year 2010. She holds more than 11 year of experience in the field of teaching, research and academic administration. She attended many UGC Orientation and Refresher Programs, FDPS, National / International Conferences / Seminar and presented papers. She has also published many research papers in National / International Journals. Presently she is working in the capacity of Assistant Professor and Head of Department in Narain College, Shikohabad.

Published & Printed By :

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Nitya Publications, Bhopal MP India
Web: www.nityapublications.com
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ISBN 978-93-91257-10-1



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List of Content

1	Environmental Education	
	Dr Sweety Singh	01
2	Indigenous Knowledge, Traditional Agriculture and Environmental Sustainability: Perspectives from Northeast India	
	Dr. Ripunjoy Sonowal	12
3	An Analysis of Observed Angiospermic Airborne Pollen of Rainy Season Based Upon Their Mode of Pollination In Firozabad District of Uttar Pradesh	
	Shalini Paliwal & S.P. Paliwal	20
4	Edible Phytoresources of North-East India	
	Aparna Deka & Nripendra Kumar Choudhury	36
5	Environmental and Ecological Changes during Covid-19 Pandemic	
	Dr. Saroj Rani	48
6	Virus Induced Gene Silencing (VIGS): A tool for analysis of Plant-Microbial interactions and Stress tolerance mechanisms in the plants	
	Shivam Parmar, Aarti, Sujata, Ambrish Kumar, Dr. Saroj Singh Chahar & Dr. Anil Kumar	56
7	Esources Of Energy	
	Dr. Arvind Kumar Sengar	68
8	Effect of Lockdown during Covid-19 Pandemic on Their Environment	
		79

Edible Phytoresources of North-East India

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Abstract: The North Eastern part of India is the home for diverse species of flora and fauna. Many species are still undiscovered and unidentified in this region of the country. Phytoresources or plant resources from wild are used mostly by the indigenous people for different purposes. A huge number of wild Flora is taken as food also. Two main reasons are there for consumption of phytoresources: to cure ailments and for nutrition. The knowledge of using plants as medicine has been passing from generation to generation in various indigenous groups of people. Due to advancement of facilities in the medical field, the knowledge of using of phytoresources as cure is decreasing. In this present review, an effort has been made to highlight the different wild edible plants of North-East India with medicinal and nutritional value. A thorough investigation of the different properties of the plants may lead to discovery of some very important medicine to some diseases.

Key Words: North East India, flora and fauna, phytoresources, wild edible plants, tribes.

INTRODUCTION

India is very rich in floral resources. According to IUCN, more than 45,000 plant species have been recorded in our country. In the northern eastern part of India there is a rich heritage of indigenous traditional knowledge on biodiversity and bioresources (Chaudhury *et al.*, 2021). North East India comprises eight states – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. There are about 427 tribal communities all over India, of which about 145 major tribal communities and total subtribes of 300 (Kala, 2005) are found in North East India. Abor, Garo, Bodo, Nishi, Angami, Khasi, Kuki, Naga, Apatani, Adi, Hmar, Mizo, Reang, Chorei, Tripuri, Deori etc. are some of the tribes from this region of the country.

In North East India, 51 different types of forests are found which are broadly classified under 6 categories: Tropical moist deciduous forest, Tropical semi evergreen forest, Tropical wet evergreen forest, Subtropical forests, Temperate forests and Alpine forests. 8,000 flowering plants reside in this area which include: 40 species of gymnosperms, 500 species of pteridophytes, 825 species of orchids, 80 species of rhododendrons, 60 of bamboo and 25 species of canes. This region has over 28 conifers, 500 mosses, 700 ferns and 728 lichen species (Prabha and Jain, 2018). There are about 800 different species of wild edible crops in India, out of which about 300 species are used mostly by the tribal and rural population of the

