ST ANTHONY'S COLLEGE
(A Don Bosco Institution)
SHILLONG 793 001
MEGHALAYA - INDIA
NAAC Re-Accredited with 'A'
College with Potential for Excellence (awarded by UGC)

DVV CLARIFICATION

NAAC CYCLE 4

CRITERIA 3 – RESEARCH, INNOVATIONS AND EXTENSION

3.3.3

2016 – 2017

Sl. No 1

Reasserting Basic Sciences

Editors

Dr. M. N. Bhattacharjee
Smt. E. N. Dkhar
Dr. (Smt.) D. L. Buam
Smt. Indasien S. Warjri

EBH Publishers (India)
Guwahati-1

ISBN: 978-93-83252-79-4

18

Web 2.0: Toolbox for Tomorrow's Classroom

Probidita Roychoudhury

Abstract

Over the last few years, there has been a sudden spurt of web applications which are collectively termed as "Web 2.0" tools. These tools have transformed the 'read-only' web to 'read-write' web making it more participatory. While many new web applications often become hyped beyond reality, the Web 2.0 tools have brought about an amazing change at least in the field of education. These tools have taken the teaching-learning process outside the formal classroom and changed the way people teach and learn. They allowed the learners to create and share their own content and thus opening new windows for interaction and collaboration. A comparison among different Web 2.0 tools and their application in the field of education is presented herewith.

Introduction

The world today is being termed as a "knowledge-driven society"; and we are living in the "information age". This stress on information, together with rapid growth in information and communication technology, has placed higher demands on our education system. The search for new pedagogical models to sustain this ever increasing demand for knowledge combined with technological advancements has made us look at our educational system from a different perspective. The focus is found to be shifting towards a more personalized, collaborative and community based-learning and towards developing skills

Sl. No 2.

Reasserting Basic Sciences

Editors

Dr. M. N. Bhattacharjee
Smt. E. N. Dkhar
Dr. (Smt.) D. L. Buam
Smt. Indasien S. Warjri

EBH Publishers (India)
Guwahati-1

17

Some Innovations in Teaching of Mathematics (at Under Graduate level)

Phrangstone Khongji
Wannarisuk Nongbsap

Abstract

Presently, science educational approaches have resulted in a mismatch between what is taught to the students and what a student really needs. As such, many institutions are moving towards problem-based learning as a solution to produce students who are creative, can think critically, analytically and are able to solve problems. As Mathematics is one of the pillars of Basic Sciences, one of the solutions is to remove the mathematics phobia that has been cribbing into the minds of the students. In this paper, we focus on the problems, objectives, needs and on the innovative methods of teaching and attracting students to this subject. Some pedagogic tools with which a teacher should be equipped have been mentioned. A brief survey of the number of students, of some colleges in the state, opting for this subject has been done and highlighted in this paper.

Keywords: *Innovations, Mathematics, Undergraduate, Syllabus enrichment, Oral Presentation*

Introduction

Mathematics, being an important subject and occupying a central position since the ancient period till date, has not been of interest to many students. The reason is mainly because while there is aspiration yet it is hard to achieve. Being highly abstract, it is concerned with ideas, which are interrelated, and with the

Sl. No 3.

2016 International Conference on Accessibility to Digital World (ICADW)

16-18 December, 2016

ICADW 2016

Venue: Assam Engineering College, Guwahati, Assam, India

Proceedings

Sponsored by: IEEE Kolkata Chapter, NORTH EASTERN COUNCIL, Oil India Limited, NVIDIA, ZALONI THE DATA LAKE COMPANY, STPI, NIELIT, NRL, Microsoft, Assam Science Technology and Environment Council, State Bank Of India

A Group-based Authentication Scheme for Vehicular Moving Networks

Probidita Roychoudhury
Dept. of CSE
National Institute of Technology
Meghalaya
Shillong, India
probidita.phukan@gmail.com

Basav Roychoudhury
Indian Institute of Management
Shillong
Shillong, Meghalaya
brc@iimshillong.ac.in

Dilip Kumar Saikia
Dept. of CSE
National Institute of Technology
Meghalaya
Shillong, India
dks@nitm.ac.in

***Abstract*—Uninterrupted mobile connectivity in fast moving public transportation systems like bus and train is difficult to achieve. Frequent handovers and security procedures for a large number of mobile users travelling together in these mass transportation systems can cause disruption in connectivity and signaling overload on the network. A possible solution to this problem is to group together all co-located users and perform a single authentication/handover procedure for the entire group. In this paper, the authors propose a lightweight, multi-layered, group based authentication protocol for a group of mobile users travelling in public transportation systems.**

Keywords*— *VMN, LTE, Authentication, Mobile Femtocell

I. Introduction

High speed mass transit systems like trains and buses ferry a large number of mobile users every day across locations. The high demand for wireless broadband services like online games, applications and others requires continuous connectivity. However, due to the high mobility of these vehicles together with the presence of a large number of users, procedures like authentication, handover etc. may become inefficient as compared to low mobility scenarios. Furthermore, the large numbers of passengers inside these vehicles increases the signaling overload on the network. Thus, there is a need for optimizing mobility management, security procedures etc. for these types of scenarios at the same time maintaining high level of security.

As per the security procedures of the Long Term Evolution-Advanced (LTE-A) , before an User Equipment (UE) can access the network, it has to perform mutual authentication and key agreement procedure, termed Evolved Packet System Authentication and Key Agreement (EPS-AKA), with the Home Subscriber Server (HSS) in the core network. On successful authentication, the UE and the Mobility Management Entity (MME) shares a secret symmetric session key. A single run of the protocol requires seven signaling message exchanges. Hence, for a large number of users in a vehicular Moving Network (VMN), the signaling overload on the Serving Network (SN) as well as Home Network (HN) will be very high. In this paper, the authors have put forth a scheme which tries to provide a solution to the above mentioned challenge by proposing a multi-layered group based authentication protocol which aims to reduce the signaling overload caused by multiple authentication requests sent at the same time by following a group-based approach.

While a lot of study is being undertaken to eliminate the delay due to handovers, there exists a research gap in finding optimization for the authentication procedure. This paper attempts to bridge this gap by proposing a lightweight, multi-layered, group based authentication mechanism for VMN with LTE-A as the backbone network. The main contributions of this paper are – introduction of a multi-layered approach for implementation of group based Authentication and Key Agreement (AKA) and introduction of integrity verification of authentication messages at multiple levels in the hierarchy to avoid batch re-authentication due to failures.

The rest of the paper is organized as follows – section II provides a brief introduction to background concepts and looks at some related works in literature; section III describes the system architecture and the proposed protocol. The performance analysis is presented in section IV while section V concludes the paper.

II. Background and Related Works

A. Vehicular Moving Network and Femtocell

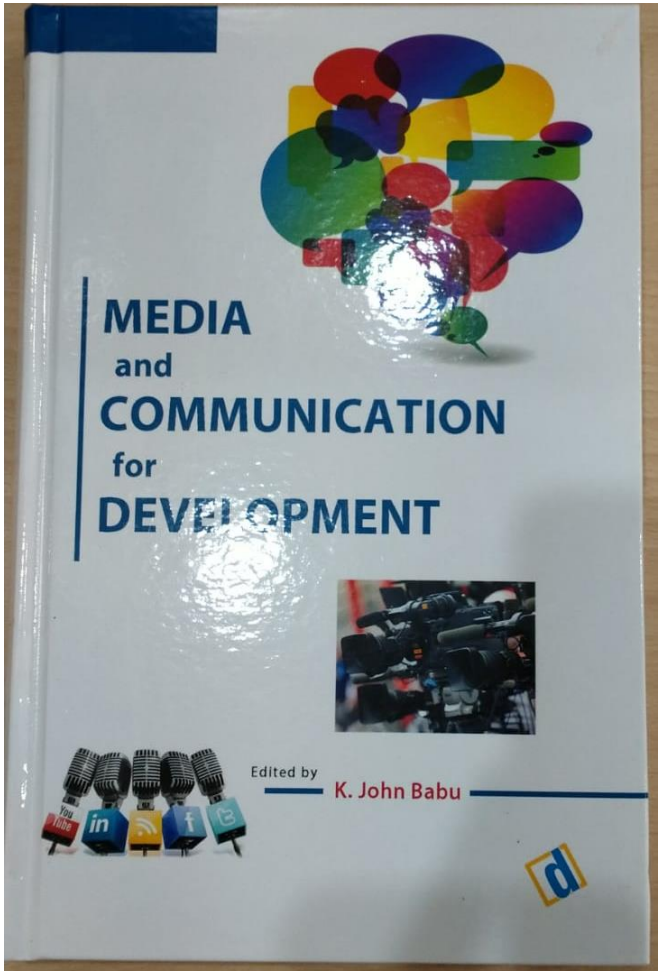
A VMN can be defined as a network of communicating nodes/UEs moving together in some public mass transit system like train or bus or even a private car.

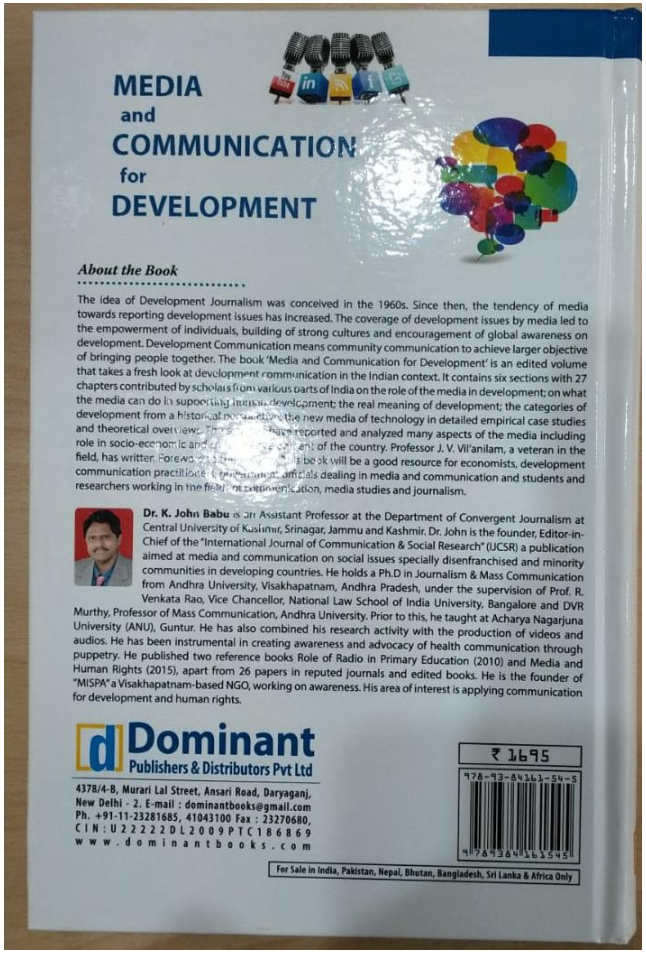
A femtocell is a small cell powered by a small, inexpensive and low-power base station- Home eNode B (HeNB) and is used in LTE-A to improve indoor cell reception. This is in contrast to macro-cell which is powered by the more powerful eNodeB (eNB). The UEs communicate with the HeNB using the cellular interface and the HeNB connects to the operator core network via the existing broadband line of the user. The research directions of future 5G cellular networks also advocate the use of small cells to handle massive cell densification as forecasted [1].

Several works exists specifically on group-based authentication in LTE-A. Multiple users are grouped together based on location; application etc. and the authentication procedure is performed for the group as a whole instead of individual users. This reduces the amount of signaling messages while ensuring that the same level of security as individual authentication is maintained. The existing schemes

978-1-5090-4291-3/16/$31.00 ©2016 IEEE

Sl. No 4.


MEDIA
and
COMMUNICATION
for
DEVELOPMENT
Edited by
K. John Babu


MEDIA
and
COMMUNICATION
for
DEVELOPMENT
About the Book
The idea of Development Journalism was conceived in the 1960s. Since then, the tendency of media towards reporting development issues has increased. The coverage of development issues by media led to the empowerment of individuals, building of strong cultures and encouragement of global awareness on development. Development Communication means community communication to achieve larger objective of bringing people together. The book 'Media and Communication for Development' is an edited volume that takes a fresh look at development communication in the Indian context. It contains six sections with 27 chapters contributed by scholars from various parts of India on the role of the media in development; on what the media can do in supporting human development; the real meaning of development; the categories of development from a historical perspective; the new media of technology in detailed empirical case studies and theoretical overviews. These ... have reported and analyzed many aspects of the media including role in socio-economic and ... ent of the country. Professor J. V. Vil'anilam, a veteran in the field, has written ... book will be a good resource for economists, development communication practitioners, ... officials dealing in media and communication and students and researchers working in the field of communication, media studies and journalism.
Dr. K. John Babu is an Assistant Professor at the Department of Convergent Journalism at Central University of Kashmir, Srinagar, Jammu and Kashmir. Dr. John is the founder, Editor-in-Chief of the "International Journal of Communication & Social Research" (IJCSR) a publication aimed at media and communication on social issues specially disenfranchised and minority communities in developing countries. He holds a Ph.D in Journalism & Mass Communication from Andhra University, Visakhapatnam, Andhra Pradesh, under the supervision of Prof. R. Venkata Rao, Vice Chancellor, National Law School of India University, Bangalore and DVR Murthy, Professor of Mass Communication, Andhra University. Prior to this, he taught at Acharya Nagarjuna University (ANU), Guntur. He has also combined his research activity with the production of videos and audios. He has been instrumental in creating awareness and advocacy of health communication through puppetry. He published two reference books Role of Radio in Primary Education (2010) and Media and Human Rights (2015), apart from 26 papers in reputed journals and edited books. He is the founder of "MISPA" a Visakhapatnam-based NGO, working on awareness. His area of interest is applying communication for development and human rights.
Dominant
Publishers & Distributors Pvt Ltd
4378/4-B, Murari Lal Street, Ansari Road, Daryaganj, New Delhi - 2. E-mail : dominantbooks@gmail.com
Ph. +91-11-23281685, 41043100 Fax : 23270680,
CIN : U22222DL2009PTC186869
www.dominantbooks.com
₹ 1695
978-93-84361-54-5
For Sale in India, Pakistan, Nepal, Bhutan, Bangladesh, Sri Lanka & Africa Only

CHAPTER 18

Social Media and Ethnic Identities—A Study on the Young Social Media Users in Shillong, Meghalaya

Rajani K. Chhetri

Social media is about people connecting people – make your band voice personable".—PRNews' best PR advice Book

