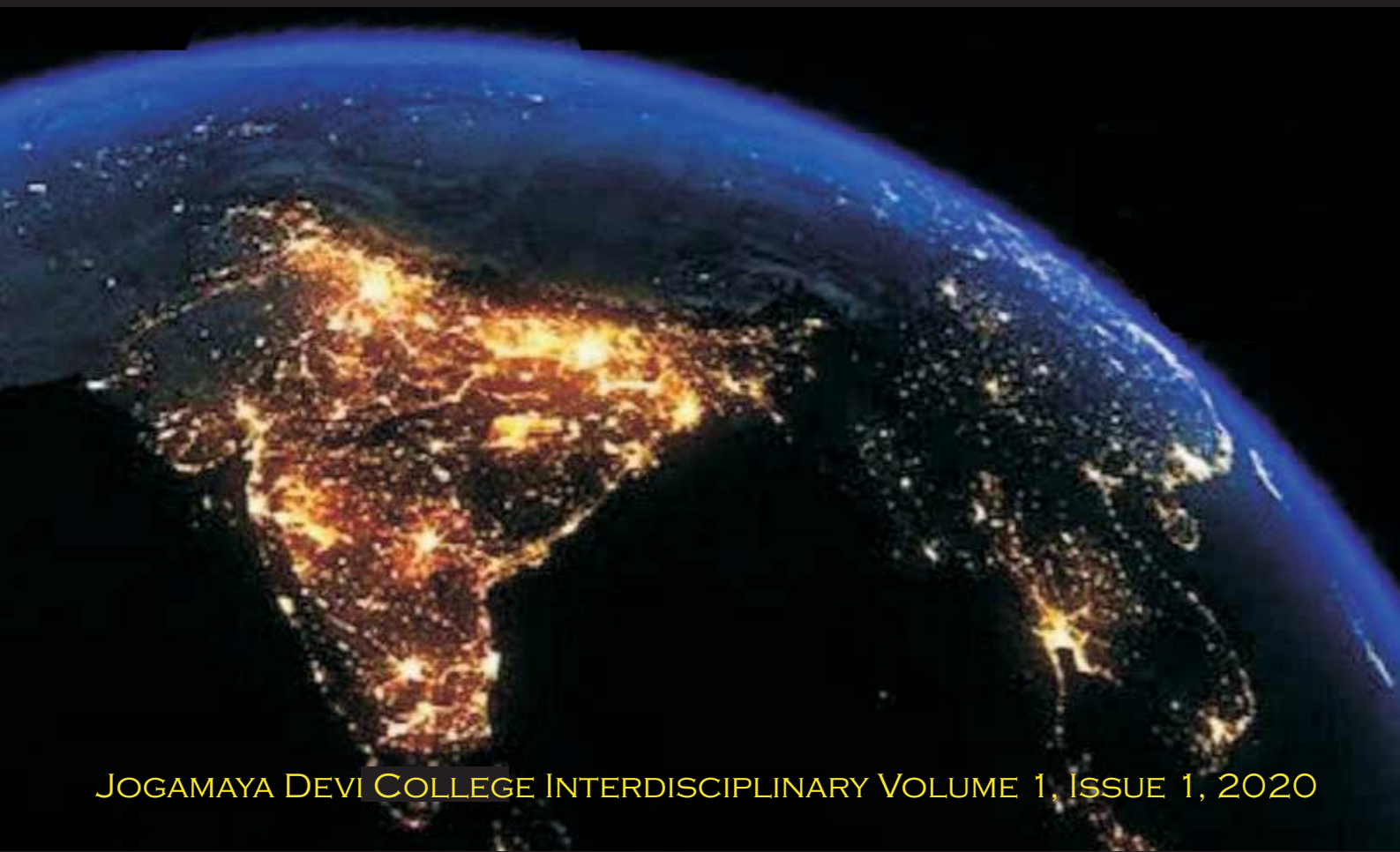
Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture Part I



Jogamaya Devi College Interdisciplinary Volume 1, Issue 1, 2020

Changing Trends in Human Thoughts and Perspectives:
Science, Humanities and Culture

Part I

Jogamaya Devi College Interdisciplinary Volume 1, Issue 1

Jogamaya Devi College
Kolkata
2020

Kolkata Jogamaya Devi College
92, Shyama Prasad Mukherjee Road, Kolkata 700026 and
5A, Rajeswar Dasgupta Road, Kolkata 700026

This publication is designed to provide accurate and authoritative information in regard to the subject matter covered. The whole project is funded by Jogamaya Devi College and it is freely available in the website of Jogamaya Devi College.

First Publication: 30th June 2020

Publication Data:
Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture (Part I)/edited by Pratip Kumar Chaudhuri
(Jogamaya Devi College Interdisciplinary Volume 1, Issue 1)
ISBN: 999-999-999

Board of Editors

Chief Editor

Dr. Pratip Kumar Chaudhuri

Dr. Pratip Kumar Chaudhuri has years of service as a Professor of Physics at Presidency College. Later in life, he worked as Director of Public Instruction at the Higher Education Department, Government of West Bengal. He has had visited several peer institutions as Peer Team member of NAAC. At present, he is associated with State Council of Higher Education and Governing Body of many colleges.

Publisher

Dr Srabani Sarkar

Dr Srabani Sarkar, Principal of Jogamaya Devi College, has an experience of 23 years of student interaction. She received her Ph.D on Fuzzy Mathematics in 2012. Working is her favourite pastime. She loves to read too. She has a very amicable and congenial personality.

Managing Editors

Dr. Sushree Chakraborty

Dr. Sushree Chakraborty is an Assistant Professor in the Department of Sanskrit at Jogamaya Devi College. A persevering student throughout her life, she received 'The President of India Medal for General Proficiency' in 2003. She was awarded with Ph.D degree from Jadavpur University in 2013. She enjoys spending her leisure with books, plants and her children.

Dr. Bhaskar Ghosh

Dr. Bhaskar Ghosh is presently working as an Assistant Professor in the department of Geology at Jogamaya Devi College, Kolkata. His areas of interest include the analyses of field structures and microstructures of deformed rocks, and the studies of the compositions, structures and socio-economic applications clay minerals. He received Ph.D. degree from the University of Calcutta for his research on stratigraphy and tectonics of Precambrian rocks of the Singhbhum Craton, Eastern India.

Language Editors

Dr. Soma Mondal

Dr. Soma Mandal is an Assistant Professor of English at Jogamaya Devi College, Kolkata. She received Ph.D degree from Rabindra Bharati Unersity,Kolkata in 2018. Her areas of interest are – Indigenous Roots of Eco-feminism in India, Postcolonial Studies, Literature from the North-east and Eighteenth Century British Fiction.

Piali Mondal

Piali Mondal is an Assistant Professor in the Department of English at Jogamaya Devi College. She is currently pursuing her Ph.D on "Violence as Dialogue in Early Germanic Literature" in Department of English, Jadavpur University. Her areas of interest include Medieval European Literature, Queer Studies, Graphic Novels (Manga and Manhwa, in particular), and Food History.

Technical Editor

Dr. Kaushik Kiran Ghosh

Dr. Kaushik Kiran Ghosh received M.Sc. and Ph.D degree from the University of Calcutta, Kolkata. He is presently working as an Assistant Professor of Jogamaya Devi College, Kolkata. His research interest includes banded iron formation (BIF) and related iron ore deposits of India. He has published several papers in national and international journals.

FOREWORD

The COVID-19 pandemic has affected a very large number of people worldwide and is the worst that we have seen in our lifetime. Even a larger number of people have been affected not by the virus itself, but by the follow-up that has been enforced in order to combat the disease and contain the spread of the virus. While the impact on industry, agriculture and, in general, economy has been of disastrous proportions, the influence on academic and intellectual activities has been considerable. It is against this backdrop that Jogamaya Devi College has taken up the challenge of publishing an E-Book with contribution from all its departments. There is no doubt that this effort deserves nothing but praise and will encourage other institutions to follow the footsteps of this institution.

The E-Book comprises articles from the whole spectrum of departments of the institution. The language departments – those of Sanskrit, Bengali and English – are well represented in the E-Book, through thought-provoking articles that would rouse the interest of readers from other disciplines as well. The History department has delved into the history of writing History. Sociological issues, homosexuality and the place of women in society have rightfully claimed their place in the publication. Science departments have come up with new ways of looking at classical topics, the history of the Periodic Table and marble, the ever-revered form of Calcium Carbonate that has been used by sculptors and architects over the ages. What will quite expectedly surprise the reader are the discussions on display technologies, artificial intelligence and a novel use of the smart-phone.

The purpose of this publication goes beyond academic exercise of the authors and trans-departmental readers. When lock-downs thwart a return to normalcy and the date of resumption of usual academic activities is as elusive as a mirage, the publication will serve to keep the minds of both the authors and readers alive and refreshed. It will, hopefully, be followed up by successive editions, in electronic or printed form, giving opportunities to all faculty members to write and publish. Until then, let us all wish that this E-Book will be read and appreciated by a wide range of readers.

Pratip Kumar Chaudhuri
Chief Editor

FROM PRINCIPAL'S DESK

It feels nice to announce that even in the long period of lockdown due to pandemic, Research Committee of Jogamaya Devi College worked relentlessly towards publishing the 4th E-Book of our college whose theme is the changing trends in human thoughts and perspectives.

The content of the book covers a wide range of perspectives- from history to science, from law to literature.

I hope readers will not only enjoy reading the articles but also will get encouraged to contribute to the future volumes.

I congratulate the editorial team for their hard work in this hard time.