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 নীলমণি ফুকন, ড° মণ্টু কুমাৰ দাস আৰু ড° বনজিৎ বৈশ্য
 স্নাতক মহলাৰ তৰ্কবিদ্যা (প্ৰথম আৰু দ্বিতীয় বাৰ্ষিক)
 নীলমণি ফুকন, ড° মণ্টু কুমাৰ দাস আৰু ড° বনজিৎ বৈশ্য
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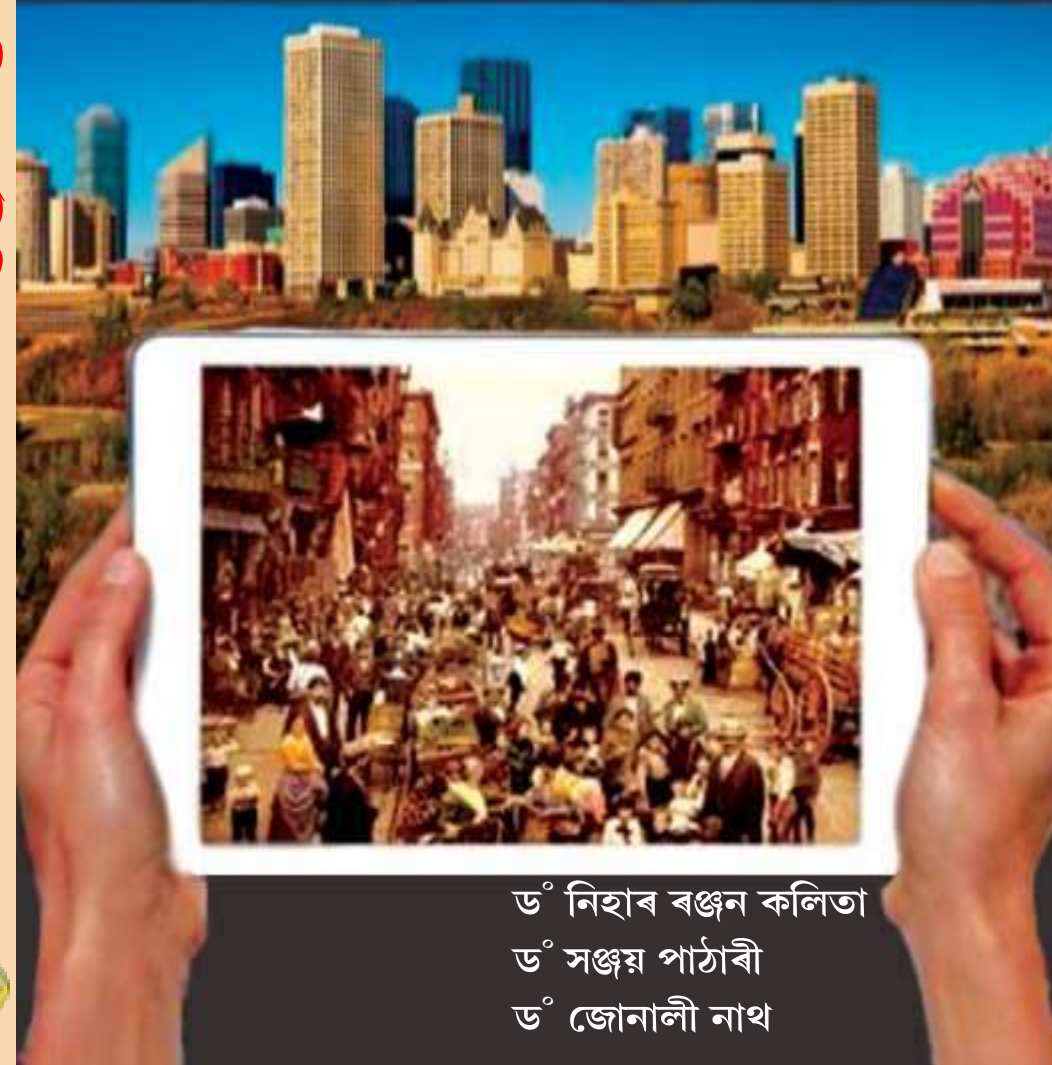
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1	978-81-949523-1-2	Snatak Mahalar Samastibadi Arthoniti-1	Dr. Nihar Ranjan Kalita, Dr. Sanjay Pathari, Dr. Jonali Nath	2021	31/01/2021	INDIA	Trade-only product/ Book		Assamese		BIDYUT KUMAR GUHA	Allotted	Edit (till -5/31/2021) Delete Book Cancel ISBN Allotted	Upland	Update Additional Details	Allotted By RRRNA
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POLITY, ECONOMY AND CULTURE OF NORTH-EAST INDIA

ISSUES AND CHALLENGES



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**POLITY, ECONOMY AND CULTURE OF NORTH-EAST INDIA:
Issues and Challenges**

Dr. Plabika Neog

Dr. Montu Chetia Dr. Kushal Taid Dr. Niranjan Thengal

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First Published June 2022

ISBN: 978-93-92108-65-5

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Published in India by

RUDRA PUBLISHERS & DISTRIBUTORS

C-293A, Street No. 3, West Karawal Nagar, New Delhi - 110094

Cell : 9312442975 E-mail : rudrapublishers@yahoo.com

Printed at Research Press India New Delhi.