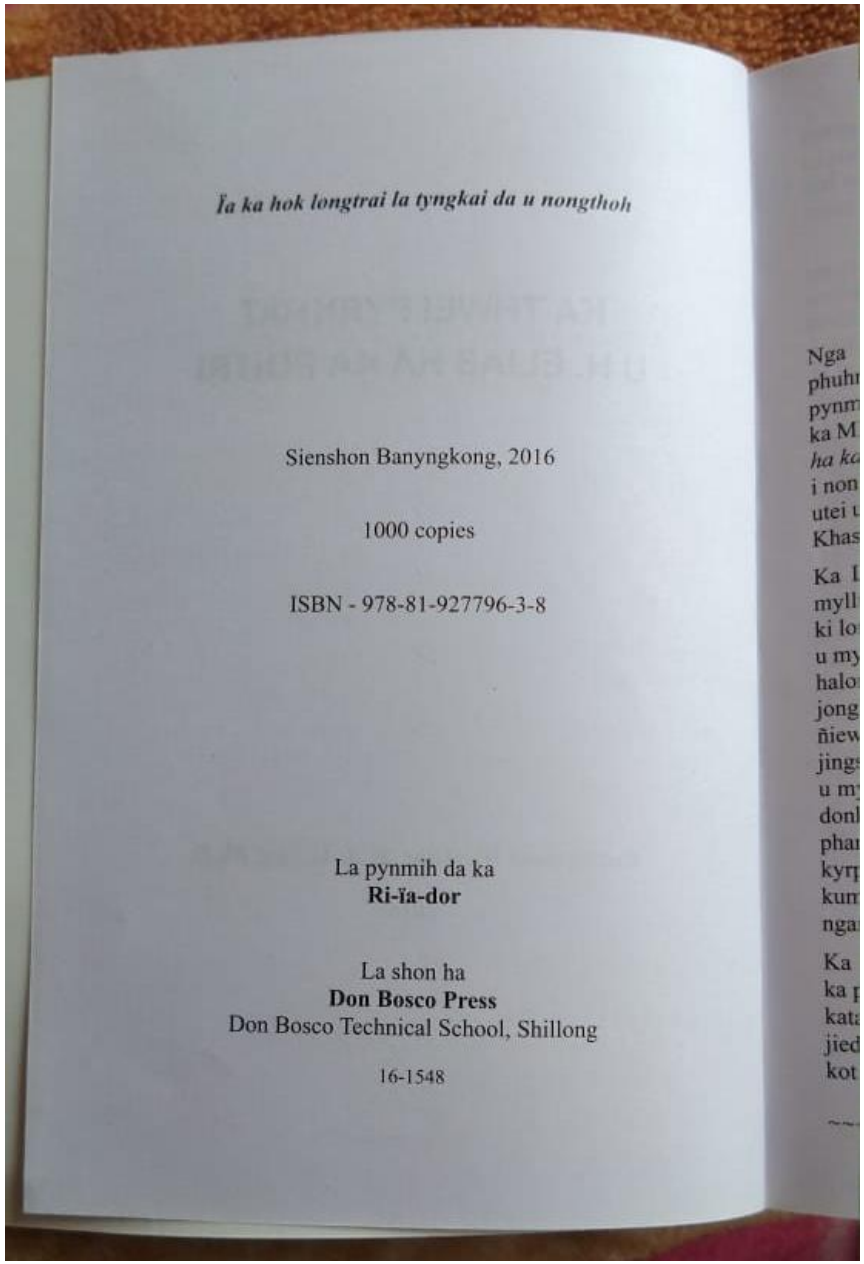
INTRODUCTION

India's northeast is magnificent. Sanjoy Hazarika, a noted academician, a writer and a filmmaker aptly captures all hues of northeast India in the following lines;

> *This is Asia in miniature, where the brown and yellow races meet and mingle, where communities and oral histories span national boundaries as seamlessly as the mountains and the forests run across them. You can be touched by its rivers, rain and mist, overwhelmed by its seeming gentleness and stirred by its powerful and evocative history. There are strength and fragility in its immense diversity — 350 communities in eight states with a population of about 35 million people- Communities with kin in neighboring countries.*

For several decades, northeast India has witnessed all forms of violence in the pretext of identity assertions, in fact the various autonomy movements led by Boros, Karbi's or the Khasi's draws its roots to identity-based purely on

Sl. No 5.



Ïa ka hok longtrai la tyngkai da u nongthoh

Sienshon Banyngkong, 2016

1000 copies

ISBN - 978-81-927796-3-8

La pynmih da ka
Ri-ïa-dor

La shon ha
Don Bosco Press
Don Bosco Technical School, Shillong

16-1548

2017 – 2018

Sl. No 6.

Recent Advances in Physics Research and its Relevance

Editors
Dr. Simanta Chutia
Dr. Shantu Saikia

Department of Physics
ST. ANTHONY'S COLLEGE
Shillong–793001, Meghalaya India

INDIA PUBLISHERS
EXCEL INDIA PUBLISHERS
NEW DELHI

Contents

First Impression: June, 2017

Recent Advances in Physics Research and its Relevance

ISBN: 978-93-86256-85-0

RECENT ADVANCES IN PHYSICS RESEARCH AND ITS RELEVANCE

Editors
Dr. Simanta Chetia
Dr. Shantu Saikia

Department of Physics
St. Anthony's College
Shillong-793001, Meghalaya

First Impression: June, 2017

Recent Advances in Physics Research and its Relevance

ISBN: 978-93-86256-85-0

DISCLAIMER

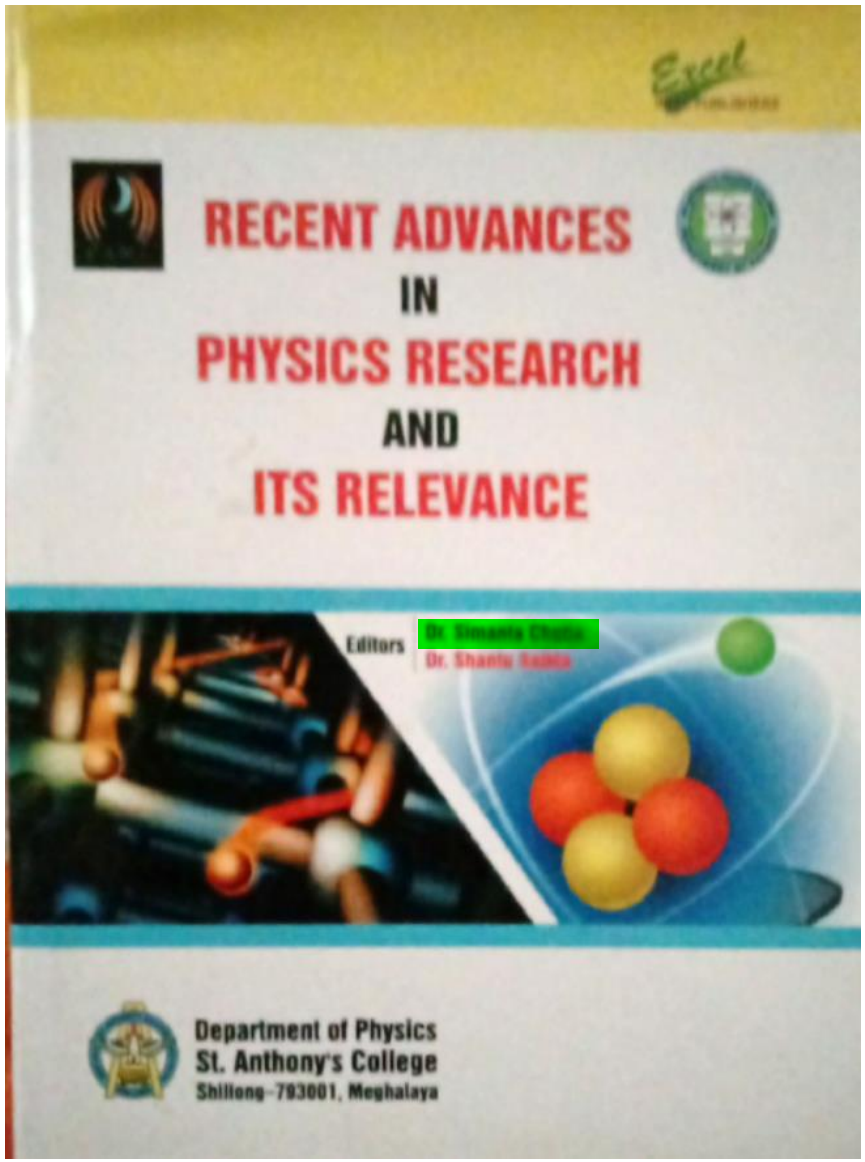
The authors are solely responsible for the contents of the papers compiled in this volume. The publishers or editors do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Published by
EXCEL INDIA PUBLISHERS
91 A, Ground Floor
Pratik Market, Munirka, New Delhi–110 067
Tel: +91-11-2671 1755/ 2755/ 3755/ 5755
Fax: +91-11-2671 6755
E-mail: publishing@groupexcelindia.com
Web: www.groupexcelindia.com

Typeset by
Excel Publishing Services, New Delhi–110 067
E-mail: production@groupexcelindia.com

Printed by
Excel Printing Universe, New Delhi–110 067
E-mail: printing@groupexcelindia.com

Sl. No 7.



First Impression: June, 2017

Recent Advances in Physics Research and Its Relevance

ISBN: 978-93-86256-85-0

DISCLAIMER

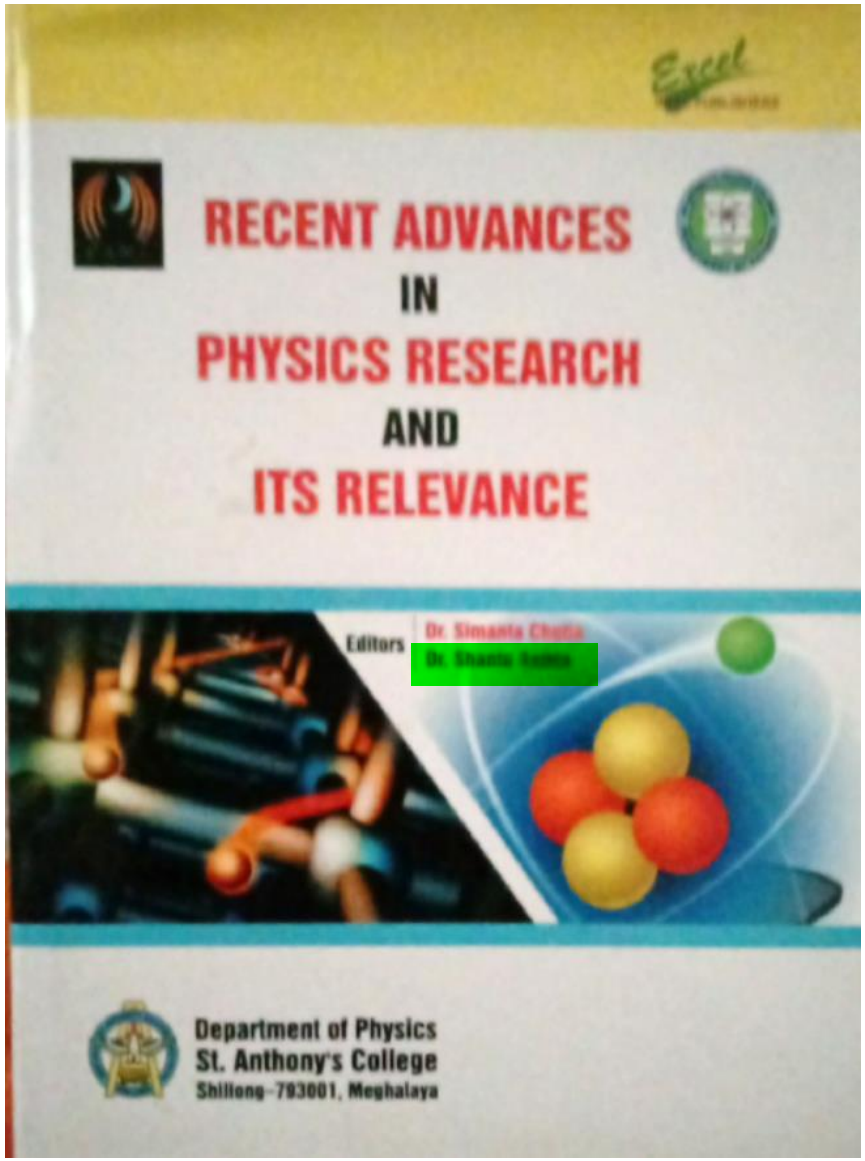
The authors are solely responsible for the contents of the papers compiled in this volume. The publishers or editors do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Published by
EXCEL INDIA PUBLISHERS
91 A, Ground Floor
Pratik Market, Munirka, New Delhi–110 067
Tel: +91-11-2671 1755/ 2755/ 3755/ 5755
Fax: +91-11-2671 6755
E-mail: publishing@groupexcelindia.com
Web: www.groupexcelindia.com

Typeset by
Excel Publishing Services, New Delhi–110 067
E-mail: production@groupexcelindia.com

Printed by
Excel Printing Universe, New Delhi–110 067
E-mail: printing@groupexcelindia.com

Sl. No 8.



First Impression: June, 2017

Recent Advances in Physics Research and its Relevance

ISBN: 978-93-86256-85-0

DISCLAIMER

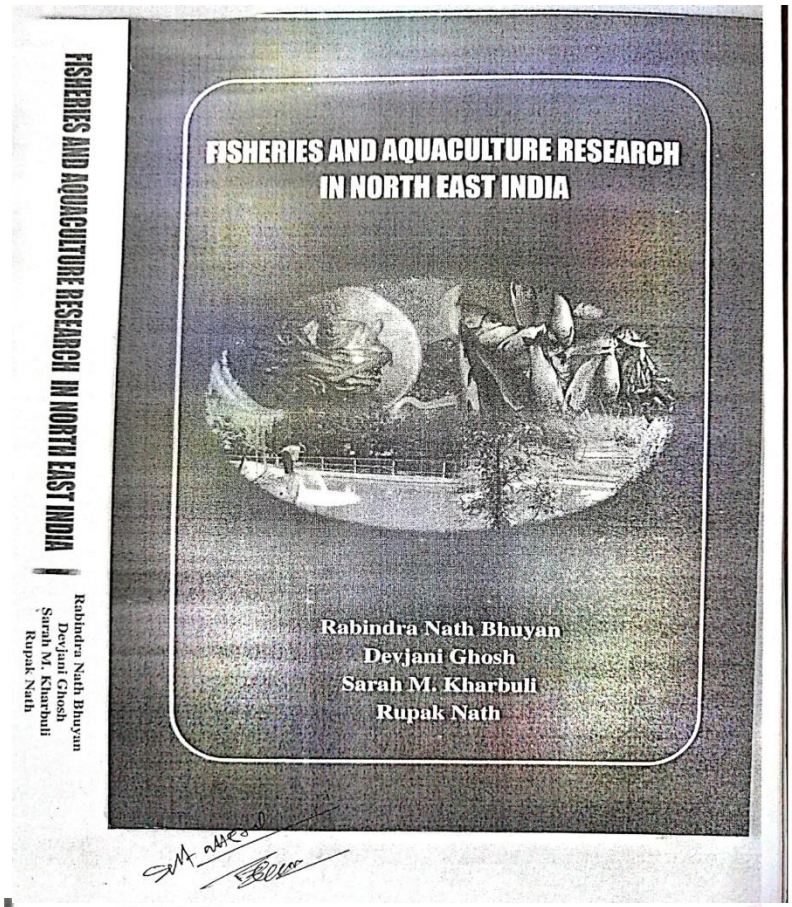
The authors are solely responsible for the contents of the papers compiled in this volume. The publishers or editors do not take any responsibility for the same in any manner. Errors, if any, are purely unintentional and readers are requested to communicate such errors to the editors or publishers to avoid discrepancies in future.

Published by
EXCEL INDIA PUBLISHERS
91 A, Ground Floor
Pratik Market, Munirka, New Delhi–110 067
Tel: +91-11-2671 1755/ 2755/ 3755/ 5755
Fax: +91-11-2671 6755
E-mail: publishing@groupexcelindia.com
Web: www.groupexcelindia.com

Typeset by
Excel Publishing Services, New Delhi–110 067
E-mail: production@groupexcelindia.com

Printed by
Excel Printing Universe, New Delhi–110 067
E-mail: printing@groupexcelindia.com

Sl. No 9.