With thanks

Principal

FROM THE EDITORS' DESK

When the *Homo sapiens sapiens* emerged as the Supreme Being among all the species on this planet, all they knew were the lighting of fire and the art of making of a few kinds of crude flint tools for hunting, gathering and different types of household (or 'cave-hold') works. Quite a few millennia after that, through deliberate plantation of seeds and domestication of animals, they entered the period of agrarian culture from the vulnerable state of hunter gatherers. Once their basic needs – food, shelter and clothing – were addressed, the humans started to explore their creative faculties which distinguished them from the other animals. They became behaviourally modern with symbolic art, advanced tools and specific indigenous cultures. Gradually, with the large population centres, shared communication strategies, common social norms, developed culture and advanced forms of governance, the human civilizations came into existence. Along with material prosperity, human intellect and conscience started being manifested in every possible way. Various branches of knowledge— Science, Mathematics, Logic, Humanities, History, Philosophy, etc. entered the purview of human cultivation leading to the advent of dynamic theories and discoveries.

The history of science, which includes both natural and social sciences, commenced its journey by the 'Natural Philosophers'; scientific methods have been employed since the Middle Ages, and Modern Science began to develop during the Scientific Revolution of 16^{th} -17^{th} century Europe. From the 18^{th} through the 21^{st} century the history of Science presents progressive accumulation of knowledge leading to the competition of paradigms and conceptual systems. On the other hand, humanities deal with the 'non-science' subjects and concern themselves with the study of all languages, literature, arts, history and philosophy. The term 'Humanities', derived from Greek word *'humanitas',* originally denoted a training programme for Greek orators. From that point of inception, history of humanities underwent numerous changes and transformations during its journey. In the present-day scenario, humanities are considered as 'Idiographic Human Sciences', which objectively deal with the worldly phenomena with reference to its unique value within the cultural and human contexts. Therefore, it is conclusive that innumerable illuminating thoughts, giving rise to myriad novel ideas and notions from both theoretical and analytical perspectives, have created marvels in the evolution of mankind and have redefined the connotation of human civilization in every era.

When we, the members of the Research Committee of Jogamaya Devi College were pondering over the prospective themes of our upcoming Interdisciplinary volume, these diverse trends of human thoughts caught our attention. The oxymoron 'Constantly Changing', is possibly the most acknowledged attribute of the phases mankind is undergoing from time immemorial and we thought that this ubiquitous and intriguing idea, encompassing all the branches of knowledge, will definitely fascinate everyone concerned.

So, here we are, with the electronic version of our third Interdisciplinary Volume titled 'Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part – I' with an array of eleven articles, judiciously authored by the teachers and researchers of our college and other educational institutions, and reviewed by the eminent academicians from different fields of study.

The smartphones have become of late the most commonly used electronic device, and apart from their conventional use in telecommunications, they are being widely used in the diversified fields of internet browsing, digital photography, multimedia applications, entertainment and so on, thus replacing gradually a host of other instruments like the computers with all their peripheral instruments, the still cameras and the video cameras, video games etc. Amrita Ghosh and D. Amilan José, in their article titled "Smartphone: A Convenient Analytical Measuring Tool for Chemical Sensors", have explained that apart from the above well-known uses, the smartphones have evolved into an essential and convenient analytical tool for chemical sensors and health monitoring.

The present age is appropriately called 'the age of electronics', and a major part of human creativity of the 21st Century is employed in designing new and improved electronic devices. In her article titled "Advancement of Display Technology: From CRT to Quantum Dot and MicroLED", Amrita Mukherjee has described the rapidly changing world of modern display technology to meet the evolving needs of the newly designed electronic gadgets and their updated versions.

The chemists and the physicists across the world celebrated last year the 150th anniversary of the periodic table of elements, which was first published by Dmitri Ivanovich Mendeleev in 1869. It was slowly shaped to its present form by the relentless efforts of the best of human intellect over the years. Bhaskar Ghosh, in his article titled "Scientific advancements leading to the evolution of the periodic table and discovery of new elements after Mendeleev" presents an overview of the gradual evolution of the periodic table of elements and the scientific innovations on which they are based, along with a glimpse of the discovery of new elements after 1869.

Chandrabali Mukhopadhyay has discussed the properties of marble, the necessity of artificial marble and the environmental impact of marble mining industry on the workers with special reference to the Makrana marble of Rajasthan in her article labelled "Marble: Elegance through Ages- From Natural Deposits to Artificial Production".

In her article titled "Changing Trends in Writing Autobiography: A Comparative Analysis of the Autobiographies of Gandhi, Nehru and Dr. Kalam", Juthika Bishwakarma has explored the changing trends of the literary genre of autobiography through the comparative study of the three widely acclaimed autobiographies written by three eminent Indians: *The Story of My Experiments with Truth* by Mahatma Gandhi, *An Autobiography* by Jawaharlal Nehru and *Wings of Fire* by Dr. A. P. J. Abdul Kalam (with Arun Tiwari) from the perspectives of the stylistic mechanics and the problematics of the genre.

On 6th September 2018, a historic judgement was made by the Supreme Court of India which scrapped down Article 377 that criminalized homosexuality. In her article, labelled "Section 377: Challenges and Changing Perspectives in the Indian Society", Nisha Tamang discussed the various

challenges faced by the 'Queer Community' due to section 377 of the Indian Penal Code and how the verdict passed to scrap this section has affected the legal and social status of the community.

Piali Mondal has chosen her topic from a 'not-so-cultivated' subject of Anglo-Saxon literature. In her paper titled *"Hwær Sindon Seledreamas*?: The Joyless Mead-hall of Late Anglo-Saxon Literature and the Politics of Absence and Disruption", she has examined the cultural shift as the reasons, due to which the mead-hall or winsele, usually portrayed as a place of cheer in Early Germanic Literature, gradually became a place of sorrow and sin in the late Anglo-Saxon literature.

In a country like ours, the pressing need for the introduction of new teaching methodologies has always been felt, and the recent technological advancement has made it possible to disseminate knowledge and continue student-teacher interactions during the lockdown period. Rituparna Mukherjee, however, explored another field of application of the state-of-the-art technology in the educational institutes. In her article labelled "The Introduction of Artificial Intelligence in ESL Teaching: Possibilities and Limitations", she has tried to locate the areas in which the technology of artificial intelligence can aid the teachers based on their dissemination of classroom lectures as well as administrative duties, alongside noting the nature of infrastructural preparedness the use of this technology would necessitate.

The European Renaissance of fifteenth century marks the transition from the middle age to the modern age, when the traditional cultural traits were amalgamated with the new ideas to bring about revolutionary changes in various fields of literature, science, and arts. A similar phenomenon occurred in Bengal from early nineteenth to mid-twentieth century, when a synthesis of the traditional Indian culture and the modern Western civilization laid the foundation of the modern Bengali literature, and greatly enriched all its branches. This was the time when the creative mind of Bengal not only found expression in mother tongue but also in other languages, and apart from English, Sanskrit was indisputably the most favoured and appreciated language of the contemporaneous Bengali intelligentsia. Sushree Chakraborty, in her article titled "Changing Trend in Modern Sanskrit Drama: The Bengal Scenario", has discussed the manner and explained the probable reasons due to which, the tradition-bound Sanskrit literature of the early and medieval periods were transformed into a nice blend of tradition and modernity with the applications of modern elements and modern techniques by the Sanskrit literary artists of twentieth century Bengal.

We are glad to announce that, in spite of some technical complications which were difficult to sort out in the present situation, we could make necessary arrangement to publish two articles in Bengali also. Conforming to the theme of this volume, Aditya Haldar has narrated the history of the historical studies and researches in India in his article titled 'ভারতের ইতিহাসের যুগবিন্যাস ও তার ধারা'. Rajat Kumar Naskar, in the article named 'সমাজদর্পণে নারী', has described the periodically evolving status and position of women in the Indian society in three ages – in the Vedic age, in the age of *Manusmriti*, and in the nineteenth century.

As soon as the articles were invited for the present volume, the enthusiastic response we received from the teachers of various institutions made us optimistic of its acceptance and appreciation to our

wide range of readers, and we are proud to declare that even before its publication we have been compelled to announce the publication of another volume on this topic, titled 'Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part – II'. The work is already in progress and we expect to publish it later this year.

Presently all of us are going through a trying situation, arising from the global pandemic and the natural calamities of the region, which has caused severe hindrances to all our academic endeavours. At a stage we found it extremely difficult to continue the works, and the lack of any mode of communications cast a shadow on the timely publication of this volume. Finally all the impediments could be eliminated, and to this we owe to our highly esteemed reviewers, most of whom have sincerely and scrupulously completed their works within the scheduled time in spite of all the odds.

We consider ourselves fortunate because this humble effort of ours, still at its incipient stage, has received the blessings of some distinguished academicians. It is an honour to acknowledge the guidance and assistance we have received from Dr. Chittaranjan Bhattacharyya, Professor of Geology (Retired), University of Calcutta and Dr. Amitava Das, Professor, Department of Chemical Sciences, IISER Kolkata. In spite of their extremely busy schedules, they have spent much of their valuable time to extend their helps to us.

We also gratefully acknowledge the support and encouragement we have received from our honoured Principal and revered colleagues at the different stages of the work. We will consider this initiative to be a success if the students, researchers and teachers can enrich their knowledge bases from its discourses and are encouraged to participate actively in similar endeavours in future.