Perspectives on Fieldwork in Mising Autonomous Council areas in Assam

Dr. Bhasker Pegu

ABSTRACT

Researchers of Political Science conducting field studies gain divergent experiences, which remain unexplored on the path to scholasticism. Many a time researchers face an array of complexity in their field. Empirical studies as a part of one's methodology needs much more delicate handling in the field. As researchers in Political Science, approaching either through qualitative or quantitative methodology, we hardly have a choice to compromise our objectives while pursuing a study. When a researcher goes to the field, he is caught between the urge for objectivity and subjectivity. While attempting to explore the "real world problems", an investigator in the field finds oneself in a position of situational complexity. Field experience sometimes turns out to be emotional. A field investigator has to reconsider

Advances in Agricultural and Life Sciences

Volume - 9

Chief Editor
Dr. Zhanibek Yessimbekov



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Published By: Weser Books

Weser Books, No. 79737

Äussere Weberstr. 57

02763 Zittau, Germany

Email: weserbooks@gmail.com

Chief Editor: Dr. Zhanibek Yessimbekov

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Publication Year: 2022

Pages: 93

ISBN: 978-3-96492-374-5

Book DOI: <https://doi.org/10.33545/wb.book.216>

Price: € 12

Advances in Agricultural and Life Sciences

Volume - 9

Chief Editor

Dr. Zhanibek Yessimbekov

Shakarim State University of Semey, Republic of Kazakhstan

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Contents

S. No.	Chapters	Page No.
✓ 1	Microbe to Microbiome: Way to Sustainable Agriculture (Dr. Gargi Chakravarty)	01-17
2	Bioenhancer/Liquid Organic Manures in Natural Farming (Sawa Lal Yadav and Manish Yadav)	19-38
3	Monitoring Soil Health and Its Management (Manish Yadav and Sawa Lal Yadav)	39-60
4	Monensin: Antibiotic growth Promoter for Ruminants (Ravi Kumar Soni)	61-74
5	Synergistic Interaction of Plant Parasitic Nematodes with Soil-Borne Fungi and Their Management (Lochan Sharma, Sujata, Sarita, Vikas Chauhan and Gurpreet Singh)	75-93

Chapter - 1

Microbe to Microbiome: Way to Sustainable Agriculture

Dr. Gargi Chakravarty

Abstract

Sustainable agriculture is a big challenge and its success lies in new approach to accomplish the goals of growing crops with minimal environmental pollution. The microorganisms are the best natural resources and their contribution to agriculture is established. Plants and soil harbour millions of microorganisms, which collectively form a microbial community known as the microbiome. An effective microbiome can offer benefits to its host, including plant growth promotion, nutrient use efficiency, and control of pests and phytopathogens. Traditionally only specific microbes have been studied and applied as inoculants in eco friendly agriculture practice. But these have yielded only limited results due to complexity of interactions with the native microbiota. Therefore, there is an immediate need to bring functional potential of plant-associated microbiome and its innovation into crop production. In addition to that, new microbial techniques give structural and functional data on the microbiome and offer opportunities for the design of more efficient microbial consortia that can optimize crop yield and fulfil the goal of sustainable agriculture.