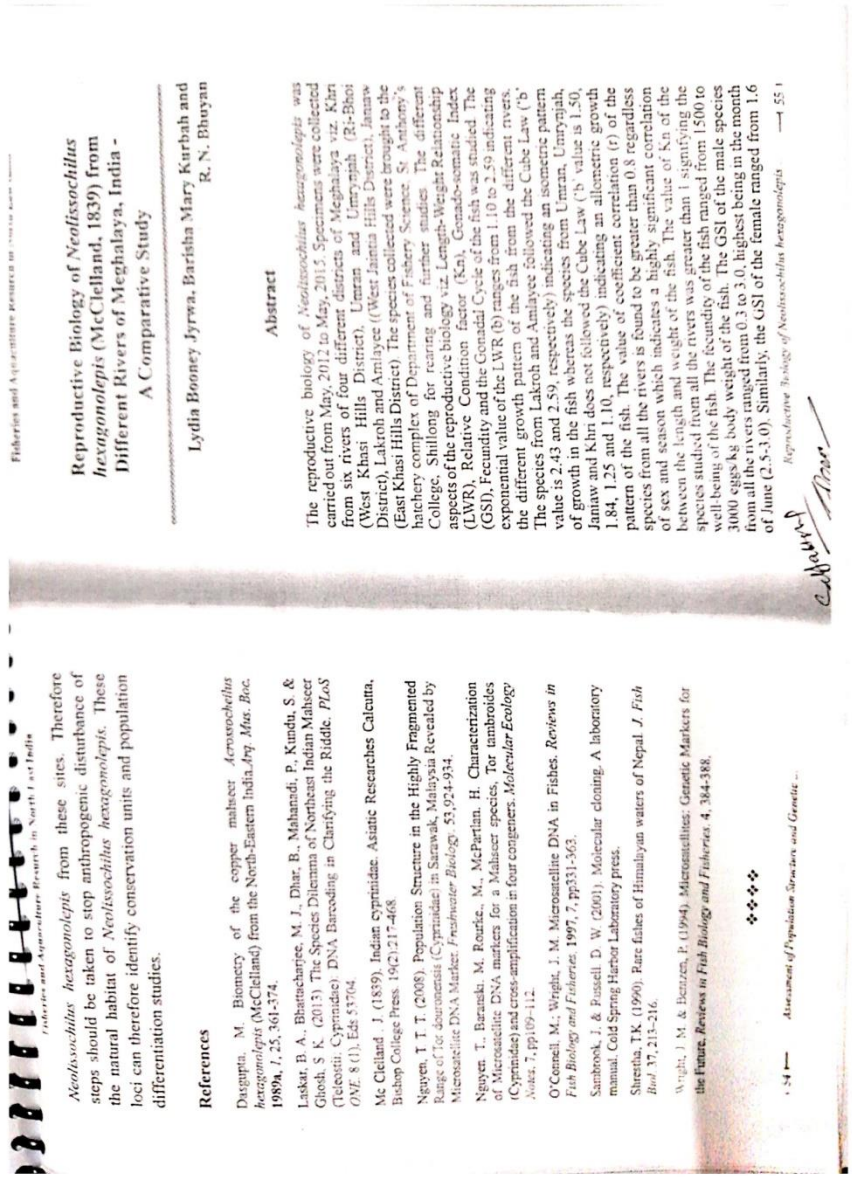


Published by
Department of Fishery Science

ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com
@SAC 2017

Printed at Ratna Printers, Shillong, Meghalaya (India)



Neolissochilus hexagonolepis from these sites. Therefore steps should be taken to stop anthropogenic disturbance of the natural habitat of *Neolissochilus hexagonolepis*. These loci can therefore identify conservation units and population differentiation studies.

References

Dasgupta, M. Biometry of the copper mahseer *Acrossocheilus hexagonolepis* (McClelland) from the North-Eastern India.*Arq. Mus. Boc.* **1989a**, *1*, *25*, 361-374.

Laskar, B. A., Bhattacharjee, M. J., Dhar, B., Mahanadi, P., Kundu, S. & Ghosh, S. K. (2013) The Species Dilemma of Northeast Indian Mahseer (Teleostii: Cyprinidae) DNA Barcoding in Clarifying the Riddle. *PLoS ONE*. 8 (1). Edt 53704

Mc Clelland J. (1839). Indian cyprinidae. Asiatic Researches Calcutta, Bishop College Press. 19(2):217-468

Nguyen, T T T. (2008). Population Structure in the Highly Fragmented Range of Tor douronensis (Cyprinidae) in Sarawak, Malaysia Revealed by Microsatellite DNA Marker. *Freshwater Biology*. 53,924-934.

Nguyen, T., Baranski, M., Rourke., M., McPartlan, H. Characterization of Microsatellite DNA markers for a Mahseer species, Tor tambroides (Cyprinidae) and cross-amplification in four congeners. *Molecular Ecology Notes*. 7, pp109-112.

O'Connell, M.; Wright, J. M. Microsatellite DNA in Fishes. *Reviews in Fish Biology and Fisheries*, **1997**, *7*, pp331-363.

Sambrook, J. & Russell, D. W. (2001). Molecular cloning. A laboratory manual. Cold Spring Harbor Laboratory press.

Shrestha, T.K. (1990). Rare fishes of Himalayan waters of Nepal. *J. Fish Bud* 37, 213-216.

Wright, J. M. & Bentzen, P. (1994). Microsatellites: Genetic Markers for the Future. *Reviews in Fish Biology and Fisheries*. 4, 384-388.

❖❖❖

Reproductive Biology of *Neolissochilus hexagonolepis* (McClelland, 1839) from Different Rivers of Meghalaya, India - A Comparative Study

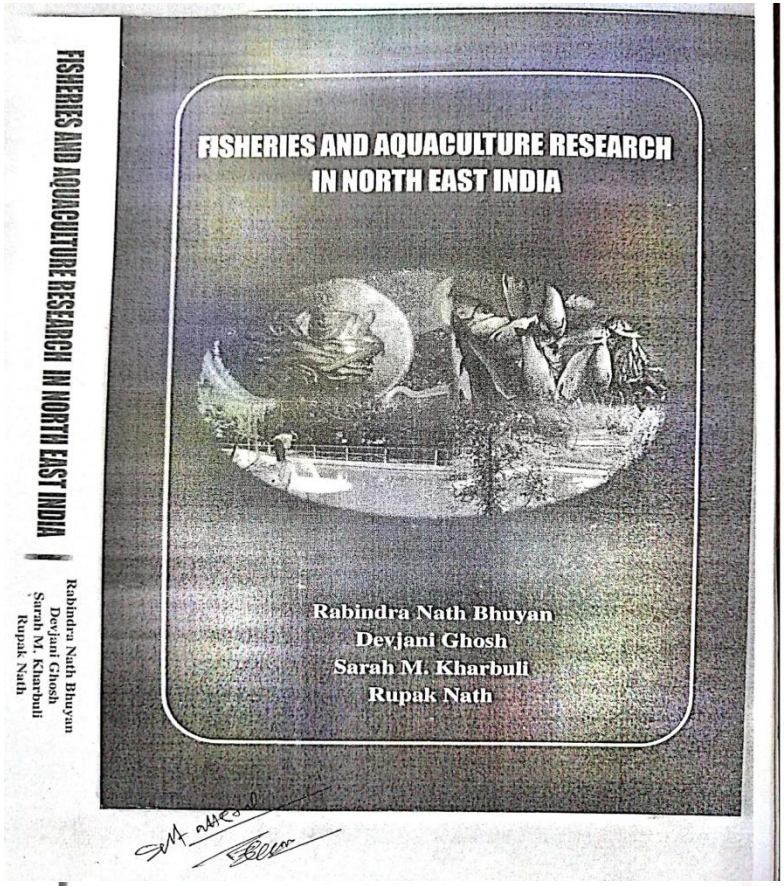
Lydia Booney Jyrwa, Barisha Mary Kurbah and R. N. Bhuyan

Abstract

The reproductive biology of *Neolissochilus hexagonolepis* was carried out from May, 2012 to May, 2015. Specimens were collected from six rivers of four different districts of Meghalaya viz. Khan (West Khasi Hills District), Umran and Umryiah (Ri-Bhoi District), Lakroh and Amlayee ((West Jaintia Hills District), Jantaw (East Khasi Hills District) The species collected were brought to the hatchery complex of Department of Fishery Science, St. Anthony's College, Shillong for rearing and further studies. The different aspects of the reproductive biology viz. Length-Weight Relationship (LWR), Relative Condition factor (Kn), Gonado-somatic Index (GSI), Fecundity and the Gonadal Cycle of the fish was studied. The exponential value of the LWR (b) ranges from 1.10 to 2.59 indicating the different growth pattern of the fish from the different rivers. The species from Lakroh and Amlayee followed the Cube Law ('b' value is 2.43 and 2.59, respectively) indicating an isometric pattern of growth in the fish whereas the species from Umran, Umryiah, Jantaw and Khri does not followed the Cube Law ('b' value is 1.50, 1.84, 1.25 and 1.10, respectively) indicating an allometric growth pattern of the fish. The value of coefficient correlation (r) of the species from all the rivers is found to be greater than 0.8 regardless of sex and season which indicates a highly significant correlation between the length and weight of the fish. The value of Kn of the species studied from all the rivers was greater than 1 signifying the well being of the fish. The fecundity of the fish ranged from 1500 to 3000 eggs/kg body weight of the fish. The GSI of the male species from all the rivers ranged from 0.3 to 3.0, highest being in the month of June (2.5-3.0). Similarly, the GSI of the female ranged from 1.6

CONTENTS

Sl. No 10.



Published by
Department of Fishery Science

ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com

Printed at Ratna Printers, Shillong, Meghalaya (India)

Bhuiyan A S & Haque S (1984) cannibalistic food habit of G.giuris (Ham.) in relation to its size and sex: Bangladesh Journal of Zoology 12, 111-113

Doha S (1974). Investigation into the biology of goby *Glossogobius giuris* (Ham-Buch). Bangladesh J. Zool. 2(2): 95-106

Dasgupta M. (2002). Morphometric of alimentary canal of some freshwater fishes of West Bengal in relation to their food and feeding habits. Indian J. Fish 49(4): 461-464

Islam M.N. (2004) Eco-biology of freshwater gobi, *G. giuris* (Ham.) of the river Padma in relation to fishery: a review of Biological sciences 4(6): 780-793

Kovacic M.(2007). Reproductive biology of the striped goby, *Gobius vittatus* (Gobiidae) in the Nothern Adriatic Sea. Sci. MAR. 71(11): 145-151

Le-Cren E.D (1951). The length- weight relationship and seasonal cycle in gonad weight and condition in perch. Journal of Animal Ecology 20: 201-219

Rao S. & L.M Rao. (2007). Sex ratio, fecundity, maturity and spawning details of *G. giuris* (Hamilton) from Gosthani Estuary near Visakhapatnam. J. Life Sci., 1: 16-29

Roy, Sulistiono & Rao (2014). Fecundity and gonadosomatic index of *G. giuris* (Ham.) from Pinya river, Patuakhali, Bangladesh. Journal of fisheries 2(2): 141-147

Tandon K.K (1962) studied on the biology of *G. giuris* (Ham.), Res. Bull. Punjab Univ. Bill-IV. 257-262.

❖❖❖❖

Assessment of Population Structure and Genetic Diversity of Chocolate Mahseer (*Neolissochilus hexagonolepis*, McClelland, 1839) in Selected Water Bodies of Meghalaya using Microsatellite Markers

Raffealla Nongrum, M. A. Laskar and R.N. Bhuyan

Abstract

Present study therefore an attempt has been made to explore different rivers for the presence of *Neolissochilus hexagonolepis* and to study the population structure of *Neolissochilus* by using microsatellite molecular markers. Fish specimens collected were also sent to ZSI (Zoological Survey of India), Shillong for species conformation.

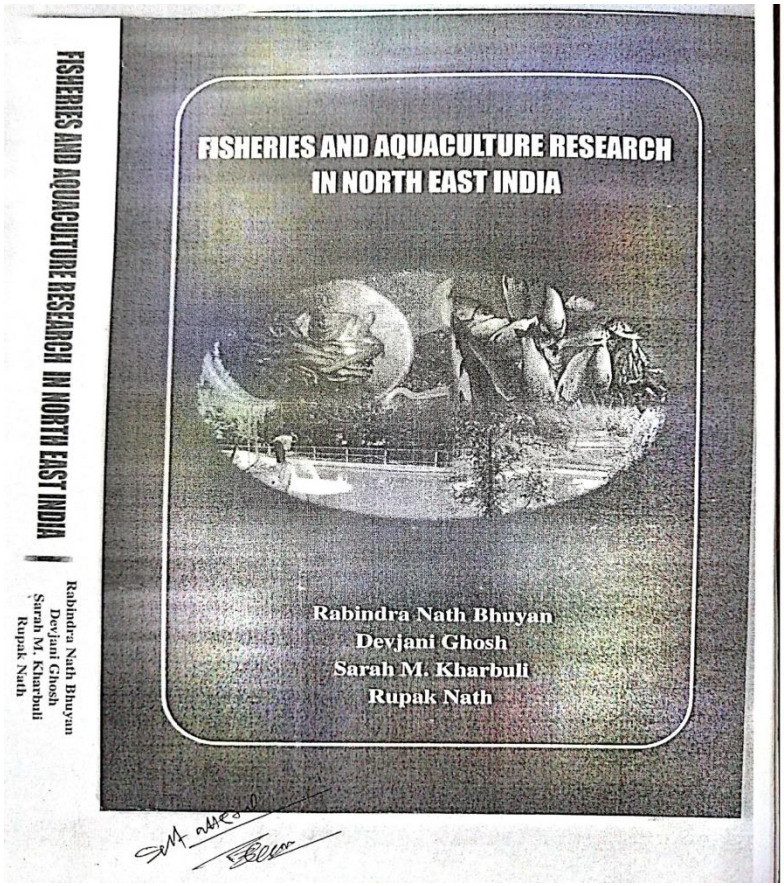
Key words: Population Structure, Genetic Diversity *Neolissochilus hexagonolepis*, Microsatellite Markers

Introduction

Neolissochilus, *Tor* and *Naziritor* belong to a group of cyprinid fish called Mahseers. These fish are large scale barbels and are found in upstream, clean and fast flowing rivers (Shrestha, 1990). In North East India, Laskar *et al.*, (2013) reported the presence of *Neolissochilus hexastichus* in river Diyung. Assam of North East India. In Meghalaya, there have been no reports on the presence of *Neolissochilus hexastichus* but the

CONTENTS

Sl. No 11.