Sushree Chakraborty &
Bhaskar Ghosh
(Managing Editors)

CONTENT

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 01-09

ভারতের ইতিহাসের যুগ বিন্যাস ও তার ধারা

আদিত্য হালদার

সহকারী অধ্যাপক, ইতিহাস বিভাগ, যোগমায়া দেবী কলেজ, কোলকাতা।

haldar.aditya30121989@gmail.com

Abstract: প্রাচীন, মধ্যকালীন ও আধুনিক – ভারতের ইতিহাসের এই তিনটি যুগকে কেন্দ্র করে এই প্রবন্ধটির নির্মাণ। ইতিহাসের ধারা প্রবাহমান। একটি যুগের সঙ্গে অপর যুগের সম্বন্ধ ধারাবাহিক ভাবে বিদ্যামান। বর্তমান ভারতের ইতিহাসের গতিধারাকে নিয়ন্ত্রণ করছে মুলতঃ তিনটি বিষয় – জাতীয়তাবাদ, সাম্প্রদায়িকতা এবং সাম্রাজ্যবাদ। প্রাচীন ভারতের ইতিহাসে উগ্র জাতীয়তাবাদ ঐতিহাসিকদের রচনায় কিভাবে স্থান পেয়েছে, এই বিষয়ে স্থান পেয়েছে, এই বিষয়ে আলোকপাত করা হয়েছে বর্তমান প্রবন্ধের প্রথম পর্বে। প্রসঙ্গতঃ এসেছে প্রাচীন ভারতীয় ইতিহাস প্রণেতাদের রচনায় সাম্প্রদায়িক প্রবণতা ও পরমত-অসহিষ্ণুতার বিষয়টি। বর্তমান প্রবন্ধের দ্বিতীয় পর্বে আলোচনা করা হয়েছে মধ্যকালীন ভারতের শাসকশ্রেনীর নিজস্বতা ও রাষ্ট্র-পরিচালনার ক্ষেত্রে তাঁদের ধর্মীয় প্রবণতার কাকতালীয় সমাপতন। প্রবন্ধের শেষপর্বে আধুনিক ভারাতের ইতিহাসের ঘরানাগুলি কিভাবে ইতিহাসকে নিয়ান্ত্রণ করে, সেবিষয়ে আলোকপাত করা হয়েছে।

বীজশব্দঃ সাম্প্রদায়িকতা, জাতীয়তাবাদ ও সাম্রাজ্যবাদ

ভারতবর্ষের মতো দেশে যেখানে সামাজিক সংস্কার এবং ধর্ম মানুষের জীবনচর্চার সঙ্গে ঐতিহাসিক বিবর্তনের মধ্যে দিয়ে যুগের পর যুগ চলে এসেছে এবং যে দেশে ধর্ম, ভাষা, বর্ণের বৈচিত্র্য এবং ভিন্নতা ব্যাপক, সেখানে আজন্মলালিত বিশ্বাস দ্বারা আচ্ছন্ন হয়ে ইতিহাসকে দেখার চেষ্টা করলে ইতিহাসের সত্যরূপ দেখা খুবই কঠিন, এ কথা বুঝেছিলেন ভারত ইতিহাসের অভিজ্ঞ রবীন্দ্রনাথ। নিজ ধর্ম, বর্ণ, ভাষা বা সম্প্রদায়ের প্রতি অন্ধভাবে স্বার্থ মগ্ন হওয়ার যে ধরণের জীবন বিমুখতা ফুটে ওঠে এবং যার ফলে অপরাপর মানবগোষ্ঠীর প্রতি যে উপেক্ষা, বিদ্বেষ এবং সংঘাত সৃষ্টি হয়, তাই যদি সাম্প্রদায়িকতার সহজ সংজ্ঞা হয় তবে সেই মনোভাব মনের সহজ যুক্তিকে টলিয়ে দিয়ে বিশ্বাসকেই আঁকড়ে ধরে। ফলে দেখা এবং দেখানোর কাজ হয় একদেশধর্মী। ভারত ইতিহাসের অনুশীলনে সাম্প্রদায়িক ব্যাখা যে ধরণের বাঁধা ও সীমারেখা সৃষ্টিকরে তা স্পষ্ট করে তোলাই ঐতিহাসিকদের কাজ (চট্টোপাধ্যায়, গৌতম ২০১১)। যদি ঐতিহাসিকরা এই বিষয়টি ঠিক ভাবে উপলব্ধি করতে না পারে তবে ইতিহাস অধ্যয়ন ও ইতিহাসবোধ বিকৃত হতে বাধ্য। এই কাজ একই সঙ্গে বিদ্যালয়ের স্তর থেকে গবেষণামূলক রচনার উচ্চক্ষেত্র পর্যন্ত পরিসর করতে পারলেই জাতীয় সংহতির পথ সুদৃঢ় হবে। এ-কথা বলার অর্থ এই নয় যে ভারতবর্ষের মতো বহু জাতির, বহু ধর্মের, ভাষার ও বর্ণের ভিন্নতা রয়েছে সেখানে বিরোধ এবং সংঘাত কখনোই ছিলনা তা কিন্তু বলা যাবেনা বরং সেই সংঘাতের মধ্যেই লুকিয়ে ছিল ভারতীয় জাতীয়তাবাদের প্রেরণা। কিছু কিছু ঐতিহাসিকরা বিরোধকে সর্বদা সংঘাত হিসেবেই ধরেছেন কিন্তু বিরোধের মধ্যে দিয়ে মিলনের যে চেষ্টা ভারতবর্ষ আবহমানকাল করে এসেছে, সেদিকে উপযুক্ত দৃষ্টি দেননি। আমি যে সম্প্রদায়েরই অন্তর্গত হই না কেন শুধু তার প্রতি অন্ধ আনুগত্যে যদি অতীতের মিলন ও বিরোধ খোলা মনে না দেখি তাহলে ভবিষ্যতে মানবজাতির সঠিক বিকাশ সম্ভব কি? 'ভারতবর্ষের ইতিহাসের ধারা' শীর্ষক বিখ্যাত রচনায় রবীন্দ্রনাথ এই সত্যের প্রতি আমাদের দৃষ্টি আকর্ষণ করে বলেছিলেনঃ 'এমনি করিয়া দুই ধাক্কার মধ্যে পড়িয়া মাঝখানের সত্য পথটি আমাদের জাতীয় জীবনে চিহ্নিত হইয়া যাইবে এবং এককথা উপলদ্বি করিব যে স্বজাতির মধ্য দিয়াই সর্বজাতিকে এবং সর্বজাতির মধ্য দিয়াই স্বজাতিকে সত্যরূপে পাওয়া যায়-এই কথা নিশ্চিত রূপেই বুঝিব যে আপনাকে ত্যাগ করিয়া পরকে চাহিতে যাওয়া যেমন নিষ্ফল ভিক্ষুকতা, পরকে ত্যাগ করিয়া আপনাকে কুঞ্চিত করিয়া রাখা দারিদ্র্যের চরম দুর্গতি' (রবীন্দ্র রচনাবলী, অষ্টাদশ খণ্ড পৃ ৪৬৫)।

দেশ, জাতি তথা মানব সভ্যতার অতীত সম্বন্ধে না জানলে বর্তমানকে বোঝা যায়না। ইতিহাস এমন একটা বিষয় যার গুরুত্ব জাতীয় জীবনে অপরিসীম এবং যে কোনো আধুনিক এবং অগ্রসর জাতির শিক্ষার আবশ্যিক অঙ্গ। আর তারজন্যই ইতিহাসবেত্তাদের জরুরী আর্দশ হওয়া উচিত সচেতন দায়িত্ববোধ, সত্যবাদিতা এবং সম্পূর্ণ নিরপেক্ষ দৃষ্টিভঙ্গী। যে কোনো দেশের ইতিহাস অনুশীলনে তাই সকলের সতর্ক হওয়া উচিত। যেহেতু ঐতিহাসিকরা মানুষ তাই মানবিক দুর্বলতায়, কখনো অজ্ঞতায়, কখনো উদ্দেশ্য প্রণোদিত ভাবেই, তারা সত্যবাদিতার পথে নাও যেতে পারেণ। ফলে তাদের সিদ্ধান্ত আমরা বিচার না করে গ্রহণ যদি সর্বদাই করি, তাহলে শুধু নিজেরাই অশিক্ষিত থাকব তাই নয়, সামাজিক জীবনে ও বিপদ ডেকে আনবো (চট্টোপাধ্যায়, গৌতম ২০১১)। যেমন ধর্মীয় বা অন্যান্য সাম্প্রদায়িক দৃষ্টি ভঙ্গীর কথাই ধরা যাক। এর শিকার হলে ইতিহাস রচনা যেমন বিকৃত হতে বাধ্য তেমনি সেই ইতিহাস অধ্যয়ন এবং তার পাঠগ্রহণ আমাদের রুচি, শিক্ষা ও বোধকে সংকীর্ণ করতে বাধ্য।

একসময় সাম্রাজ্যবাদী শক্তি ভারতীয় ইতিহাসের গতিকে নিজের স্বার্থে ব্যবহার করার জন্য নিজেদের মতো যুগ বিন্যাস করেছিলেন। সুখের বিষয় এই যে, জাতীয়তাবাদী ঐতিহাসিকরা ইতিহাসের এই সাম্প্রদায়িক প্রবণতাকে রুখে দিয়ে নতুন নামকরণ করতে সক্ষম হয়েছেন যেমন প্রাচীনযুগ,