Keywords: Microorganism, microbiome, sustainable agriculture

Introduction

The continued use of fertilizers and water to meet the demand of future global food requirements is not sustainable. In the last five decades, the total area of cultivated land worldwide has increased over 500% in the last five decades with a 700% increase in fertilizer use and a several-fold increase in pesticide use^[1]. Maintenance and preservation of natural resources including diverse and functional microbial population in the soil is essential to sustainable agriculture^[2]. There are about 6000 different bacterial genomes per gram of soil taking the genome size of *Escherichia coli* as a unit^[3]. Despite, the huge bacterial population in soil, only few have been cultured and used in agriculture as biofertilizers, biocontrol and bioremediation agents. Vast pools of microorganism which are unculturable have remained

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Emerging Trends in Agriculture Sciences

Volume - 11

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Published By: Integrated Publications

Integrated Publications

H. No. - 3 Pocket - H34, Sector - 3,

Rohini, Delhi-110085, India

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Publication Year: 2022

Pages: 129

ISBN: 978-93-93502-61-2

Book DOI: <https://doi.org/10.22271/int.book.168>

Price: ₹ 721/-

Contents

Chapters	Page No.
1. Management of Problematic Soils in Dryland Areas <i>(Jaydeep, Padarth, Haneesha and R. Meena)</i>	01-11
2. Management of Nitrification in Agricultural Soils <i>(Madhumita, Kundan Kumar Singh, Lalit Kumar Maitray and Soumen Chakraborty)</i>	13-21
3. Soil Characteristics Influencing Growth and Activity of Microflora <i>(Aditi, Krishan Gopal Kumawat, Harbhajan Singh, Abhishek Kumar Meena, and Deepika Yadav)</i>	23-36
4. Soil Characteristics Influencing Growth and Activity of Soil Macrofauna <i>(Ariyugabha Sarkar)</i>	37-45
5. Microbial Transformation of Sulphur in Soil <i>(Lalit Kumar Maitray, P.K. Sharma, S. Chakraborty, Madhumita and Neelkamal Mishra)</i>	47-59
6. Farm to Table: Management of Crop loss through Post Harvest Technology <i>(Dr. Gargi Chakravarty)</i>	61-74
7. ICT for Climate Change Adaptation in Agriculture: Role, Challenges and Copping Strategies <i>(Asha Dagar, Rajshree Upadhyay and Dhriti Solanki)</i>	75-99
8. Biofortification and Government Initiatives: Ensuring India's Nutritional Security <i>(Kavita, Preetam Kumar, Shweta, Dharmender Singh and Manish Kumar)</i>	101-117
9. Green Manuring: To Improve Soil Fertility and Crop Production <i>(Sandeep Kumar, Panchadi Abhishek, Neeraj Kumar, Kumar Ashish and Yogesh Kumar)</i>	119-129

Chapter - 6

Farm to Table: Management of Crop loss through Post Harvest Technology

Dr. Gargi Chakravarty

Abstract

There has been an increase in the production of horticultural crops along with the production of cereals and pulses, due to the increased demand following preference, rise in income and urbanization. After production in the farm, the produce undergoes a series of post harvest operations before they reach the consumers. Each post-harvest stage results in some losses as a result of which, the value distribution between the consumer and producer is affected. From the time of harvest till the end use, there is quantitative (decreased weight or volume) and qualitative (unwanted changes in the cosmetic features of food and reduced nutrient value) losses along the supply chain. Research and development on effective post harvest management strategies at each stage of harvesting, handling, storage, processing packing, transportation and cold chain maintenance are required to minimise the loss between production and consumption levels.

Keyword: Post harvest crop loss, management strategy

Introduction

India's food system has been transitioning with an increasing demand for high value horticulture and livestock products with rising income and urbanisation, along with the demand for cereals and pulses. Farmers, in this demand-led system, however, have not received commensurate benefits from this transition. Value chains remain poorly developed, in terms of storage facilities at the farm level, transportation, and food processing units, especially in case of the perishables. Due to this, farmers incur higher losses compared to wholesalers, processors and retailers. Farmers' incomes have fallen progressively below that of the non-farm sectors. Most farmers in India remain stuck in a low-income trap.

After production, agricultural operations...



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Cover Design :

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ISBN : 978-93-944960-16

Price : 200/- (Rupees Two Hundred only)

Published by :