Published by
Department of Fishery Science

ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com

Printed at Ratna Printers, Shillong, Meghalaya (India)

Histopathology of Gills of Common carp (*Cyprinus carpio* L.) inhabiting Umiam Reservoir in Meghalaya

Bashida Massar

Abstract

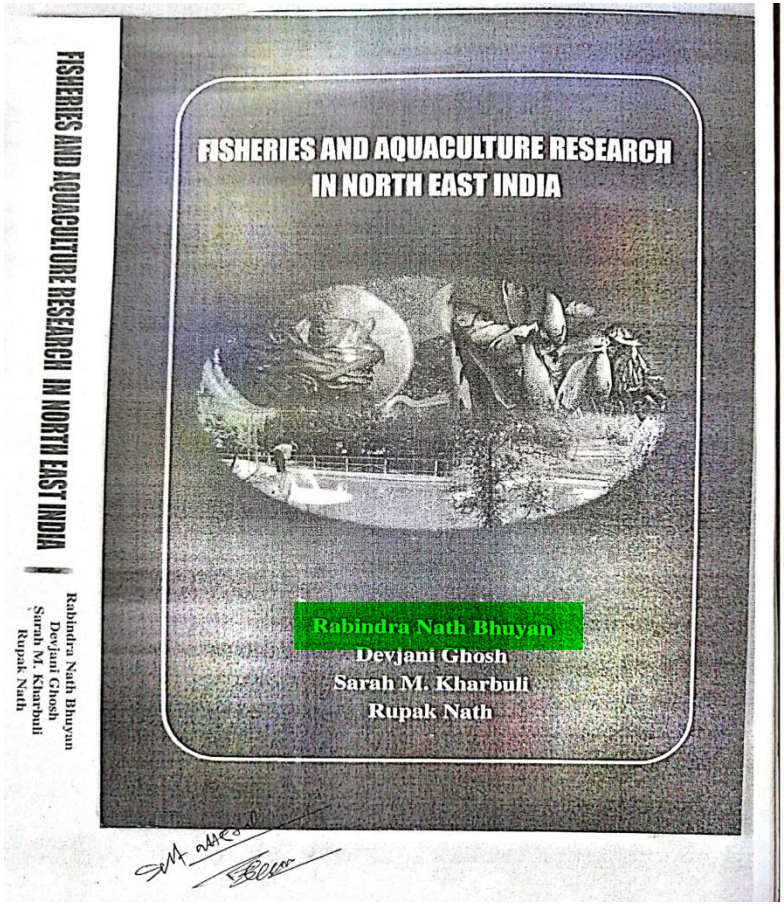
Organs and tissues respond to stimuli, either physiological or pathological, in various ways, many of which can be identified and studied by histology. The present study highlights the histopathological changes observed in the gills of common carp inhabiting a polluted Umiam reservoir through light microscopy. Anomalies observed in the gills are hyperplasia, hypertrophy of the epithelial cells, lifting of the lamellar epithelium, fusion of the lamellae, disorganized pillar cells, lamellar aneurysms and hemorrhages. All these histological abnormalities in the gill of fish are discussed with the help of relevant literature.

Key words: Histopathology; *Cyprinus carpio* Umiam; Reservoir; Gills; Lamellae

Introduction

Histopathological changes have been widely used as biomarkers in the evaluation of the health of fish exposed to contaminants, both in the laboratory (Wester & Canton, 1992; Thophon *et al.*, 2004) and field studies (Hinton *et al.*, 1992; Teh *et al.*, 1997). These morphological changes can provide the clues necessary to establish a diagnosis (Morrison *et al.*, 2010), and also help to identify target organs of toxicity and mechanism of action (Wester *et al.*, 2002).

Sl. No 12.



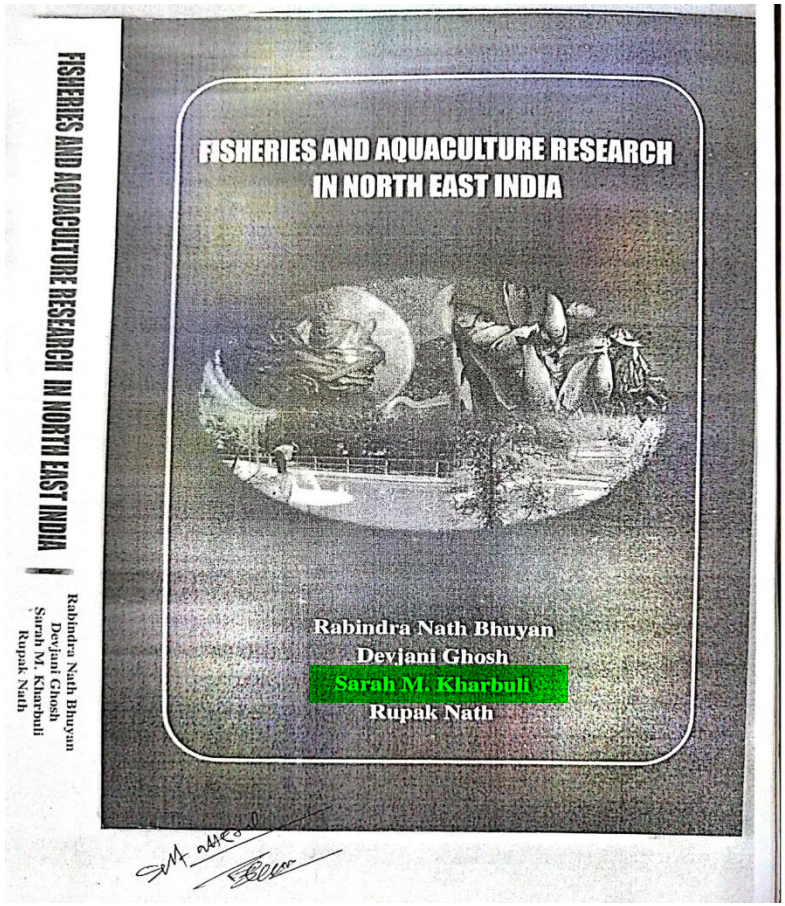
Published by
Department of Fishery Science

ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com
@SAC 2017

Printed at Ratna Printers, Shillong, Meghalaya (India)

Sl. No. 13.



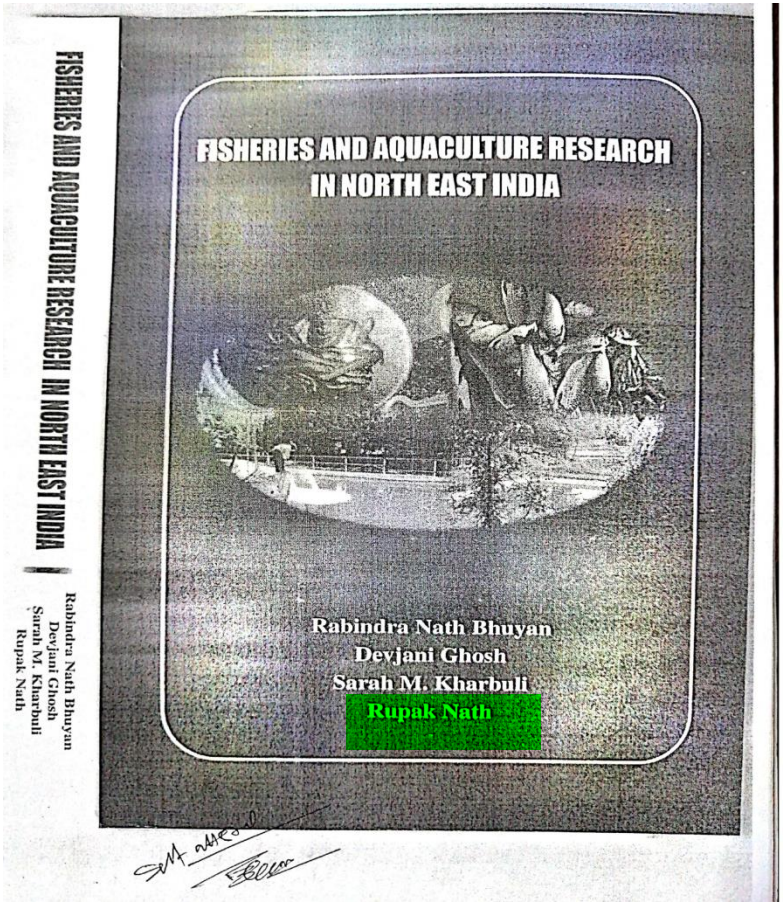
Published by
Department of Fishery Science

ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com
@SAC 2017

Printed at Ratna Printers, Shillong, Meghalaya (India)

Sl. No. 14.



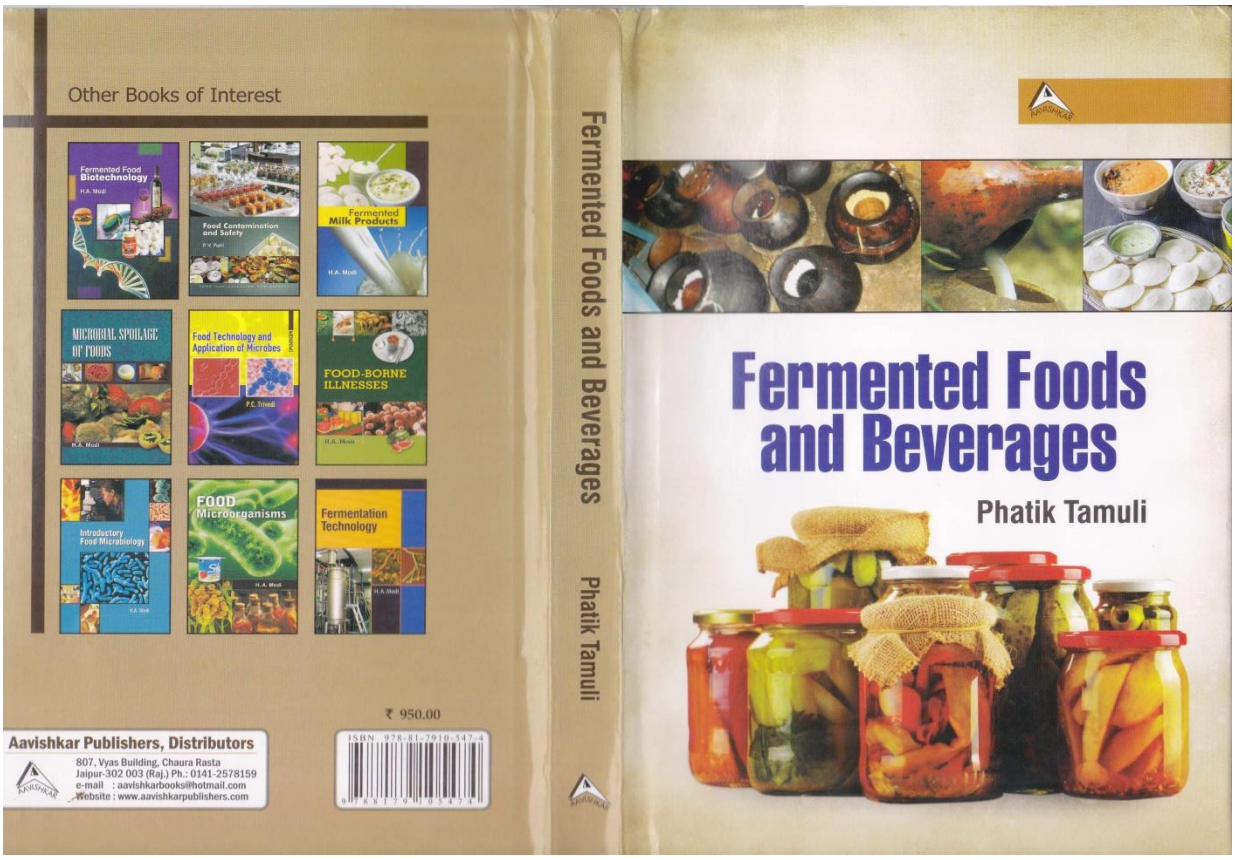
Published by
Department of Fishery Science

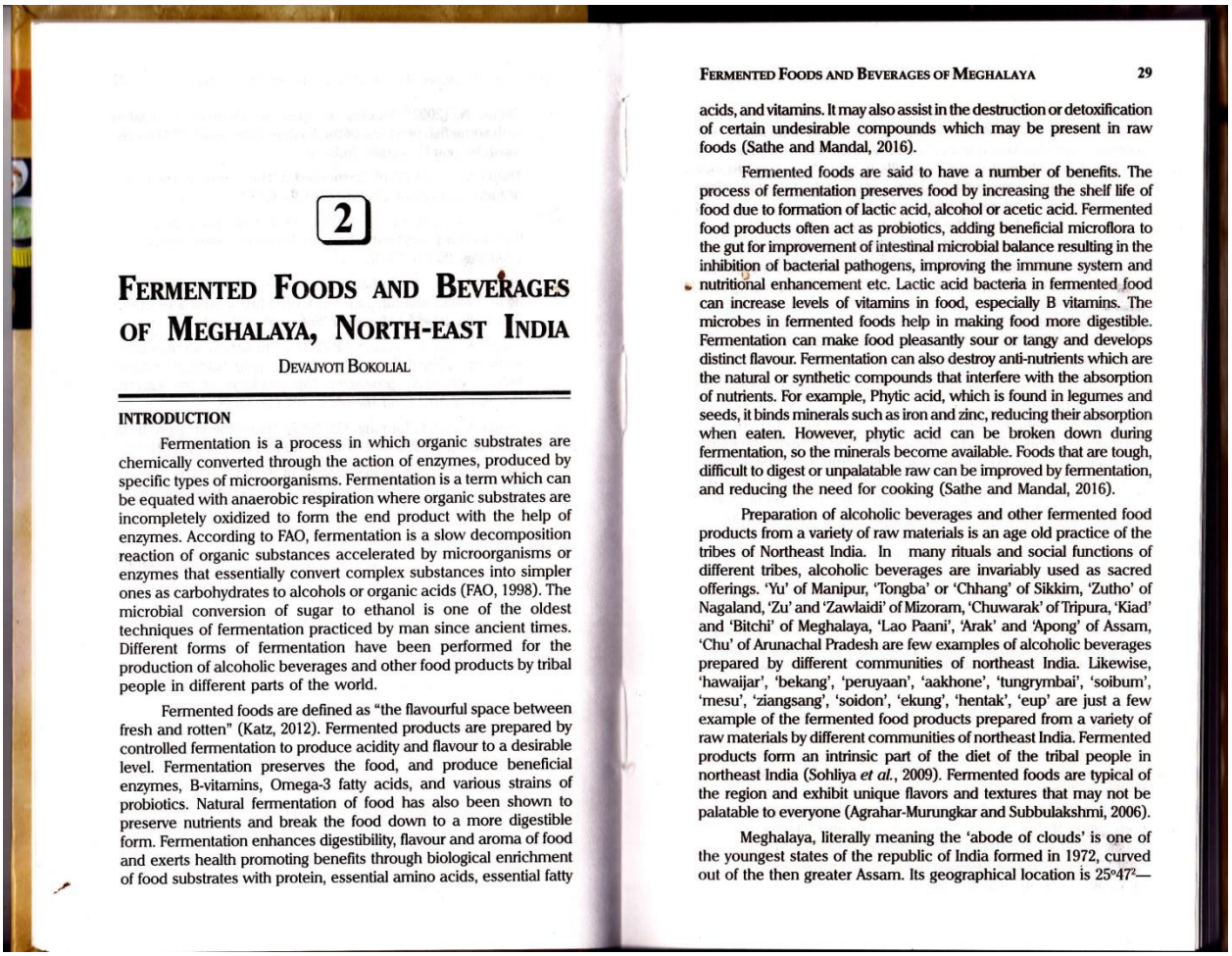
ISBN 978-0-00-000978-4

1st Edition: 2017
ISBN NO
978-000000-978-4
Department of Fishery Science
St. Anthony's College, Shillong
Email: fisheryscience@gmail.com
@SAC 2017

Printed at Ratna Printers, Shillong, Meghalaya (India)

Sl. No. 15.





2

Fermented Foods and Beverages of Meghalaya, North-east India

Devajyoti Bokolial

INTRODUCTION

Fermentation is a process in which organic substrates are chemically converted through the action of enzymes, produced by specific types of microorganisms. Fermentation is a term which can be equated with anaerobic respiration where organic substrates are incompletely oxidized to form the end product with the help of enzymes. According to FAO, fermentation is a slow decomposition reaction of organic substances accelerated by microorganisms or enzymes that essentially convert complex substances into simpler ones as carbohydrates to alcohols or organic acids (FAO, 1998). The microbial conversion of sugar to ethanol is one of the oldest techniques of fermentation practiced by man since ancient times. Different forms of fermentation have been performed for the production of alcoholic beverages and other food products by tribal people in different parts of the world.