মধ্যযুগ, আধুনিকযুগ ইত্যাদি। তবে এর মানে এই নয় যে, এই নামকরণের মধ্যেদিয়ে ইতিহাসের সাম্প্রদায়িকতা এককভাবে সমাপ্তি ঘটে গেল, সাম্প্রদায়িকতা এখনো যেমনি রয়েছে তেমনি ইতিহাসের গতিধারার মধ্যেও অনেকটা পরিবর্তন এসেছে। সম্প্রতি উগ্রহিন্দুর আক্রমণে সেকুলার মতাবলম্বীরা কিছুটা দিশেহারা হয়ে পড়েছেন। ভারতবর্ষ যে নানা ভাষা, ধর্ম, বর্ণ, গোষ্ঠীর মিলনভূমি, ভারতের জাতীয়তা যে ধর্মীয় চেতনার উর্ধ্বে, সংখ্যাগরিষ্ঠ হিন্দুদের স্বার্থ যে আসলে সাম্প্রদায়িক স্বার্থ যা জাতীয় স্বার্থের পরিপন্থী- এসব কথা এখনো বলা হচ্ছে ঠিকই কিন্তু কোথায় যেন একটা দ্বিধা গ্রস্ত ভাব এসে পড়েছে (চট্টোপাধ্যায়, পার্থ ২০১১)। উগ্রহিন্দুবাদীদের দাবী গণতান্ত্রিক ভারতে সংখ্যাগরিষ্ঠ হয়েও হিদুর স্বার্থ কেন স্বীকৃত হবেনা, কেন সংখ্যালঘুর স্বার্থ মর্যাদা পাবে? যে কোন রাষ্ট্রীয় আইনে ধর্মীয়সংখ্যালঘুর স্বতন্ত্র স্বীকৃতি দেওয়াটাই তো সাম্প্রদায়িকতা, তা তুলে দেওয়ার দাবীই যথার্থ সেকুলার রাষ্ট্রের দাবী। বর্তমান রাষ্ট্রের তর্জন গর্জন এই বিষয়টিকে যেন আরো জোড়ালো করে তুলেছে। উগ্রহিন্দুরা আরো বলেছেন, বিদেশী আক্রমণের সমস্ত চিহ্ন মুছে দিয়ে প্রকৃত জাতীয়তার সন্মান পুনরুদ্ধার করতে হবে; এক্ষেত্রে ইংরেজ যে অর্থে বিদেশী, পাঠান বা মুঘল শাসকরাও সেই অর্থেই বিদেশী। উগ্রহিন্দুর অভিযোগ, এই দাবীর বিরোধিতা করে সেকুলাররা প্রকৃত জাতীয়তারই বিরোধিতা করেছেন। প্রকৃত জাতীয়তার সংজ্ঞা নির্ণয় করার ক্ষেত্রে ইতিহাসের সাক্ষ্য একটা বিরাট ভূমিকা নিয়ে ফেলেছে। ঐতিহাসিকভাবে ভারতের জাতীয়তাবাদের উদ্ভব বিচার করলে বোঝা যায়। এর উদ্ভবের প্রক্রিয়া অতিশয় জটিল এবং বহুমুখী। প্রাক-ব্রিটিশ ভারতীয় সমাজের কাঠামো অতিশয় স্বতন্ত্র; এর তুলনা মেলাভার। আর্থিক ভিত্তির প্রশ্নে এই সমাজ পুঁজিবাদ উদ্ভবের আগে মধ্যযুগীয় ইউরোপীয় সমাজ থেকে সম্পূর্ণ পৃথক। উপরন্তু ভারতবর্ষের পরিসর বিরাট এবং এই দেশে বহু ভাষাভাষী এবং নানা ধর্মের বিপুল সংখ্যক লোক বাস করে। হিন্দু ধর্মের লোক ছিল ভারতীয় জনসংখ্যার দুই-তৃতীয়াংশ। সামাজিকভাবে হিন্দু বিভিন্ন জাত উপজাতে বিভক্ত ছিল। জাতিভেদ হিন্দু সমাজের নিজস্ব বৈশিষ্ট্য আবার হিন্দুধর্ম সুসংহত সমরূপ নয়, বহু বিশ্বাসের সমাহার। এই কারণে হিন্দুরা অনেক গুলি ধর্ম সম্প্রদায়ে বিভক্ত। সাধারণভাবে ভারতীয়দের এবং বিশেষভাবে হিন্দুদের বহুল সামাজিক ও ধর্মীয় ভেদের ফলে ভারতের জাতীয়তাবাদ বিকাশের প্রেক্ষাপট অতিশয় বৈচিত্র্যপূর্ণ। অন্যান্য দেশে জাতীয়তাবাদ উদ্ভবের প্রেক্ষাপটে এই রকম অভিনব ও শক্তিশালী ঐতিহ্য এবং প্রতিষ্ঠান ছিলনা। একদিকে সামাজিক, আর্থিক ও রাজনৈতিক কাঠামো এবং ধর্মীয় ইতিহাসের অভিনবত্ব। অন্যদিকে বিশাল পরিসর ও বিপুল জনসংখ্যা মিলে যে পরিস্থিতি সৃষ্টি হয়েছিল তাতে ভারতীয় জাতীয়তাবাদের উদ্ভব ও বিকাশের পর্যালোচনা বেশ দুরূহ ঠেকে বটে। বিগত সামাজিক, আর্থিক ও সাংস্কৃতিক কাঠামোর আত্মসংরক্ষণের শক্তি বোধহয় বিশ্বের অন্যান্য দেশের তুলনায় ভারতে বেশি ছিল। উপরন্তু মানব সমাজের বর্তমান ও ভবিষ্যৎ ইতিহাসে ভারতীয় জাতীয়তাবাদী আন্দোলনের তাৎপর্য গভীর, কেননা এই আন্দোলনের গতিবেগ ক্রমশ বেড়েছে এবং মানব সমাজের বড় অংশ এতে আত্মনিয়োগ করেছে (দেশাই ২০০১)।

ভারতীয় জাতীয়তাবাদের আর একটা গুরুত্বপূর্ণ বৈশিষ্ট্য হল যে, ব্রিটিশ শাসনের বিরুদ্ধে জাতীয়তাবাদের উদ্ভব। প্রাগ্রসর ব্রিটিশ জাতি নিজস্ব স্বার্থের প্রয়োজনে ভারতীয় সমাজের আর্থিক ব্যবস্থা আমূল বদলে দিয়েছিল, কেন্দ্রীভূত রাষ্ট্র স্থাপন করেছিল। এর ফলে নতুন সামাজিক শ্রেনীর উদ্ভব হল এবং অভিনব নতুন সামাজিক শক্তি সমূহ ক্রিয়াশীল হয়ে উঠলো (দেশাই ২০০১)। নিজস্ব প্রকৃতিগত কারনেই এই সামাজিক শক্তিসমূহ সাম্রাজ্যবাদের বিরুদ্ধবাদী হয়ে উঠেছিল এবং ভারতীয় জাতীয়তাবাদের ভিত্তি প্রতিষ্ঠা করে তাতে প্রাণশক্তির সঞ্চার করেছিল। তবে ইতিহাস চর্চার সংকট এখানেই- আজকের রাষ্ট্রনীতির সঙ্গে জাতীয়তার ইতিহাসের সামঞ্জস্য আনা। সংকট এই জন্য যে জাতীয়তার ইতিহাস গত শতাব্দী থেকে লেখা হয়ে এসেছে তার রন্ধ্রে রন্ধ্রে ঢুকে রয়েছে এমন সব কাহিনী, ধারণা, ব্যাখা যা আজকের উগ্রহিন্দু প্রচারের প্রধান উপাদান। সত্যি কথা বলতে কি, বিষয়টা একটু তলিয়ে দেখলে একটা সাংঘাতিক সত্য বেরিয়ে আসবে। সেটা হল যে, হিন্দু সাম্প্রদায়িকতা আসলে ভারতীয় জাতীয়তাবাদেরই প্রতিচ্ছবি, আয়নায় মুখ দেখার মতো-তার রুপ, আকৃতি, গড়ন, অবিকল এক (চট্টোপাধ্যায়, পার্থ ২০১১)।

প্রাচীন ভারতের ইতিহাস রচনায় সাম্প্রদায়িকতার সমস্যা বুঝতে হলে বিগত কয়েকটি শতকে ইতিহাস প্রণয়নে সমসাময়িক চিন্তাধারার প্রভাব বিচার করা উচিত। প্রাচীন ভারতীয় ইতিহাস সম্বন্ধে আধুনিক রচনা ও প্রাচীন ভারতীয় সংস্কৃতির চর্চা শুরু হয় অষ্টাদশ শতাব্দীতে এবং তখন থেকে বিংশ শতাব্দী পর্যন্ত মতবাদের দিক দিয়ে তিনটি প্রধান ধারা লক্ষ্য করা যায়ঃ প্রাচ্যবাদী, হিতবাদী এবং জাতীয়াবাদী। পঞ্চদশ শতাব্দী থেকে ইউরোপ ও এশিয়ার মধ্যে বানিজ্যিক প্রসারের ফলে বহু ইউরোপীয় পণ্ডিত এবং ধর্মপ্রচারকগন এশিয়ার সংস্কৃতি বিষয়ে ক্রমশ আগ্রহী হয়ে উঠলেন। ভারতবর্ষের ক্ষেত্রে এই আগ্রহের সূচনা দেখি ভাষা চর্চায় বিশেষতঃ সংস্কৃত ও পারসিক ভাষা শিক্ষার মধ্যে। এই ভাষা চর্চার নতুন উদ্যম শুরু হলো আঠারো শতকের শেষে রয়াল সোসাইটির গোড়াপত্তনের পর থেকে। প্রাচ্যবাদী নামে খ্যাত এই পণ্ডিতরা অনেকে সংস্কৃত অধ্যয়ন করেছিলেন এবং তাঁরা বৈদিক সংস্কৃতির রীতিমতো ভক্ত হয়ে উঠলেন। বৈদিক যুগের অকুণ্ঠ গুণগান শুরু করতে লাগলেন এবং তাদের ধারণা হলো প্রাচীন ভারতে মোটামুটি একটি আদর্শ সমাজ ব্যবস্থা ছিল। সেই ব্যবস্থার মধ্যে যে সব সঙ্কট ছিল তা প্রচ্ছন্ন রেখে তাঁরা তার গৌরব কীর্তনই বেশী করতে লাগলেন। তাঁদের এই ধারণার সঙ্গে গোঁড়া হিন্দুদের মতের পুরোপুরি মিল হলো। কারণ হিন্দুরা এমনিতেই বেদ ও বৈদিক সাহিত্যের মাহাত্ম্যে বিশ্বাসী ছিলেন (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)। যেসব ভারতীয় ঐতিহাসিকরা পরে এই চিন্তা ধারাকে অবলম্বন করেন, তাঁরা প্রাচ্যবাদীদের প্রাচীন ভারতীয় সমাজের মাহাত্ম্য কীর্তনের পিছনে যে উদ্দেশ্য গুলি করেছে তা নিয়ে মাথা ঘামাতেন না। সবচেয়ে স্পষ্ট যে কারণটি তা হলো বেশির ভাগ প্রাচ্যবাদী পণ্ডিত তাঁদের নিজস্ব সমাজ থেকে বিচ্ছিন্ন ছিলেন এবং শিল্প বিপ্লবের সমকালীন ইউরোপে যে সব ঐতিহাসিক পরিবর্তন ঘটেছিল, তার সম্বন্ধে তাঁরা সবিশেষ সন্দিহান ছিলেন। এর ফলে তাঁরা অন্যত্র রামরাজ্য খুঁজে বেড়াতেন এবং বেশিরভাগই প্রাচ্যের প্রাচীন সভ্যতায় তা আবিষ্কার করার চেষ্টা করতেন। তাছাড়া অন্য একটি কারনেও প্রাচ্যবাদীরা প্রাচীন ভারতের সংস্কৃতিকে সমর্থন করার চেষ্টা করেছিলেন, তাহলো হিতবাদীদের সঙ্গে বিতর্কে