Pratishruti Publication

on behalf of

Department of Botany, University of Science and Technology

Meghalaya, Techno City, Kiling Road, Ri-Bhoi

Printed at

GRAFIX

Hedayetpur, Guwahati-781003

Mobile : 94350-17839 / 8638899245 :: E-mail : rbhagabati2015@gmail.com

ISBN : 978-93-944960-16

Current Advancement of Bioremediation and its Future Prospects in India

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ABSTRACT

India, one of developing country in the world is facing severe environmental pollution issues which has arisen due to increased human activity on energy reserves, dangerous farming methods and rapid industrialization over the last few decades. It has become utmost necessary to delimit the continuous xenobiotic and associated recalcitrant compound contamination from the environment. The key to removing persistent pollutants from the environment is bioremediation. In the past two decades, there have been recent developments in bioremediation techniques with the decisive goal being to successfully restore polluted environments in an economic and eco-friendly approach. Heavy metals, nuclear wastes, pesticides, greenhouse gases, and hydrocarbons are among the contaminants that cause environmental and public health concerns due to their toxicity. Because of its environmentally benign characteristics, bioremediation of polluted places has proven to be effective and trustworthy. Depending on the situation, bioremediation might be done *ex situ* or *in situ*. *Ex situ*

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Kaishar Monibhayan : A Textbook of Education for B.A. Second Semester (General courses) under CBCS curriculum, Gauhati University, written by Dipika Devi, Associate Professor, Dept. of Education, Dakshin Kamrup College, Mirza and published by Ashok Book Stall, Panbazar, Guwahati-1

First Impression : 2022

Price : ₹ 150/-

© : Author

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(An Imprint of Asian Humanities Press)
Third Floor, 47/7/25 Ansari Road, Daryaganj, New Delhi-11002
Whats app : 75770-73357; Tel. No. : +91011-35670665
E-mail : support@globalnetpublication.com
www.globalnetpublication.com

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ISBN : 978-81-939447-82-3

Cover Illustration : Sanjay Kalita

মুদ্রণ : শ্রী বালুচর্কী, গুৱাহাটী, অসম

প্রকাশক : অশোক বুক ষ্টল, গুৱাহাটী, অসম

Price : ₹ 150/-

Autonomy and Democratic Governance in Northeast India

Edited by M. Amarjeet Singh

SOUTH ASIA EDITION



A Routledge India Original

Complimentary Copy

Not For Sale

First South Asia edition 2022

First published 2022

By Routledge

4 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge

605 Third Avenue, New York, NY 10158

Routledge is an imprint of the Taylor & Francis Group, an informa
business

© 2022 selection and editorial matter, M. Amarjeet Singh; individual
chapters, the contributors

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British Library Cataloguing-in-Publication Data

A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data

A catalog record has been requested for this book.

ISBN: 978-1-032-37429-1 (hbk)

ISBN: 978-1-003-15841-7 (ebk)

DOI: 10.4324/9781003158417

Typeset in Sabon

by SPi Technologies India Pvt Ltd (Straive)

Printed and bound in India

For sale in India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka only.

Understanding the autonomy movement of the Misings in Assam

Bhasker Pegu

Introduction

The political mobilisation of ethnic groups has been a recurrent feature in the studies of ethnic politics in Northeast India. The Misings, who are the second-largest Schedule Tribe in Assam, are also engaged in the mobilisation for autonomy since the 1980s. They are one of the few tribes who have not lifted arms in order to achieve their stated objective. The absence of armed militia and the adoption of the democratic method of struggle to exert political demand has been one of the significant features of the Mising autonomy movement which is least studied in the context of ethno-political mobilisation. While the abstinence from armed violence might have been one of the main reasons for failure to realise their demand for autonomy to safeguard their socio-cultural identity, land and resources when compared to the Nagas, Mizos or Bodos in so far as the responses of the state and central government are concerned. This essay argues that the Mising movement has its own relevance in understanding ethnic politics in India. The essay is drawn with a qualitative approach from secondary sources such as articles, leaflets, pamphlets and newspapers, periodicals magazines as well as primary sources such as interviews and field visits.

Historical background

The autonomy movement of the Misings can be traced back to the days of pre-Independent India. As early as May 1947, the North East Frontier Miri Abor Sanmila, a community organisation, expressed its desire for separate politico-administrative arrangement for the Misings, the Adis and the Nyishis. The sanmila also demanded the creation of an autonomous administrative unit with specific boundaries for all Tani tribes (such as Adi, Mising, Nyishi, Galo, Apatani and Tagin) inhabited areas of Brahmaputra valley to the border of Tibet (Pegu 1998). In successive years of post-colonial India, like many other indigenous people of Assam, the Misings also joined the echoes of deprivation and injustice against the hegemonic project. The formation of the Mising Agom Kebang, a literary body, in 1972, became