Fermented foods are defined as "the flavourful space between fresh and rotten" (Katz, 2012). Fermented products are prepared by controlled fermentation to produce acidity and flavour to a desirable level. Fermentation preserves the food, and produce beneficial enzymes, B-vitamins, Omega-3 fatty acids, and various strains of probiotics. Natural fermentation of food has also been shown to preserve nutrients and break the food down to a more digestible form. Fermentation enhances digestibility, flavour and aroma of food and exerts health promoting benefits through biological enrichment of food substrates with protein, essential amino acids, essential fatty

acids, and vitamins. It may also assist in the destruction or detoxification of certain undesirable compounds which may be present in raw foods (Sathe and Mandal, 2016).

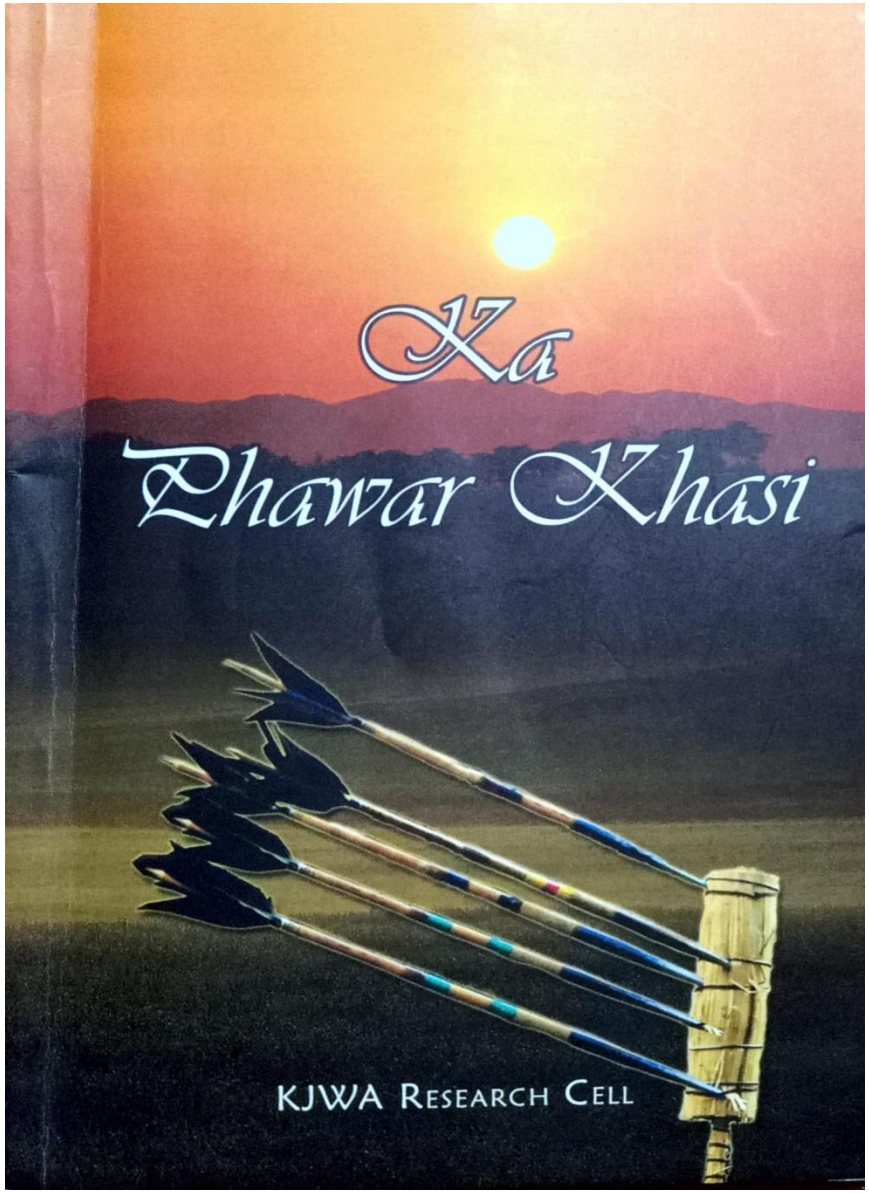
Fermented foods are said to have a number of benefits. The process of fermentation preserves food by increasing the shelf life of food due to formation of lactic acid, alcohol or acetic acid. Fermented food products often act as probiotics, adding beneficial microflora to the gut for improvement of intestinal microbial balance resulting in the inhibition of bacterial pathogens, improving the immune system and nutritional enhancement etc. Lactic acid bacteria in fermented food can increase levels of vitamins in food, especially B vitamins. The microbes in fermented foods help in making food more digestible. Fermentation can make food pleasantly sour or tangy and develops distinct flavour. Fermentation can also destroy anti-nutrients which are the natural or synthetic compounds that interfere with the absorption of nutrients. For example, Phytic acid, which is found in legumes and seeds, it binds minerals such as iron and zinc, reducing their absorption when eaten. However, phytic acid can be broken down during fermentation, so the minerals become available. Foods that are tough, difficult to digest or unpalatable raw can be improved by fermentation, and reducing the need for cooking (Sathe and Mandal, 2016).

Preparation of alcoholic beverages and other fermented food products from a variety of raw materials is an age old practice of the tribes of Northeast India. In many rituals and social functions of different tribes, alcoholic beverages are invariably used as sacred offerings. 'Yu' of Manipur, 'Tongba' or 'Chhang' of Sikkim, 'Zutho' of Nagaland, 'Zu' and 'Zawlaidi' of Mizoram, 'Chuwarak' of Tripura, 'Kiad' and 'Bitchi' of Meghalaya, 'Lao Paani', 'Arak' and 'Apong' of Assam, 'Chu' of Arunachal Pradesh are few examples of alcoholic beverages prepared by different communities of northeast India. Likewise, 'hawaijar', 'bekang', 'peruyaan', 'aakhone', 'tungrymbai', 'soibum', 'mesu', 'ziangsang', 'soidon', 'ekung', 'hentak', 'eup' are just a few example of the fermented food products prepared from a variety of raw materials by different communities of northeast India. Fermented products form an intrinsic part of the diet of the tribal people in northeast India (Sohliya *et al.*, 2009). Fermented foods are typical of the region and exhibit unique flavors and textures that may not be palatable to everyone (Agrahar-Murungkar and Subbulakshmi, 2006).

Meghalaya, literally meaning the 'abode of clouds' is one of the youngest states of the republic of India formed in 1972, curved out of the then greater Assam. Its geographical location is 25°47²—

CONTENTS

Sl. No. 16.



KI PHANG PDENG HA KA PHAWAR KHASI: KI BARIM

Thomlin Lynshing

Ka Maitphang

Ka jaitbynriew Khasi ka long ka bariewspah bha ha ka liang jong ki puriskam, ki khanatang, ki khanapateng, khana-donnam, ki jingrwai bad kiwei kiwei. Kine baroh ki sdang bad ki hiar pateng ha ka dur ki jingïathuh , ki jingrwai, ki jingkren syllok bad ki jingthnum kñia, kaba ki pyndonkam tang da ka ktien. Namarkata, ka atiar ba kongsan tam ba la pyndonkam ban saiñdur bad seng nongrim ïa ki jait jingïathuh khana bad ki jait jingrwai bapher bapher dei da ka ktien. Bad kine baroh ki hiar pateng, ki im bad ki longdoh longsnam ha ka jaitbynriew lyngba ka ktien, dei tat ynda la ïoh ïa ka thoh ka pule ba la lah ban lum ban lang ïa kine ki jingïathuh bad jingrwai bad ban buh ha ki thup jingthoh. Ka Phawar ka long [32]

Sl. No. 17.

KA PHAWAR BAD KI JAIT PHAWAR

Thomlin Lynshing
Khasi Department
At. Anthony's College, Shillong

U Khasi u sngewthuh bad shemphang ba tang ka put ka tem kam biang kam pura ka niam ka rukom, ka phur-ka-siang, ka rong-ka-taw, ka shad ka kmen, donkam ruh ïa ka rwai ka kynud, kumta sa mih ka rwai ka phawar ha ki khep bad ki por bapher bapher. Kum ka jaitbynriew ngi kiba riewspah bha ha ka liang jong ki puriskam, ki khanatang, ki khanapateng/khana-donnam, ki jingrwai bad kiwei kiwei. Kine baroh ki sdang bad ki hiar pateng ha ka dur ki jingïathuh, ki jingrwai, ki jingkren syllok bad ki jingthnum kñia, kaba ki pyndonkam tang da ka ktien. Namarkata, ka atiar ba kongsan tam ba la pyndonkam ban saiñdur bad seng nongrim ïa ki jait jingïathuh khana bad ki jait jingrwai bapher bapher dei da ka ktien. Bad kine baroh ki hiar pateng, ki im bad ki longdoh longsnam ha ka jaitbynriew lyngba ka ktien, dei tat ynda la ïoh ïa ka thoh ka pule ba la lah ban lum ban lang ïa kine ki jingïathuh bad jingrwai bad ban buh ha ki thup jingthoh. Ka Phawar ka long kawei na ki jingrwai ba ju kynduh ha ki khep bad ki lat ne tamasa bapher bapher.

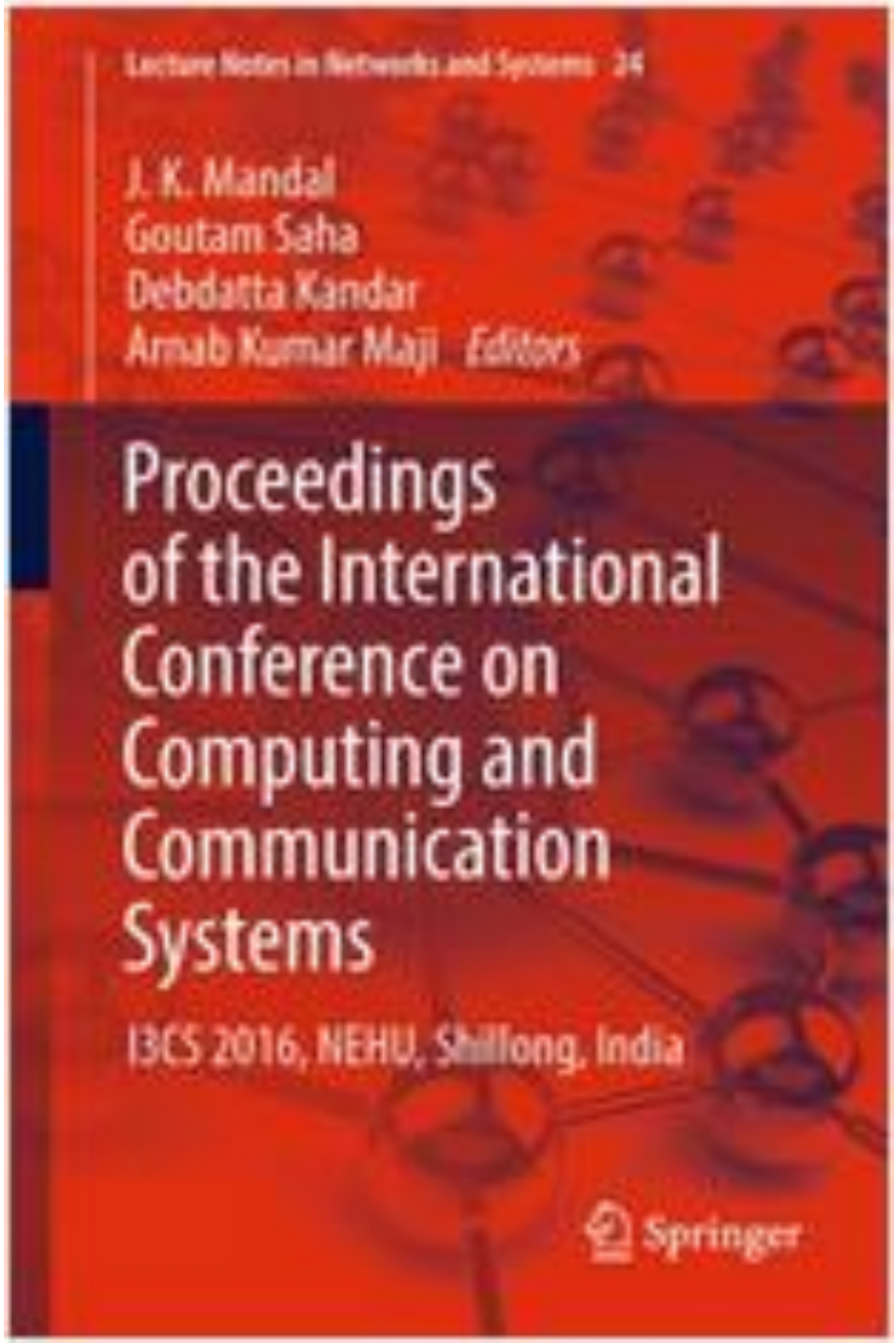
Ka Phawar ka dei ka rukom jingrwai poitri tynrai jong ki Khasi, ïa kaba u la saiñdur ha ka rukom jingkynud sur ne

KI SKER

Bynta I

Bynta II

Sl. No. 18.



Lecture Notes in Networks and Systems

Volume 24

Series editor

Janusz Kacprzyk, Polish Academy of Sciences, Warsaw, Poland
e-mail: kacprzyk@ibspan.waw.pl

J. K. Mandal · Goutam Saha
Debdatta Kandar · Arnab Kumar Maji
Editors

Proceedings of the International Conference on Computing and Communication Systems

I3CS 2016, NEHU, Shillong, India

Editors
J. K. Mandal
Department of Computer Science and Engineering
University of Kalyani
Kalyani, West Bengal
India

Goutam Saha
Department of Information Technology
North-Eastern Hill University
Shillong, Meghalaya
India

Debdatta Kandar
Department of Information Technology
North-Eastern Hill University
Shillong, Meghalaya
India

Arnab Kumar Maji
Department of Information Technology
North-Eastern Hill University
Shillong, Meghalaya
India

ISSN 2367-3370 ISSN 2367-3389 (electronic)
Lecture Notes in Networks and Systems
ISBN 978-981-10-6889-8 ISBN 978-981-10-6890-4 (eBook)
https://doi.org/10.1007/978-981-10-6890-4

Library of Congress Control Number: 2017958721

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer Nature Singapore Pte Ltd.
The registered company address is: 152 Beach Road, #21-01/04 Gateway East, Singapore 189721, Singapore

Springer

Contents

Sl. No. 19.

CYCLIC VOLTAMMETRY STUDIES OF COPPER AND CADMIUM PORPHYRINS

A.Murugan[1], V. Thandiayyakone[2] and Mithun Chakrabarty[3]
[1]Department of Chemistry, North Eastern Regional Institute of Science and Technology (Deemed University)
Nrijuli – 791109, Arunachal Pradesh
[2]Science and Humanities, P.A.C. Ramasamy Raja polytechnic college, Rajapalayam, Tamil Nadu
[3]Department of Chemistry, St. Anthony's College, Shillong- 793001, Meghalaya
Email: amu@nerist.ac.in

Abstract

The ligands meso-5,10,15,20-Tetrakis(2,5-dimethoxyphenyl)porphyrin, [T(2,5-$(OCH_3)_2$)PP] and meso-5,10,15,20-Tetrakis (o-nitrophenyl) porphyrin [T(*o*-NO_2)PP] were prepared according to literature procedure. Copper and cadmium porphyrin were prepared with the above mentioned ligands [T(2,5-$(OCH_3)_2$)PP] and [T(*o*-NO_2)PP] according to a procedure described in previously published papers. Formation of porphyrins and its metalloporphyrins were confirmed by UV-visible spectrophotometic studies Redox potential of the metallophorphyrins were measured using Cyclic Voltammetry (CV). The present study of Cd[T(2,5-$(OCH_3)_2$)PP] indicated that no redox processes occur at the metal center and the redox processes occur at the ligand. The complex Cu[T(2,5-$(OCH_3)_2$)PP] shows lowering in the oxidation potentials due to the presence of electron donating group(-OCH_3). On the other hand Cu[T(*o*-NO_2)PP] show increase in the oxidation potentials due to the presence of electron withdrawing group(-NO_2). It is suggested that the variations in the oxidation potentials of copper porphyrin may also be dependent on the ligand structural ruffling.