তাঁরা ক্রমশ পরাজিত হচ্ছিলেন। হিতবাদীরা হ'লেন উনিশ শতকের বিশেষ প্রভাবশালী একদল ব্রিটিশ দার্শনিক। তাঁরা সুনিশ্চিত ভাবে জানতেন যে, ব্রিটিশদের আগমন ভারতবর্ষের পক্ষে দৈবানুগ্রহ বিশেষ, কারণ ব্রিটিশ শাসন ও আইনের ফলে ভারতবর্ষের অনগ্রসরতা দূর হবে। সঙ্গে সঙ্গে এ যাবত নিরবচ্ছিন্নভাবে যে সব সেচ্ছাচারী শাসকরা রাজত্ব করেছেন তাদের ধারাও শেষ হবে এবং ভারতবর্ষের মানুষ রাজনৈতিক চেতনা লাভ করবে।

হিতবাদীদের মধ্যে জেমসমিল ভারতীয় ঐতিহাসিক চিন্তাধারার ওপরে সবচেয়ে বেশি প্রভাব বিস্তার করেছিলেন। তাঁর 'ব্রিটিশ ভারতের ইতিহাস'-এর সবচেয়ে গুরুত্বপূর্ণ দিক বোধহয় এটি ভারতীয় ইতিহাসের সাম্প্রদায়িক ব্যাখার সূচনা করেছিল এবং পরে দ্বিজাতিতত্ত্বের ঐতিহাসিক সমর্থন যুগিয়েছিল। ঐতিহাসিকদের মধ্যে তিনিই সর্বপ্রথম ভারতীয় ইতিহাসকে তিনটি পর্বে ভাগ করার রীতি প্রচলন করেন। এই তিনটি অধ্যায় হল হিন্দুসভ্যতা, মুসলিম সভ্যতা এবং ব্রিটিশ সভ্যতা [বিচিত্র হল, খ্রীষ্টান সভ্যতা নয়] মিলের (History of British India) লেখা ছিলো সধারণভাবে স্বীকৃত সর্বপ্রথম ভারতের ইতিহাস এবং এর প্রভাব এতোই বেশি যে, এখনো অনেকে তাঁর মূলধারণা গুলিতে বিশ্বাস করেন। কোনো কোনো ঐতিহাসিক ভারতীয় ইতিহাসকে অতীত, মধ্য এবং আধুনিক যুগে বিভক্ত করেন বটে, কিন্তু এই বিভাগের মূলেও আছে মিলের মতবাদ, অর্থাৎ গুরুত্বপূর্ণ রাজবংশগুলির ধর্মের পরিবর্তন। ভারতীয় শাসন বিভাগের আমলাদের প্রাথমিক পাঠ্যসূচীর অন্তর্গত ছিলো মিলের ইতিহাস এবং ঊনবিংশ শতকের বিট্রিশ ঐতিহাসিকদের অধিকাংশই এই শ্রেনী থেকে এসেছিলেন। মিল তাঁর ইতিহাসে হিন্দু সংস্কৃতিকে বর্ণনা করেছেন পশ্চাৎমুখী এবং প্রগতি এবং যুক্তির পরিপন্থী হিসেবে। তিনি যার নাম দিয়েছেন 'মুসলমান সভ্যতা'। সে বিষয়ে তিনি একটু বেশি সহানুভূতিশীল ছিলেন, যদিও সে সম্পর্কে ও তিনি কখনো কখনো বিরূপ সমালোচনা করতে ছাড়েননি। এর ফলে প্রাচ্যবাদীদের একটি অংশ পরবর্তীকালে ভারতীয় ঐতিহাসিকদের কেউ কেউ কিছুটা বাধ্য হয়েই 'হিন্দু সভ্যতার' সমর্থন করেছেন, যদিও তার জন্যে তাদের প্রাচীন অতীতকে অতিরিক্ত গৌরবদান করতে হয়েছে।

খ্রিষ্টপূর্ব ১০০০ সন থেকে ১২০০ খৃষ্টাব্দ পর্যন্ত যে যুগ তাহলো হিন্দুযুগ, কারন তখন সমস্ত উপমহাদেশের শাসক বংশ গুলি হিন্দু ধর্মাবলম্বী ছিলো। কিন্তু রাজবংশের ইতিহাসের ভিত্তিতে এ যুগকে হিন্দু মনে করা সঠিক নয় কারন মৌর্য, ইন্দো-গ্রীসিয়, শক, কুষাণ প্রভৃতি বহু প্রধান রাজবংশই অহিন্দু ছিল। অনেক রাজারই ছিলেন বৌদ্ধ, এবং হিন্দুবিদ্বেষী না হলেও তাঁরা সচেতনভাবে নিজেদের বৌদ্ধ বলে পরিচয় দিতেন। তাহলে কি আমরা মনে করব যে খ্রিষ্টপূর্ব ৫০০ সাল থেকে ৩০০ খ্রীষ্টাব্দ পর্যন্ত একটি বৌদ্ধ যুগও ছিল? আজকের ভারতে যদি যথেষ্ঠ সংখ্যক বৌদ্ধ থাকতেন, তাহলে হয়তো এ ধারণাটিও স্বীকৃতি পেতো।

হিন্দু কথাটির প্রকৃত অর্থ কি এ নিয়ে কিছু প্রশ্ন থেকে যায়। ভারত সম্পর্কিত প্রাক-ইসলামীয় উপাদান সমূহে কথাটি পাওয়া যায়না। হিন্দ্ [ইন্ডিয়া] দেশে যারা বাস করতেন তাঁদের বর্ণনা করার জন্যে প্রথমে আরবরা এবং পরে অন্যরা এটি ব্যবহার করতেন। অর্থাৎ 'হিন্দু' সংজ্ঞাটি গোড়ায় হিন্দুরা নিজেরা সৃষ্টি বা ব্যবহার করেননি, এটি ছিলো একটি বিদেশী শব্দ যা পরে হিন্দুরা গ্রহণ করেছেন। আজকের দিনে আমরা যাকে হিন্দু বলে স্বীকার করি, অতীত যুগে তার প্রায় কোনো পরিচয়ই মিলবে না। আজকের অর্থে হিন্দুর উন্মেষ ঘটে গুপ্তযুগের পরে, পঞ্চম খ্রীষ্টাব্দে। প্রাক-মুসলমান যুগের ভারত বিভিন্ন ধর্মীয় সম্প্রদায় ও গোষ্ঠীগুলি যে নিজেদের হিন্দু বা কোনো ঐক্যবদ্ধ ধর্মসম্প্রদায় বলে মনে করতেন না তার প্রচুর প্রমান প্রাচীন ভারতের ঐতিহাসিক উপাদান থেকে পাওয়া যাবে। বৌদ্ধদের নিজস্ব ধর্ম সংগঠনের যে রূপ ছিল তা সম্পূর্ণ আলাদা। প্রকৃতপক্ষে আধুনিক হিন্দু ধর্মের, বিশেষত ভক্তি সম্প্রদায়ের লক্ষণ গুলি বিশেষভাবে মধ্য যুগেই দেখা দিলো, যদিও সাম্প্রদায়িক ঐতিহাসিকরা এ যুগকে অবক্ষয়ের যুগ বলে মনে করেন (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)।সপ্তম থেকে ত্রয়োদশ শতাব্দী পর্যন্ত নিজেদের মুসলমানদের থেকে পার্থক্য নির্দেশের জন্য হিন্দুরা অনেক পরিভাষা ব্যবহার করতেন। তবে লক্ষনীয় বিষয় হলো আজকের দিনে সে যুগের ইতিহাস লেখার সময় আমরা আরব, তুর্কি এবং পারসিক সকলকে একসঙ্গে 'মুসলমান' বলে অভিহিত করি। কিন্তু আকর গ্রন্থ গুলিতে ত্রয়োদশ শতাব্দী পর্যন্ত এইসব বিভিন্ন লোকেদের বর্ণনায় মুসলমান শব্দের ব্যবহার বিরল। সে যুগের আকর গ্রন্থে ধর্মীয় পরিভাষা ব্যবহার না করে সম্পূর্ণ রাজনৈতিক সংজ্ঞার্থ ব্যবহার করা হতো। তুর্কিদের বলা হ'তো তুরস্ক এবং আরব দের বলা হ'তো যবন। পশ্চিম এশিয়া বা ভূমধ্যসাগরীয় অঞ্চল থেকে আগত গ্রীক, রোমীয়, আরব, নির্বিশেষে সকলেই যবন বলার রীতি ছিল। সংস্কৃতে 'যবন' কথাটি প্রাকৃত যোনা থেকে গৃহীত এবং যোনা কথাটি এসেছে 'আয়োনিয়া' থেকে। কারন পশ্চিম এশিয়ার সঙ্গে সর্বপ্রথম এবং ঘনিষ্ঠতম সম্পর্ক স্থাপিত হয় আয়োনীয় গ্রীকদের (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)। প্রাচীন ভারতের ইতিহাসে সবচেয়ে কূটসমস্যা হলো আর্য সমস্যা। এর মূল অর্থ নিহিত আছে কয়েকজন প্রাচ্যবাদীর লেখায়। তারা প্রথম থেকে আর্য জাতিকে বহিরাগত হিসেবে প্রমান করার চেষ্টা করেছেন। সর্বশেষ গবেষণালব্ধ বিষয়ে এটা প্রমানিত যে আর্য এখন আর জাতি নয় এটি একটি ভাষা। একই ভাষাভাষী একটি গোষ্ঠীর ক্ষেত্রে ব্যবহার করা হয় বলে ঐতিহাসিকরা এর নাম রেখেছে 'ইন্দো-ইউরোপীয়ান' ভাষা। আবার ভারতবর্ষকে আর্যদের বাসভূমি প্রতিপন্ন করার চেষ্টা কিছুকিছু ঐতিহাসিকরা করেছিলেন। কেননা তাদের উদ্দেশ্য ছিল একটি ভূয়ো জাতীয় অহমিকাকে প্রতিষ্ঠা করা। কিন্তু শেষ পর্যন্ত সেটা সফল হয়নি। আবার প্রাচীন ভারতের ইতিহাসে গুপ্তযুগকে স্বর্নযুগ বলে কিছু ঐতিহাসিকরা অভিহিত করেছিলেন। কিন্তু স্বর্ণযুগের এই তত্ত্বটিও ছিল পরস্পর বিরোধিতায় ভরা। কিছু ঐতিহাসিক গুপ্তযুগকে হিন্দু নবজাগরণের যুগ বলে মনে করেন। কিন্তু সে যুগের প্রধান প্রধান শিল্প নৈপুণ্যের নিদর্শন যেমন চিত্রকলা ও ভাস্কর্য আমরা দেখতে পাই সেগুলো বৌদ্ধ মঠের অনুপ্রেরনায় নির্মিত হয়েছিল। তাহলে হিন্দু নবজাগরনের যুগ বলে কি লাভ? আবার অহিংসাকে যদি হিন্দু ঐতিহ্যের শ্রেষ্ঠ অবদান বলে মনে করা হয় তাহলে গুপ্তগযুগ স্বর্নযুগ দাবী করতে পারেনা কেননা সামরিক বিজয়ের মধ্যে দিয়ে তাদের শাসন টিকিয়ে রেখেছিলেন গুপ্ত শাসকেরা। এইভাবে প্রাচীন ভারতের ইতিহাসে সমাজের একটি শ্রেণীকে নিয়ে অধিক গুরুত্ব দেওয়া হয়েছিল। অন্য

শ্রেণী গুলিকে তেমন গুরুত্ব দেওয়া হয়নি। পরবর্তিকালে যার ফল হয়েছিল মারাত্মক। সাম্প্রদায়িকতার এই প্রভাব পরবর্তিকালের ইতিহাস রচনার ক্ষেত্রে ব্যাপক প্রভাব বিস্তার করেছিল।

প্রাচীন ভারতের ইতিহাস চর্চার ক্ষেত্রে এই ধরনের উগ্র মনোভাব প্রায়ই দেখা যায়। ইতিহাস চর্চার পীঠভূমি বাংলার প্রেক্ষাপট বিচার করলেই এই সত্যে উপনীত হতে পারবো। বঙ্কিম চন্দ্র চট্টোপাধ্যায় একদা ক্ষোভ প্রকাশ করে বলেছিলেন, 'বাঙালীর ইতিহাস নাই' (বঙ্গদর্শন পত্রিকা, ১৮৯২)। ইতিহাস বই লেখা হচ্ছিল অনেক কিন্তু তাতে বাঙালীর প্রকৃত ইতিহাস থাকছিল না। এই প্রকৃত ইতিহাস কি, তা নিয়ে ও বঙ্কিমের মত ছিল স্পষ্ট। প্রকৃত ইতিহাস হল পূর্বপুরুষের গৌরবের স্মৃতি। আসলে তাঁর ক্ষোভ হল, বাঙ্গালীর স্ব-রচিত বাংলার ইতিহাস নেই। এমনকি 'একখানি ইংরাজি গ্রন্থেও বাংলার ইতিহাস নাই'। আসলে সাহেবরা কেবল বিজাতীয় মুসলমানদের সাক্ষ্য অবলম্বন করে বাংলার ইতিহাস লিখিছেন, তাতে বাঙ্গালির সাক্ষ্য নেই। বাঙ্গালির কাছে এই ইতিহাস গ্রহন যোগ্য নয়। 'আত্মজাতিগৌরবান্ধ, মিথ্যাবাদী, হিন্দুদ্বেষী মুসলমানদের কথা যে বিচার না করিয়া ইতিহাস বলে গ্রহন করে, সে বাঙালি নয়'। বিদেশী শাসকের লেখা ইতিহাসে পরাধীন জাতি তার নিজের কথা খুঁজে পাবেনা, নিজেদের ইতিহাস নিজেদেরই লিখতে হবে- জাতীয়তাবাদের এই হল প্রাথমিক শ্লোগান। স্ব-রচিত ইতিহাসের অভাব নিয়ে বঙ্কিমের ক্ষোভ নিঃসন্দেহে তাঁর জাতীয়তাবাদেরই প্রকাশ (চট্টোপাধ্যায়, পার্থ ২০১১)। ১৮৮০ সালে বঙ্কিম যখন আহ্বান জানাচ্ছেন, 'বাঙলার ইতিহাস চাই, নাহলে বাঙলার ভরসা নাই, কে লিখিবে? তুমি লিখিবে, আমি লিখিব, সকলেই লিখিবে। যে বাঙ্গালী, তাহাকেই লিখিতে হইবে'। কিন্তু পরবর্তিকালে যে ইতিহাস বই রচিত হয় তাতেও রয়েছে প্রকৃত ইতিহাসবোধের অভাব (চট্টোপাধ্যায়, বঙ্কিমচন্দ্র, বাঙ্গালার ইতিহাস সম্বন্ধে কয়েকটি কথা, বিবিধ প্রবন্ধ, দ্বিতীয় খণ্ড।

ভারতে ইতিহাসবোধের প্রকৃত ধারণা প্রতিষ্ঠিত হয় উনিশ শতকের দ্বিতীয়ভাগে ব্রিটিশদের হাতধরে। উনিশ শতকের গোড়ার দিকে লেখা মৃত্যুঞ্জয় বিদ্যালঙ্কারের 'রাজাবলি' (১৮০৮) সম্পূর্ণ অন্য ঐতিহাসিক স্মৃতি ধারণ করে আছে। এটি সাহেবদের ফরমায়েশে লেখা। বাংলা ছাপা বই এর মধ্যে প্রথম ভারতবর্ষের ইতিহাসটি লিখতে গিয়ে মৃত্যুঞ্জয়কে নতুন করে গবেষণা করতে হয়েছিল, তা মনে হয় না। তবে তাঁর রচনার একটি প্রধান বৈশিষ্ঠ্য হল, ইতিহাসের ঘটনা এবং তার পারস্পর্য সম্পর্কে তাঁর পরিপূর্ণ নিশ্চিতি। দিল্লি ও বাংলার সিংহাসনে যে যে বাদশা ও নবাব হয়েছেন তার একটা প্রচলিত বিবরণই মৃত্যুঞ্জয় লিপিবদ্ধ করেছেন। বাংলার পণ্ডিত সমাজ, বিশেষ করে কুলগ্রন্থ রচয়িতাদের মহলে যে এরকম একটা ইতিহাস সুপ্রচলিত ছিল, তাতে বিশেষ সন্দেহ নেই। রাজাবলিতে মৃত্যুঞ্জয় প্রাচীন ভারতের ইতিহাসকে আলোকপাত করেছেন এইভাবে - 'পরেমশ্বর এই পৃথিবী পালন নিমিত্ত ইক্ষ্বাকু নামে অশ্বত্থ বৃক্ষ রূপ রাজাকে সত্য যুগে প্রথমত আরোপিত করিয়াছিলেন। ঐ রাজার স্কন্ধ শাখাদ্বয় রূপ সূর্যবংশ ও চন্দ্রবংশ এই দুই বংশের ধারাবাহিক সন্তান- পরম্পরাতে চারিযুগে এই পৃথিবী মণ্ডল অধিকৃত ছিলেন। এই উভয় বংশীয় রাজাদের মধ্যে মহত্তম ধর্ম্ম তপোবল প্রভাবে কেহ কেহ সপ্তদ্বীপ পৃথিবীর শাসন করিয়াছেন, কেহ কেহ মহত্তর ধর্ম্ম তপস্যাবল ও প্রতাপে জম্বুদ্বীপ মাত্রের অধিকার করিয়াছেন। কেহ কেহ মহাধর্ম্ম তপোবল বশতঃ ভারতবর্ষ মাত্রের অধিকার করিয়াছেন, কেহবা কুমারিকা খন্ড মাত্রের রাজা ছিলেন এই দুই বংশের রাজাদের মধ্যে একতর সম্রাট হইলে অন্যতর মণ্ডলেশ্বর হইতেন। ইহাদের বিবরন পুরানেতিহাসাদি শাস্ত্রে বিস্তারিত আছে'।