Keywords: cadmium porphyrin, copper porphyrin and cyclic voltammetry.

1. Introduction

The tern "porphyrin" is derived from the Greek word *porphura* which means purple color. In earlier days, due to their colors, the porphyrins were usually used as pigments. One of the characteristics that make porphyrins special is that they are associated with blood, and many of the redox enzymes involved in various metabolic processes. The main function of porphyrins in nature is to bind metal atoms, which act as centers for significant biochemical process[1]. Metalloporphyrins are found to be present in plants and animals. Hemoproteins ,vitamin B12, and nickel porphyrins are found to work in biological processes while other metalloporphyrins have been used to study essential reactivity and functional relationships[2,3,4]. Most of electrochemistry of metalloporphyrins has been found to be dependent on either the nature of the central metal ion or the on the nature of the macrocyclic ligand containing conjugated π system. However, electrochemistry of metalloporphyrins can be influenced by the structural factors related to the number and type of substituents attached to the macrocycle or to the number of axial ligands bound to the central metal ion[5]. Cyclic voltammetric data of 5,10,15,20 -tetra(N-ethyl-3-carbazolyl) porphyrin complex, [CuTECP] illustrates two oxidation processes at 0.875 V and 1.248 V vs. S.C.E and is attributed to two successive one-electron oxidations. The presence of electron donating group in [CuTECP] enhances oxidation and inhibits reduction[6]. Cyclic voltammetric studies indicate that the copper porphyrin undergoes an irreversible electron transfer in cathodic region and quasireversible electron transfer in the anodic region[7]. The ferrocenyl groups of CuII(Fc_2Ph_2P) has undergone oxidation more easily via a single two-electron quasi-reversible process[8]. The cyclic voltammetric studies of the heterogeneous electron transfer of CdTPP at the nitrobenzene/water interface indicated that one electron transfer was involved in this process[9]. The present work was carried out because of very limited data availability for cyclic voltammetic studies of copper and cadmium porphyrin.

Sl. No. 20.

Climate Change and Developing Countries

Edited by

Banshaikupar Lyngdoh Mawlong

Cambridge Scholars Publishing

ISBN (10): 1-5275-1174-X
ISBN (13): 978-1-5275-1174-3

CHAPTER THIRTEEN

IMPACT OF CLIMATE CHANGE ON THE RURAL LIVELIHOOD IN MEGHALAYA

PYNSHONGDOR L. NONGBRI[1]

1. Introduction

Climate change has become a global concern, especially since the international forums (UNFCC, COP 13, IPCC, and FAO) urged us to take immediate collaborative actions to meet the challenges of climate change. Climate change contributes to increase frequency and severity of disasters with adverse impacts on humans, natural ecosystem and quality of human survival. Following any disaster, the poor suffer from malnutrition as they fail to procure food (crop loss/damage, high price of essentials, etc.). Deforestation, over-fishing, over-grazing, salt build-up, water-borne diseases from irrigation, endangered wildlife from loss of habitat, loss of genetic diversity, water pollution, air pollution and climate change - all have impacts on food production, lives and livelihood of the people of Meghalaya, India.

Meghalaya is a part of the region that has been designated as one of the eight Global Biodiversity Hotspots - the Indo-Burma Hotspot, containing high biodiversity and endemism. Meghalaya has a geographical position that favors immigration and introduction of different species. Thus more than 35% of the Indian mammal species are found in the state apart from the vast richness of plant species. Traditionally, people of Meghalaya have always recognized the natural wealth it has been bestowed upon; the presence of Sacred Groves - for setting aside natural areas – is an example of the integration of the concept of ecological sustainability into the culture of human communities.

[1] Assistant Professor, St. Anthony's College, Shillong, India

Contents

Climate Change and Developing Countries

Edited by Banshaikupar Lyngdoh Mawlong

This book first published 2018

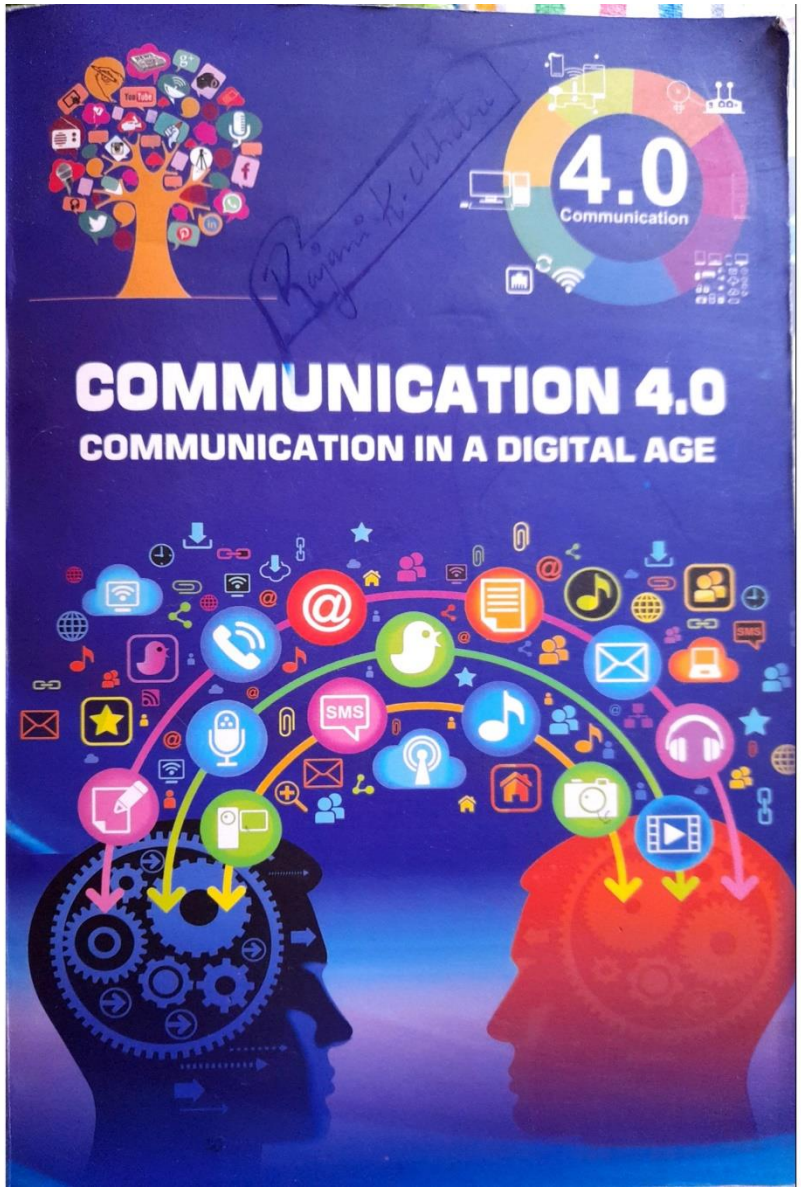
Cambridge Scholars Publishing

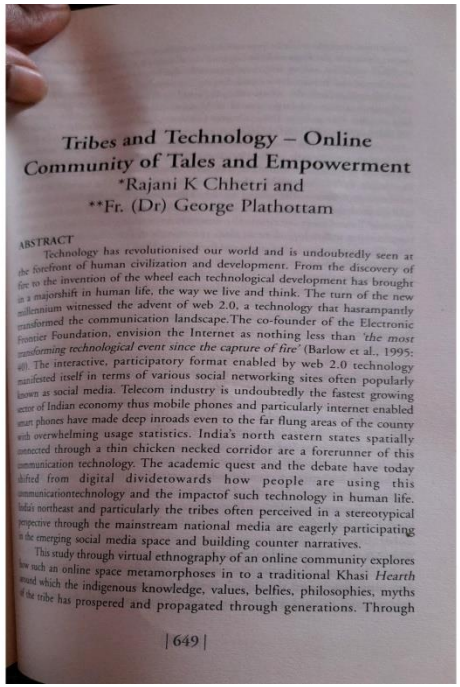
Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

ISBN (10): 1-5275-1174-X
ISBN (13): 978-1-5275-1174-3

Sl. No. 21.





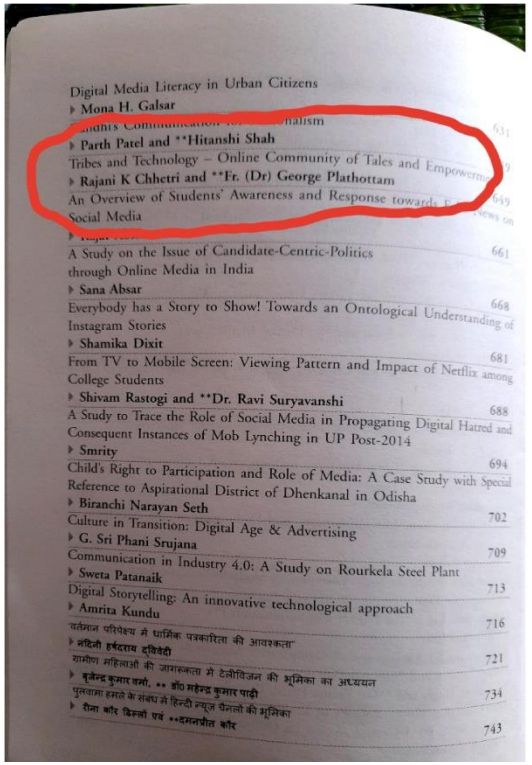
Tribes and Technology – Online Community of Tales and Empowerment

*Rajani K Chhetri and
**Fr. (Dr) George Plathottam

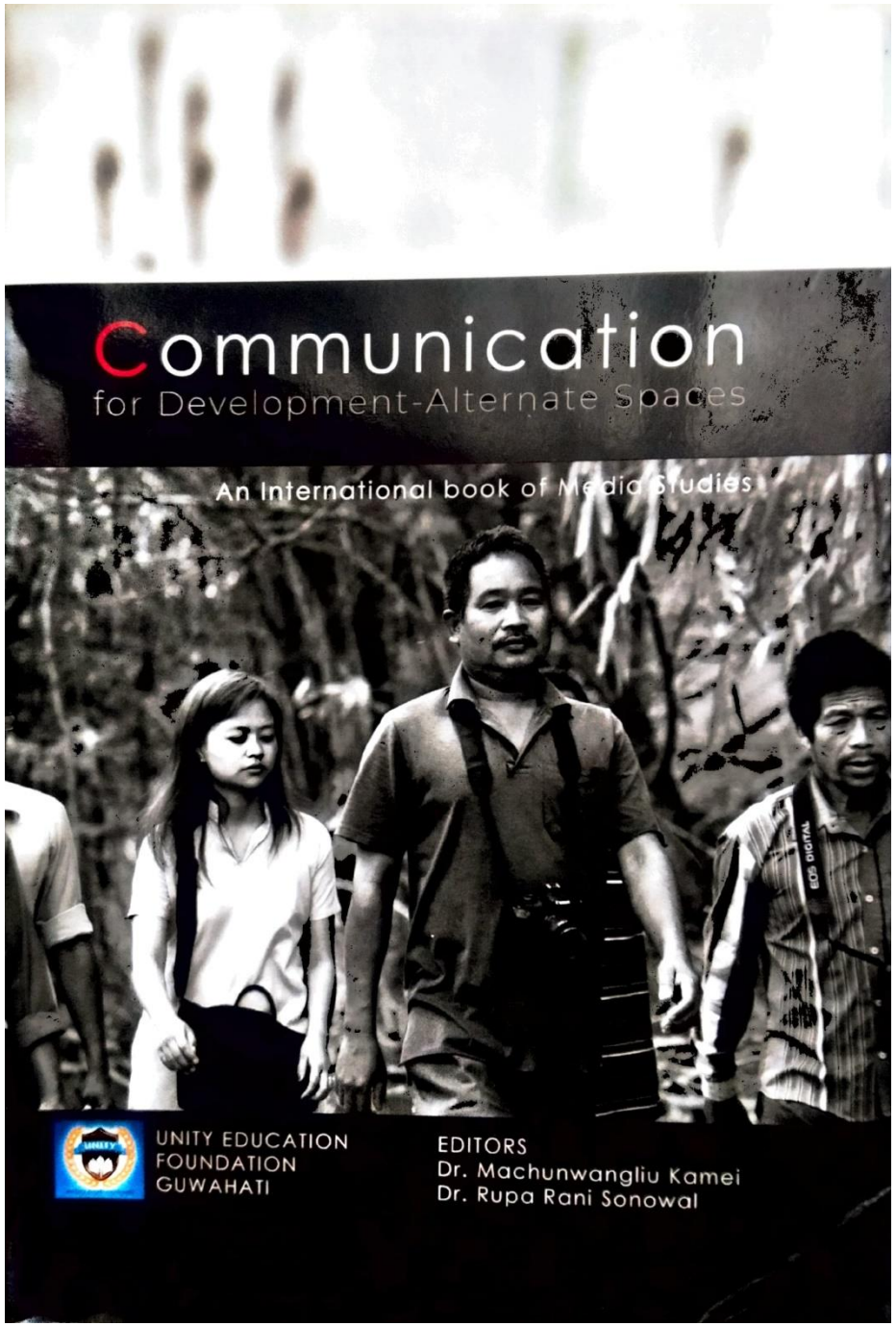
ABSTRACT

Technology has revolutionised our world and is undoubtedly seen at the forefront of human civilization and development. From the discovery of fire to the invention of the wheel each technological development has brought in a majorshift in human life, the way we live and think. The turn of the new millennium witnessed the advent of web 2.0, a technology that hasrampantly transformed the communication landscape.The co-founder of the Electronic Frontier Foundation, envision the Internet as nothing less than *'the most transforming technological event since the capture of fire'* (Barlow et al., 1995: 40). The interactive, participatory format enabled by web 2.0 technology manifested itself in terms of various social networking sites often popularly known as social media. Telecom industry is undoubtedly the fastest growing sector of Indian economy thus mobile phones and particularly internet enabled smart phones have made deep inroads even to the far flung areas of the county with overwhelming usage statistics. India's north eastern states spatially connected through a thin chicken necked corridor are a forerunner of this communication technology. The academic quest and the debate have today shifted from digital dividetowards how people are using this communicationtechnology and the impactof such technology in human life. India's northeast and particularly the tribes often perceived in a stereotypical perspective through the mainstream national media are eagerly participating in the emerging social media space and building counter narratives.

This study through virtual ethnography of an online community explores how such an online space metamorphoses in to a traditional Khasi *Hearth* around which the indigenous knowledge, values, belfies, philosophies, myths of the tribe has prospered and propagated through generations. Through



Sl. No. 22.



CONTENTS

ANALYSIS OF THE FILM MANIK RAITONG: VOGLER'S CAMPBELLIAN APPROACH

Dr.Etawanda Saiborne
Associate Professor
Mass Media Department,
St.Anthony's College
Shillong-1

Abstract

The concept of the *monomyth* is a universal pattern that is found in almost all folk narrative .The monomyth is the thread of commonality that runs through almost all myths; the structure that all hero-quests are built around. Campbell found that irrespective of the culture or geographical origin of the myth, the narrative conformed to his prescribed monomyth formula. In short, all tales are the same, but retold in an infinite number of ways and all heroes are but one – the hero with a thousand faces.