মৃত্যুঞ্জয়ের ধারণায় পৃথিবীর প্রতিপালক শাসনকর্তারা পরমেশ্বর প্রেরিত। ধর্মের তপস্যাবলে তাঁরা এই অধিকার ভোগ করেন। সেই তপস্যা শুধু মহৎ না মহত্তর, না মহত্তম, তার ওপর নির্ভর করছে এদের আধিপত্যের সীমানা। মহত্তম ধর্ম তপস্যার প্রভাবে সমগ্র পৃথিবীর অধিপতি হওয়াও সম্ভব ছিল। এমন ধারণার ওপর প্রতিষ্ঠিত রাজবংশের ইতিহাস কে আমরা হয়ত অনেকেই ইতিহাস বলে মানতে রাজি হব না, যদিও একটু পরেই দেখা যাবে যে নিঃসন্দেহে ঐতিহাসিক ঘটনার স্মৃতিও এই ধারণার সঙ্গেই গ্রথিত হয়ে রয়েছে। যাই হোক, অকারণ ভুল বোঝাবুঝি এড়াতে মৃত্যুঞ্জয়ের কাহিনী গুলিকে ওঁরই সূত্রানুসারে বলা যাক 'পুরাণেতিহাস'। 'যবনদের' উত্থানের বিষয়ে তিনি উল্লেখ করেন- 'পৃথ্বী রাজের পিতার দুই স্ত্রী ছিল। এক স্ত্রী মানুষের মাংস খেত। স্বামীকেও সে নরমাংস খাওয়ার অভ্যাস করায়। অপর স্ত্রীর পুত্রকে একদিন সেই রাক্ষসী খেয়ে ফেলে। অপর স্ত্রী তখন পালিয়ে ভাইয়ের আশ্রয়ে যায় এবং সেখানে এক পুত্র সন্তান প্রসব করে। তার নাম হয় পৃথু। পৃথু বড় হয়ে তার পিতার সঙ্গে মিলিত হয়। পিতার অনুরোধে পৃথু তার পিতার শিরোচ্ছেদ করে একুশজন স্বজাতীয় স্ত্রীলোককে সেই মাংস খাওয়ায়। পরে রাজা হয়ে পৃথু সেই একুশ জনের পুত্রকে তার সামন্ত করে। এইরূপে পৃথু রাজার পিতৃহত্যা করাতে পূর্ব হইতেও অধিক অখ্যাতি দিনে দিনে বাড়িতে লাগিল ও পূর্বে যে রাজারা কর দিতো তাহারা কেহ কর দিল না। মোটকথা রাজা হিসাবে পৃথ্বীরাজ বড় একটা লোকমান্য ছিলোনা। এমন সময় শিহাবুদ্দিন ঘুরীর আক্রমন উপস্থিত হল- 'রাজা যবনদের প্রাগলভা শুনিতে পাইয়া অনেক পন্ডিতদিগকে আনাইয়া কহিলেন হে পণ্ডিতেরা এমন কোনো যজ্ঞের আরম্ভ কর যাহাতে প্রতিভা ও প্রাগোলভা উত্তোরত্তর হ্রাস পায়। পন্ডিতেরা আজ্ঞা করিলেন হে মহারাজ এমন যজ্ঞ আছে আমরা কহিতেও পারি কিন্তু আমরা যে সময়ে অবধারণ করিবো সে সময়ে যজ্ঞের যুপ স্থাপন যদি হয় তবে সে যুপ যাবত থাকিবে সে তাবৎ যবনেরা এদেশে কখনো আসিতে পারিবে না। রাজা পন্ডিতদের এই বাক্যে সন্তুষ্ট হইয়া বড়ো সমারোহ করিয়া যজ্ঞের আরম্ভ করলেন। যূপ স্থাপনের সময় হইলে পন্ডিতদের অনুমতিমাত্রে যূপ স্থাপন করিতে যূপ উঠাইতে নানা যত্ন করিলেন যুপ কদাচ উঠিল না। তদন্তর পন্ডিতেরা কহিলেন হে মহারাজ ঈশ্বরের যে ইচ্ছা সেই হয় পুরুষ ঈশ্বরেচ্ছা অপর প্রবল নয় কিন্তু তাহার সহকারী বটে ঈশ্বরেচ্ছা সহকৃত পুরুষ কার্য সাধক হয় অতএব নিবৃত্ত হও বুঝি এ সিংহাসন যবনাক্রান্ত হইবে'।

পন্ডিতদের কথায় পৃথ্বীরাজ যুদ্ধে শৈথিল্য করিলেন। শিহাবুদ্দিন শত্রু সৈন্য ধ্বংস করে দিল্লি পৌছে গেলেন, পৃথ্বীরাজ তখন-'অন্তপুর হইতে নির্গত

হইয়া শাহাবুদ্দিনের সহিত ঘোরতর রণ করিলেন কিন্তু ঈশ্বরেচ্ছাতে সাহাবুদ্দিন যবন ঐ রঙ্গভুমিতে পৃথু রাজাকে ধরিয়া পৃথু রাজা জয় চন্দ্র রাজার জামাতা হন [স্মরণীয়, জয় চাঁদ ইতিমধ্যেই মুহম্মদ ঘুরির সহায়তা করেছেন] এই অনুরোধে তাহাকে নষ্ট করিলেন না, কিন্তু কএদ করিয়া খাড়া খাড়া আপন দেশে গজনেনে পাঠাইয়া দিলেন'। মৃত্যুঞ্জয় এর মত লেখকরা বিশ্বাস করেন রাজবংশের পত্তন হয় ঈশ্বরেচ্ছায়। ধর্মের প্রতি বিশ্বস্ত থাকলে তবেই সেই রাজত্ব বজায় থাকে। নরমাংস ভক্ষণ এবং পিতৃহত্যার মতো চরম পাপাচারের দোষ লেগেছিল চৌহান রাজবংশে। পৃথ্বীরাজ যে ঈশ্বরের বিরাগভাজন হয়েছেন তার প্রমাণ পাওয়া গেল যজ্ঞের আসরে। সুতরাং মুহম্মদ ঘুরির যুদ্ধ জয় এবং 'যবন রাজত্ব' প্রতিষ্ঠা একান্তই ঈশ্বরের ইচ্ছায় সম্পন্ন ঘটনা 'পুরুষ ঈশ্বরেচ্ছার ওপর প্রবল নয় কিন্তু তাহার সহকারী বটে ঈশ্বরেচ্ছা সহকৃত পুরুষ কার্য্য সাধক হয়'। মৃত্যুঞ্জয়ের অর্ধ শতাব্দী পর যখন পুরানেতিহাস বর্জন করে দস্তুরমতো ইতিহাস লেখা হবে, তখন কিন্তু থানেশ্বরের এই যুদ্ধের বিবরন আপাদমস্তক বদলে যাবে। ইংরেজী শিক্ষিত ব্রাহ্মণ পন্ডিতেরা ঈশ্বরেচ্ছাকে অতি সহজে মেনে নেবেন না।

সম্রাট ও অভিজাত শ্রেনীর মধ্যেকার সম্পর্ক একটি প্রাতিষ্ঠানিক রূপ নেবে সে খুব ভালো কথা। কিন্তু সেটাই মূল বিষয় নয়। এই স্থিতাবস্থার এক প্রধান বিপদ স্বরুপ ছিলেন হিন্দু রাজা, রাও, রানা, জমিদার প্রভৃতি। আমরা পরে দেখবো যে, এঁরাও ছিলেন বৃহত্তর শাসক শ্রেণীরই গুরুত্বপূর্ণ অংশ। কাজেই যখন সে যুগের ঐতিহাসিকরা হিন্দুদের বিনাশ কামনা করতেন, তখন তারা হিন্দু বলতে এই গোষ্ঠীর কথাই চিন্তা করতেন। পুর হিন্দু সমাজ ধ্বংস করা তাদের অভিপ্রায় হতে পারে না, বিশেষ করে যেখানে হিন্দু কৃষকদের কাছ থেকে আদায় করা খাজনার উপর নির্ভর করে হিন্দু রাজা ও মুসলমান ইক্তেদারদের মতো তাঁদেরও বিলাস ভুল জীবন যাত্রা নির্বাহিত হতো। সুতরাং ঐতিহাসিকরা যখন 'হিন্দু' শব্দটি ব্যবহার করতেন, তখন তারা রাজনৈতিক ও সামাজিক ক্ষেত্রে ক্ষমতাশালী হিন্দু সমাজভুক্ত একটি বিশেষ সম্প্রদায়েরই কথা মনে করতেন। এক্ষেত্রে হিন্দু শব্দটি ব্যবহৃত হয়েছে প্রায় সম্পূর্ণ রাজনৈতিক অর্থে, ধর্মীয় অর্থে নয় (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)।

প্রাচীন ভারতকে যেমন হিন্দু যুগ বলা ঠিক নয়। প্রাচীন যুগে মৌর্য এবং গুপ্ত শাসন যেমন বল পূর্বক সারা ভারতে চাপিয়ে দেওয়া হয়েছিল তেমনি মধ্যযুগের শাসনও বলপূর্বক সারা ভারতে চাপিয়ে দেওয়া হয়েছিল। সামরিক শর্তই ছিল তার ভিত্তি। সুতরাং জনগনের ইচ্ছা নয়, সামরিক শক্তিই ছিল রাষ্ট্র শক্তির উৎস। কখনো কি এই সময় পরিধিতে দিল্লীর বাদশার কাছে সারা ভারত স্বেচ্ছায় মাথানত করেছিল। তাই যদি না হবে তাহলে মুসলমান শাসন কর্তা বলেই কি অমুসলমানদের ইতিহাসকেও মুসলিম যুগ বলে ধরতে হবে? দ্বিতীয়ত মুসলমান শাসনের আরম্ভের কোন নির্দিষ্ট তারিখ ধরা যায়না। যদি বলি, কেন ১২০৬ খ্রিঃ? ঐ সময় তো সিন্ধু জয় হয়েছিল মাত্র, তা কি সারা ভারত জয় বলা যায়? আর ঐ সময় থেকে মুঘল সাম্রাজ্য দাক্ষিনাত্যে বিস্তারতো কয়েক শতাব্দী বছরের ব্যাপ্তি। আক্রমণকারী মুসলমানদের ভারতের এক অংশের অধিকারকে সমগ্র ভারত অধিকার বলা নিশ্চয়ই ভুল নয় কি? তৃতীয়ত, এই তথাকথিত মুসলমান আমলে বিভিন্ন মুসলমানদের কাছে ইসলাম তো একই অর্থ বহন করেনি। গিয়াসুদ্দিন বলবন, আলাউদ্দিন খলজি, আকবর, দারা-শুকোহ, ঔরঙ্গজেব, নিজাম উদ্দিন আউলিয়া কিংবা কবীর- সবার কাছে ইসলাম কি একই রকম? চতুর্থত, বেদান্ত বা উপনিষদ এবং ইসলাম যেহেতু উভয়েই ঘোষণা করেছে ঈশ্বর এক এবং অদ্বিতীয়, সুতরাং তাদের মধ্যে মৌলিক মিল যে নেই তা তো নয়। পরর্বতী কালের পৌরাণিক ধর্ম এবং অন্য দিকে স্বার্থপর মোল্লা উলেমাদের ভুল ব্যাখাই কি মানুষে মানুষে ভেদাভেদ বাড়ায়নি? মধ্য যুগে ভারতীয় সাধনার ধারায় সাম্যবাদ ভ্রাতৃত্ব (মিল্লাত) দেখা গেছে মাঝেমাঝেই। দীনেশচন্দ্র সেন, আচার্য ক্ষিতিমোহন সেন, জগদীশ নারায়ণ সরকার এবং মুহম্মদ আব্দুল জলিল এদের লেখায়। পশ্চমত, সবচেয়ে বড় কথা এই যে, তথাকথিত মুসলমান আমলে শাসক শ্রেনীর মধ্যে অন্তর্দ্বন্দ্ব কম ছিলো না। সতীশ চন্দ্র এবং আতাহার আলী প্রমুখ ঐতিহাসিকগন এটা প্রমান করেছেন। রাজনৈতিক তথা ক্ষমতার দ্বন্দ্ব অবশ্যই ছিল মুসলমান শাসক এবং হিন্দু প্রজার মধ্যে কিন্তু সমাজের নিচু তলার হিন্দু প্রজা ও মুসলমান প্রজার মধ্যে সমাজ জীবনে সংঘাত ও সংমিশ্রণের মধ্যে দেয়ে গড়ে উঠলো এক ভারতীয় সংস্কৃতি (চট্টোপাধ্যায়, গৌতম ২০১১)।