The work presented in this paper seeks to examine the Khasi film Manik Raitong in parallel with Joseph Cambell's The Hero with a Thousand Faces, emphasising on Vogler's treatment of the *monomyth* better known as the Hero's Journey. Using Christopher Vogler, modified The Hero's Journey the author applied it in order to recognize the functioning of narratives in the film *Manik Raitong*.

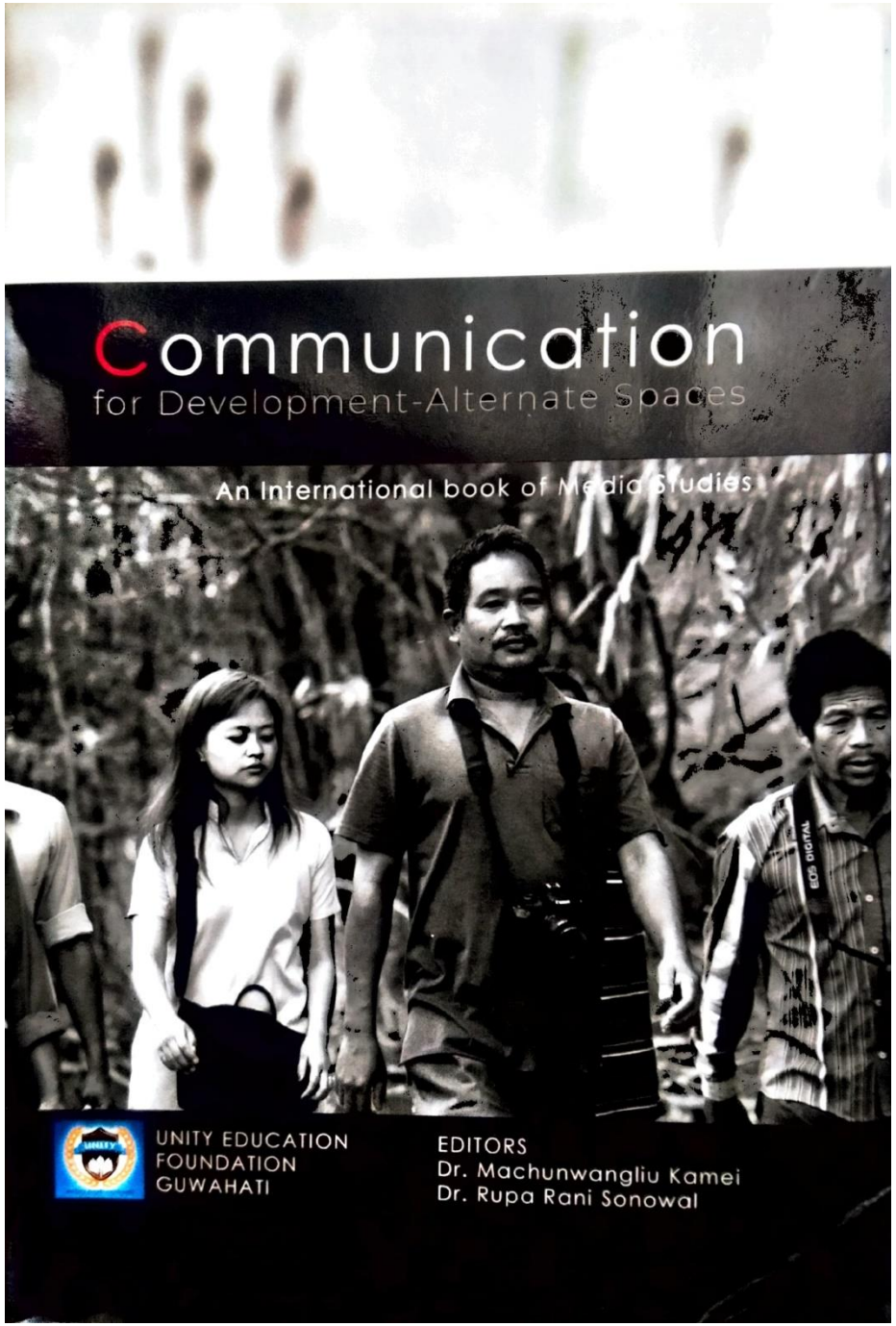
Keywords: Monomyth, narratives, hero, mentor, journey.

I. Introduction

The great American Mythological scholar Joseph Campbell in books such as *The Hero With a Thousand Faces* (2008), and *The Power of Myth* (1991) stated the resultant findings of his studies of myths, legends and folk narratives of various cultures had led him to believe that The Hero's Journey is a pattern that is universal to all myths. With this

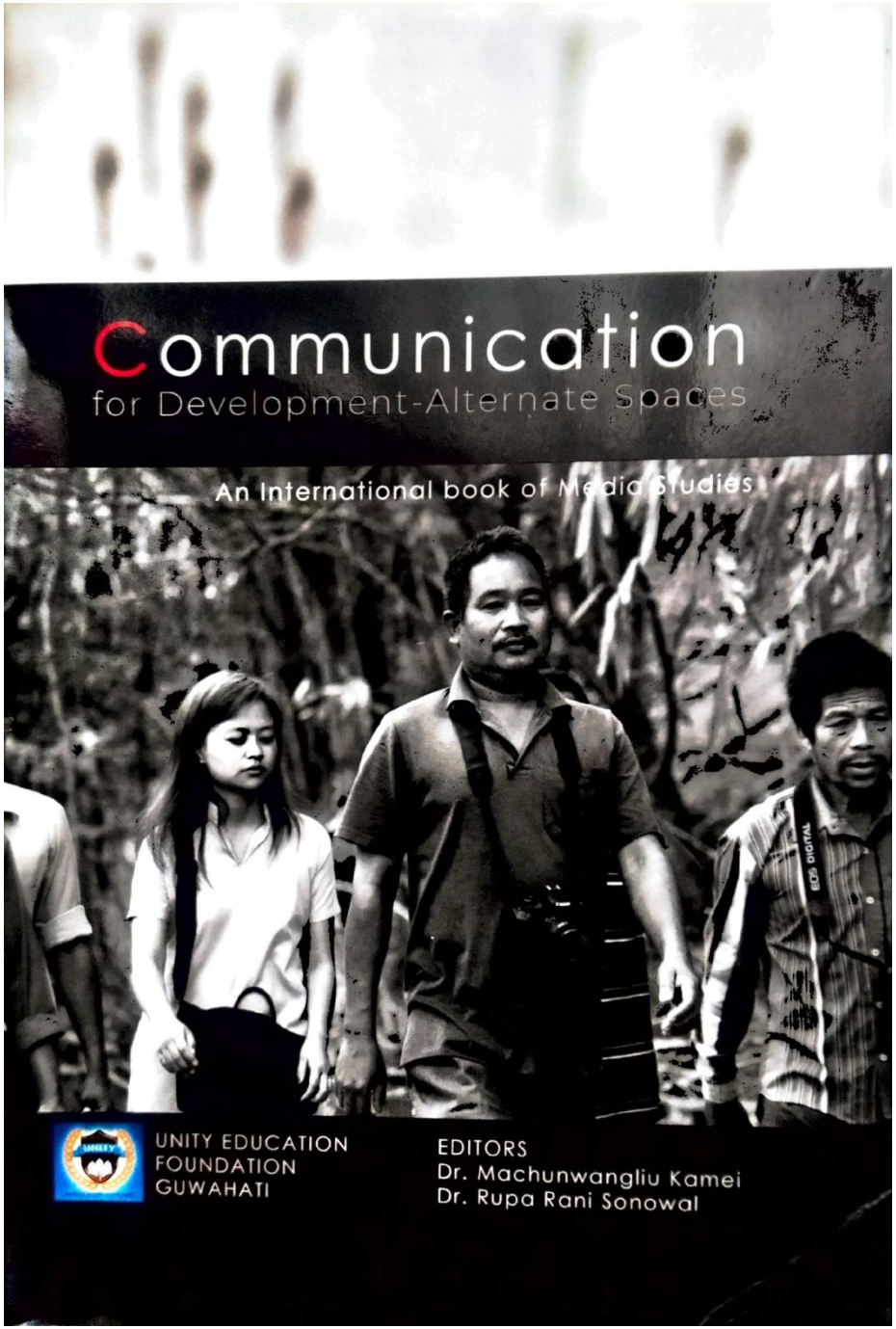
ISBN 978-93-88129-10-7

Sl. No. 23.



CONTENTS

Sl. No. 24.



CONTENTS

Sl. No. 25.

5th National Conference on

Technologically Important Crystalline and Amorphous Solids (TICAS-2019)

5th & 6th April 2019

Sponsored by CSIR

DEPARTMENT OF PHYSICS
School of Advanced Science
Kalasalingam Academy of Research and Education
(Deemed to be University)
(Under Sec. 3 of UGC Act 1956)
(Accredited by NAAC with A Grade)
Anand Nagar, Krishnankoil – 626 126
Srivilliputtur (via), Virudhunagar (Dt.), Tamil Nadu
Ph: 04563-289042, Fax: 04563-289322, www.kalasalingam.ac.in

CYCLIC VOLTAMMETRIC STUDIES OF VANADYL PORPHYRIN

A. Murugan[1], Mithun Chakrabarty[2] and V. Thandiayyakone[3]
[1]Department of Chemistry, North Eastern Regional Institute of Science and Technology, Nirjuli-791109, Arunachal Pradesh
[2]Department of Chemistry, St. Anthony's College, Shillong-793001, Meghalaya
[3]Science and Humanities, P.A.C. Ramasamy Raja Polytechnic College, Rajapalayam, Tamil Nadu

Email: amu@nerist.ac.in

Abstract

The ligand meso-5,10,15,20-Tetrakis(*o*-nitrophenyl)porphyrin, [T(*o*-NO_2)PP] and its vanadyl metal complex [VO[T(*o*-NO_2)PP] were synthesized and Vanadyl meso-5,10,15,20-Tetrakis(pyridyl)porphyrin VO[TpyP] was prepared from meso-5,10,15,20-Tetrakis (pyridyl)porphyrin [TpyP]. Formation of the vanadyl porphyrin complexes was confirmed by UV-visible spectrophotometer. Oxidation potential of the metallophorphyrins were recorded by cyclic voltammetry (CV). The present studies of [VO[T(*o*-NO_2)PP] and VO[TpyP] reveals that they undergoes two successive oxidation processes.

Keywords: Vanadyl porphyrin cyclic voltammetry

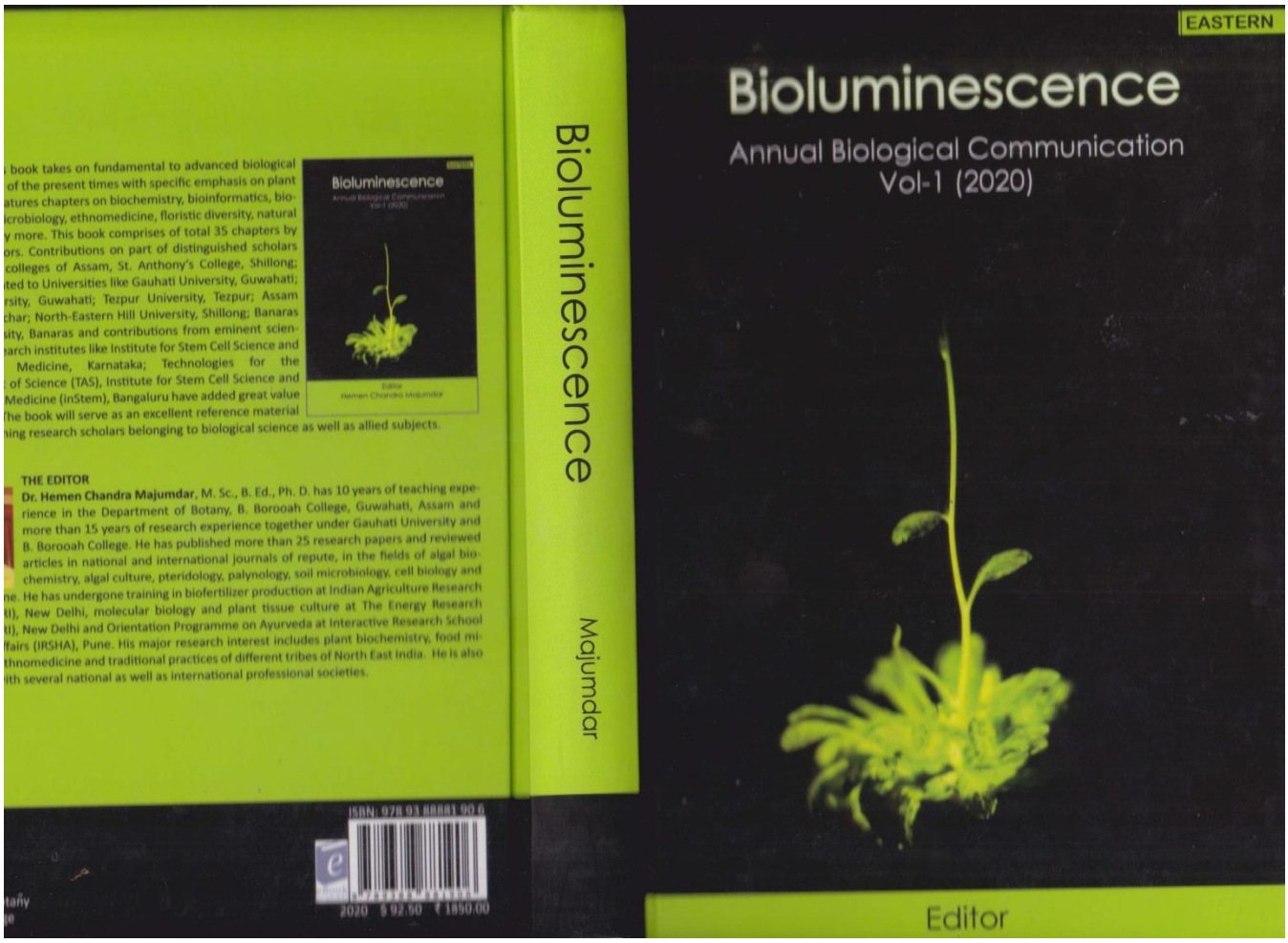
1. Introduction

Proteins and enzymes are formed form metal complexes of porphyrins and related compounds. They are found to work as redox and rearrangement catalysts[1]. The involvement of metalloporphyrins in electron transport in biological systems has made the study of electrochemical properties of particular interest. Both the central metal atoms and the porphyrin ring are electroactive center. The function of the metal present in the chlorophyll is found to change the properties of porphyrin ring reactions through electron transfer. But in the case of cytochromes metal atom is not involved in electron transfer process[2]. Cyclic voltammetric studies have shown some considerable change in the oxidation potentials. Electrophilic substitutions in the exo-positions of the pyrrole ring shift the oxidation potentials to higher side. Substitution in the phenyl ring with electron withdrawing substituents is found to shift the oxidation potentials to higher side, while substitution with electron donating group in the phenyl ring lowers the oxidation potentials.

Oxidation of Ni(T(*p*-X)PP) where X = -CH_3, -$COOCH_3$ -NO_2 in dichloromethane are reported in the literature[3]. Ni(T(p- CH_3)PP) was found to exhibit a single oxidation at 1.00V and 1.20V while Ni(T(p- $COOCH_3$)PP) exhibit only a single oxidation at 1.17V. The peak current of the later indicated two electron transfer processess. For Ni(T(*p*- NO_2)PP) all peaks were found to be shifted anodically. The shift in the first oxidation was found to be more than for the second oxidation. Ni(T(*p*-X)PP), X = electron donating or weak electron- withdrawing group exhibited two separate oxidations, while for compounds containing X = strong electro withdrawing group exhibited only a single oxidation. The first oxidation of Ni(T(*p*- CH_3)PP) in dichloromethane yielded a brown colour solution which corresponds to $[Ni(II)TPP]^+$. Removal of the second electron yielded a green coloured solution. Electrochemical oxidation of MnTPPCl, Mn[T(*p*-OCH_3)PP] and Mn(OEP)Cl have been reported[4-6]. The one electron oxidation product for each of the system [~1.1 V Vs SCE] have been reported.

Normally, metal $d_{xy}/d_{x^2-y^2}$-porphyrin (a_{1u})/(a_{2u}) interaction do not occur in planar porphyrin complexes. This is because the metal d-orbitals are orthogonal to porphyrin ligand a_{1u}/a_{2u} HOMOS. Walker and Co-workers[7-9] have reported that d orbitals of the metal and a_{1u}/a_{2u} orbitals of porphyrin ligand can have interactions in ruffle and saddle distortions. Similar view is reported by Ghosh et al[10-11], existence of such interactions is reported by Harada et al[12] in vanadyl complexes of octaphenyl porphyrin (VO(OPP)) and vanadyl dodecaphenyl porphyrin (VO(DPP)). They observed that the porphyrin with saddle distortion undergoes disproportionation on oxidation and is attributed to destabilization of a_{1u} orbital leading to accidental degeneravy with a_{2u} orbital. Thus, a_{1u} type cation radical is unstable and disproportionate to dication and neutral species. Thus, HOMO-LUMO gap narrowing down is observed in the voltammogram. They further pointed out that in vanadyl porphyrins (VO(DPP)) (vanadyl dodecaphenyl porphyrin) due to ligand distortion, a_{1u} orbital is elevated leading to the narrowing of HOMO-LUMO gap. This narrowing results in lowering

Content



. Medhi P. and Borthakur S. K. Genetic Resources of Root and Tuber Crops from North Cachar Hills of Assam. *J. Root Crops,* 37 (2), (2011), 131–143.

. Sarkar A. and Das A. P. Contribution of forest flora in rural livelihood: a study of Jayanti, Buxa Tiger Reserve, West Bengal, India. *Pleione* 6(1), (2012) 132– 140.

. Majumdar H C. Shyam J. Chowdhury U. Roy N and Koch D. An Ethnobotanical Survey of the Koch Community of South-West Garo Hills District, Meghalaya, India, *Intl. Journ. for Sci. Research & Dev.*5(6), (2017), 45-49.

. Jain S. K. and Rao R. R. A hand book of field and herbarium methods. *Today and Tomorro's Printers and Publishers,* New Delhi, India, (1977).

4

Wild Fruits and Seeds Consumed by Indigenous People of Meghalaya: An Overview

Devajyoti Bokolial

Abstract

The indigenous people of Meghalaya use a number of wild fruits and seeds collected from wild or semi-wild habitats. Present account lists 228 species of wild edible plants belonging to 123 genera and 62 families. These wild edibles are eaten raw or cooked as vegetable, in preparation of refreshing drinks, jam, jellies and pickle. They are rich in essential nutrients necessary to maintain a healthy nutritional profile of an individual. However in current times, theses wild edibles are disappearing from the diet. People should be made aware of the health benefits of consuming wild edibles and sustainable use of these species should be encouraged.

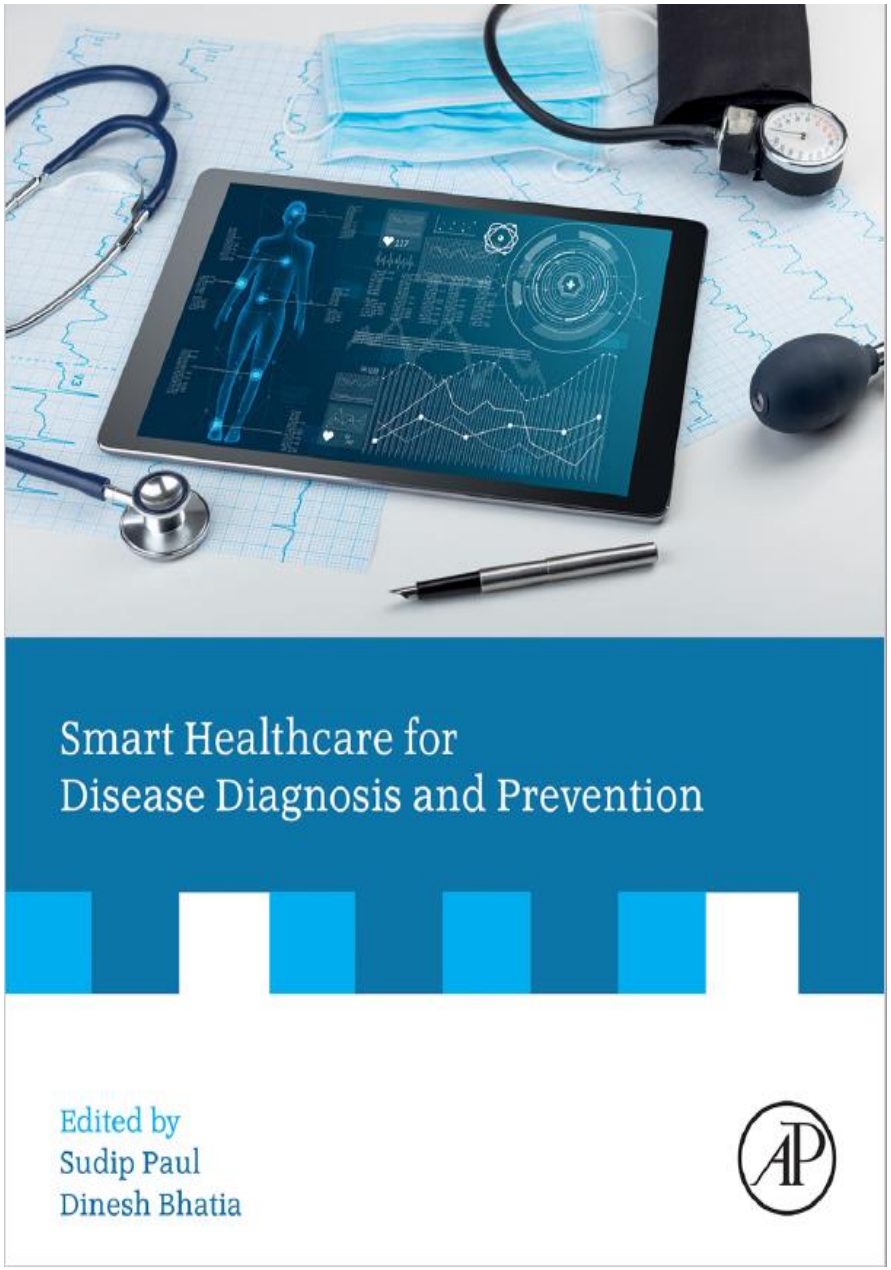
Key words: *tribes, wild edible, Meghalaya.*

Introduction

The state of Meghalaya is located in 25^0472 -26^0102 N- 89^0452 -92^0472 E (**Fig. 4.1**) andcovers an area of 22429 sq Km. Meghalaya is a part of Indo-Burma biodiversity hot spot of the world.[1] According to FSIreport 2015, the forest cover of Meghalaya is 76.76%. A total of 3128 species of flowering plants have been reported from the state, of which 1173 are endemic species[2]. The state has a tribal population of 86.1% with three main tribes- Khasi, Jaintia and Garo. These people are largely dependent on forest for their livelihood[3], which is reflected in the food habit and other socio cultural practices of these communities.

Contents

Sl. No. 27.



Smart Healthcare for Disease Diagnosis and Prevention

Edited by

SUDIP PAUL

Department of Biomedical Engineering, North-Eastern Hill University, Shillong, India

School of Computer Science and Software Engineering, The University of Western Australia, Perth, Australia

DINESH BHATIA

Department of Biomedical Engineering, North-Eastern Hill University, Shillong, India

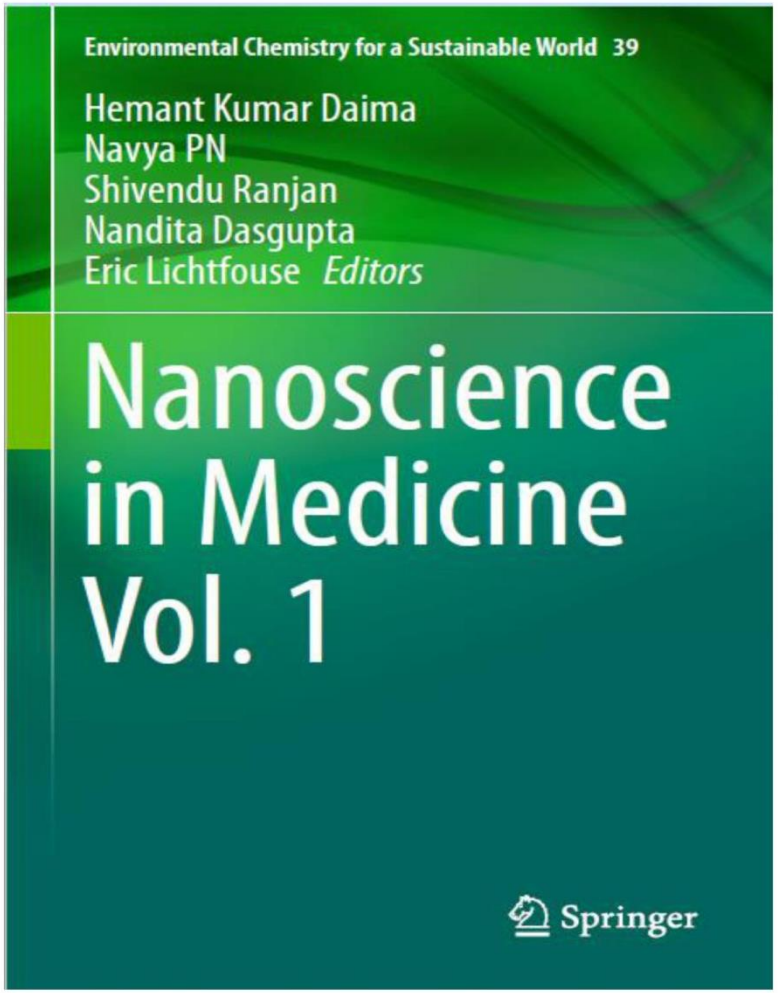
ELSEVIER

ACADEMIC PRESS

An imprint of Elsevier

Contents

Sl. No. 28.



Chapter 5
Antimicrobial Activity of Nanomaterials

Bablu Lal Rajak, Rahul Kumar, Manashjit Gogoi, and Sanjukta Patra

Contents

Abstract The World Health Organization reports that millions of deaths occurring worldwide are because of infectious diseases caused by bacteria, viruses, fungi and parasites. The existing therapeutics is not adequate enough to fight against these diseases and their prolonged uses have led to the development of drug-resistant strains which are even more difficult to control. Hence, the need for an alternative approach is growing. Development of nanotechnology, especially nanostructured particles and formulations, is providing new opportunities to combat these infectious diseases more effectively. Nanomaterials have unique physicochemical

B. L. Rajak · M. Gogoi (✉)
Department of Biomedical Engineering, North Eastern Hill University, Shillong, Meghalaya, India

R. Kumar
Department of Nanotechnology, North Eastern Hill University, Shillong, Meghalaya, India

S. Patra
Department of Biosciences and Bioengineering, Indian Institute of Technology Guwahati, North Guwahati, Assam, India

H. K. Daima et al. (eds.), *Nanoscience in Medicine Vol. 1*, Environmental Chemistry for a Sustainable World 39,
https://doi.org/10.1007/978-3-030-29207-2_5

Editors
Hemant Kumar Daima
Amity Institute of Biotechnology
Amity University Rajasthan
Jaipur, Rajasthan, India

Navya PN
Department of Biotechnology
Siddaganga Institute of Technology
Tumakuru, Karnataka, India

Shivendu Ranjan
Faculty of Engineering and Built Environment
University of Johannesburg
Johannesburg, South Africa

Nandita Dasgupta
Department of Biotechnology
Institute of Engineering and Technology
Lucknow, Uttar Pradesh, India

Eric Lichtfouse
Aix Marseille University
CNRS, IRD, INRA, Coll France, CEREGE
Aix-en-Provence, France

ISSN 2213-7114 ISSN 2213-7122 (electronic)
Environmental Chemistry for a Sustainable World
ISBN 978-3-030-29206-5 ISBN 978-3-030-29207-2 (eBook)
https://doi.org/10.1007/978-3-030-29207-2

Contents

Sl. No. 29.

Dr. Bashida Massar is an Associate Professor of Zoology at St. Anthony's College, Shillong, Meghalaya, India. Born and brought up in Lapalang village (Riwar) of Meghalaya, she enjoyed the abundance and profusion of innumerable food resources of nature during her growing up years as a child, which, however, is now almost depleted and completely exhausted because of the irresponsible behaviour and ignorance of many inhabitants. Strongly involving the local community, she is currently making a concerted effort to reclaim the lost glory of these natural resources, to save them from further threat of extinction, starting with fishes.

Rivers and streams of Riwar, East Khasi Hills, Meghalaya, India are blessed with a variety of freshwater fishes including mahseer, loach, suckers, cat fishes, puffer fish, glass fish, snakeheads, gourami, perch, barb, carp, minnow, danio, angler fish, needle fish, eel, leaf fish and a lot more. Some of these fishes such as the chocolate mahseer, Gray's stone loach, true sucker (garra), Asian catfish are categorized as threatened and vulnerable species worldwide. However, presently the richness of fish species of Riwar faces acute and grave extinction which calls for immediate action from all quarters to protect them from further deterioration. The book documents fish species inhabiting Rymben-Borhir river system of Riwar. A first-hand visit to the sites and close interaction with fishermen and village elders also throw light on the indigenous knowledge and traditional wisdom of local people about the fishes, modes and techniques adopted to catch them.

Fishes of Rymben-Borhir River System in Meghalaya, India

FISHES OF RYMBEN-BORHIR RIVER SYSTEM IN MEGHALAYA, INDIA

BASHIDA MASSAR

Published by:
Department of Zoology
St. Anthony's College
Bomfyle Road,
Shillong - 793 001
Meghalaya, India

ISBN 978-81-910147-7-8

9 788191 014778

Cover photo:
Rymben river in Lapalang village, East Khasi Hills, Meghalaya, India. Photo taken by the author on 15th August 2015

Sl. No. 30.

Understanding Water Crisis

EDITED BY

DAVID ARNOLD KHARCHANDY
KWILLY NONGRUM

P.A. SANGMA FOUNDATION
SYNOD COLLEGE, SHILLONG

LAKSHI PUBLISHERS & DISTRIBUTORS

First published in 2021 by

Lakshi Publishers & Distributors
4264/3, 1st Floor
Ansari Road, Darya Ganj,
New Delhi 110002
Published by Lakshi Publishers.

ISBN: 978-93-82120-41-4 (HB)

ST ANTHONY'S COLLEGE

(A Don Bosco Institution)
SHILLONG 793 001
MEGHALAYA - INDIA
NAAC Re-Accredited with 'A'
College with Potential for Excellence (awarded by UGC)

Declaration:

I hereby declare that the details and information given above are complete and true to the best of my knowledge and belief.

St. Anthony's College Shillong - 793 001

Principal
St. Anthony's College
Shillong - 793001
Meghalaya - India