আমরা সবাই জানি ঔরঙ্গজেব নিষ্ঠাবান গোঁড়া সুন্নি মুসলমান। তিনি যে বেশ পরিমানে ধর্মান্ধ ছিনেন সে বিষয়ে ও অস্বীকার করার প্রশ্নই ওঠেনা। কিন্তু সেই একই বাদশা যদি কখনো দেখা যায় যে হিন্দু মন্দির নির্মানে বা সংস্কারে অর্থ বিনিয়োগ করছেন তাহলে আমাদের অবাক হতে হয়, কারন প্রচলিত ধারণার সঙ্গে তা মেলে না। কেননা তাঁর ধর্মান্ধতার জন্যে নাকি মুঘল সাম্রাজ্যের পতন ঘটেছিল। কিন্তু অধুনা ইতিহাস চর্চায় একথা প্রমানিত যে, ঔরঙ্গজেবের ধর্মান্ধতাই মুঘল সাম্রাজ্যের পতনের কারণ নয়, এরজন্যে দায়ী ছিল অষ্ঠাদশ শতকের পরিবেশ, শাসক শ্রেনীর মধ্যে দ্বন্দ্ব, কৃষক শ্রেনীর প্রতিরোধ, রাষ্ট্র ব্যবস্থায় ভাঙ্গন, স্থানীয় বা আঞ্চলিক শক্তির উত্থান এবং অর্থনৈতিক দুর্বলতা (বন্দ্যোপাধ্যায় ২০১১)। একথাও আজ জানা যাচ্ছে যে আকবরের ধর্ম নীতি তার পারিপার্শ্বিক অবস্থার মধ্যেই গৃহীত ছিল। রাজনৈতিক প্রয়োজনই যেখানে রাষ্ট্রনীতির নিয়ামক সেখানে উদারতা বা ধর্মান্ধতা বড়ো নয়। মুঘল যুগে কৃষক শ্রেনীর অবস্থা, সামাজিক শ্রেনী- বৈষম্য এবং সামাজিক দ্বন্দ্ব প্রকট আকার ধারণ করেছিল। সম্রাট আকবর যেমন কোনো ধর্মনিরপেক্ষ চিন্তার অধিকারী ছিলেন না, কারন এই তত্ত্বটি একেবারে আধুনিক, তেমনি প্রমাণ করার মত প্রয়োজনীয় তথ্য আমাদের হাতে নেই যে মধ্যযুগে রাষ্ট্র পাইকারী হারে হিন্দুদেরও ইসলাম ধর্মে দীক্ষিত করার চেষ্টা করেছিল। (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)। 'জিজিয়া কর' প্রবর্তন করে বহু মুসলমান শাসক নিন্দিত, কিন্তু কম বইতে লেখা থাকে যে হিন্দুদের যেমন 'জিজিয়াকর' দেওয়া বাধ্যতা মূলক ছিল অনেক সময় মুসলমানদেরও 'জাকাত' দিতে হত। অধ্যাপক সতীশ চন্দ্র দেখিয়েছেন যে আওরঙ্গজেবের সময় 'জিজিয়াকর' পুনঃপ্রবর্তিত হয়েছিল ঠিকই তেমনি অন্য ৬৬ টি কর উঠিয়ে দেওয়া হয়েছিল যা আকবরের সময় বা পূর্ববর্তী যুগে নেওয়া হত (চট্টোপাধ্যায়, গৌতম ২০১১)।

সম্রাট আকবরের চরিত্র সম্বন্ধে মৃত্যুঞ্জয় উচ্ছসিত ছিলেন। 'শ্রী বিক্রমাদিত্যের পর এই হিন্দুস্থানে এখন পর্যন্ত গুনেতে আকবর শাহের সম সম্রাট আর কেহ নাহি'। ধর্মরক্ষা ও প্রজার প্রতিপালনে আবশ্যক সবরকম গুণ ছাড়াও আকবরের চরিত্রের যে দিকটি মৃত্যুঞ্জয় বিশেষভাবে লক্ষ্য করেছেন, সেটা হল যে আকবর 'নানাবিধ শাস্ত্র জ্ঞানের জন্য পারমার্থিক বুদ্ধি প্রতিভাতে মহম্মদের মতে অনাস্থা করিয়া মনে মনে হিন্দুদের মতই আস্থা করিতেন। অতএব ইরান ও তুরানের রাজারা ইহাকে অনুযোগ করিয়া লিখিতেন'। এমনিক 'ইনি গোমাংস ভক্ষণ করিতেন না এবং কিল্লার মধ্যেতেও গোবধ বারণ করিয়া দিয়েছিলেন, তৎপ্রযুক্ত তদরকি এখনও তাহার কিল্লাতে গোবধ হয় না' আবার আওরঙ্গজেব সম্বন্ধে মৃত্যুঞ্জয় লিখেছেনঃ 'ইনি মহম্মুদী মতে অতি বড় তৎপর হইলেন। আর প্রধান প্রধান অনেক দেবস্থান নষ্ট করিলেন। হিন্দুদের মতে সূর্য্যায্য ও গণেশ পূজাদি দেব কৃত্য সকল বাদশাহী কিল্লার মধ্যে আকবর অবধি নিয়মিত ছিল সে সকল আইনের মধ্যে অনেক আইনের অন্যথা করিয়া স্বকপোরচিত অনেক আইন জারি করলেন'।

রাজা যেখানে ঈশ্বর প্রেরিত, ঈশ্বরের অনুগ্রহেই যেখানে তাঁদের রাজ্য পাঠে অধিকার, সেখানে রাজ চরিত্রের মতিগতি বিচার করা মোটামুটিভাবে আর রাজাদের মধ্যেকার ব্যাপার। সাধারন প্রজার সেখানে একমাত্র ফলভোগ ছাড়া কোনও ভূমিকা নেই। অবশ্য ভাল রাজা আর মন্দ রাজার প্রভেদ প্রজা জানে, কারন সুশাসন কিংবা অপশাসনের ফল-সেই ভোগ করে। সুতরাং আকবরের মত মহান সম্রাটের সে গুণগান করে। আবার আওরঙ্গজেব যখন তাঁর দুষ্কর্মের ফল স্বরূপ 'ব্রাহ্মনের শাপেঁ বিকৃত শব্দ করিতে করিতে' মারা যান, সে গল্প বলতে বলতে প্রজা যেন দেবরোষের কঠোরতায় খানিক শিউরে ওঠে শেষ পর্যন্ত ধর্মের জয় সম্বন্ধে আশ্বস্তই হয়। কিন্তু শাসন কার্যের অনুষ্ঠানের সঙ্গে সে কখনো নিজেকে জড়ায় না, রাজার জায়গায় নিজেকে বসাবার কথা ভাবতেই পারেনা। রাজত্বের ইতিহাসে সে নিজের ইতিহাস খোঁজে না। 'কীর্ত্তিমন্ত পূর্ব্ব পুরুষ গনের কীর্ত্তি' বর্ননা করার মধ্যে দিয়ে যে সমগ্র জাতির ইতিহাস প্রকাশ করা যায়, এমন কথা মৃত্যুঞ্জয়ের আদৌ বোধগম্য হত বলে মনে হয় না। কয়েক হাজার বছরের রাজ পুরুষদের বিবরণ দিতে গিয়ে তাঁর নিজের অবস্থান একটিই- স্থির এবং অপরিবর্তনীয়। সে অবস্থান প্রজার অবস্থান। সেই জায়গায় দাঁড়িয়ে তিনি পৃথ্বীরাজের অপকর্মের প্রতিফলন যেমন বর্ননা করেছেন, তেমনি আকবরের গুণপনাকে ধন্য ধন্য করেছেন' কিন্তু স্বজাতীয় অথবা বিজাতীয় বলে পৃথ্বীরাজ কিংবা আকবরের কৃতকর্মের ঐতিহাসিক দায় তাঁর ওপর বর্তাতে পারে, এমন সম্ভবনা তাঁর চিন্তাতেও আসেনি। রাজাবলি জাতীয় ইতিহাস নয়, কারন ইতিহাসের কর্তা এখানে রাজা এবং দৈবশক্তি; কোনো জাতীয় ঐক্যবন্ধনের সূত্র ধরে ঐতিহাসিকের নিজস্ব চৈতন্য ইতিহাসের কর্তার স্থানটি এখানে দখল করে নিতে পারেনি। বঙ্কিম যে জাতীয় ইতিহাসের কথা বলবেন, তার রচয়িতা যেমন 'তুমি, আমি, সকলে', সে ইতিহাসের কর্তাও তেমনি 'তুমি, আমি, সকলে'। এই নতুন ইতিহাসবোধে আলোকপ্রাপ্ত হওয়ার সৌভাগ্য মৃত্যুঞ্জয়ের হয়নি। তাই বাঙালি প্রজার একান্ত বিশিষ্ট অবস্থান থেকেই তিনি রাজা রাজড়ার কাহিনী বলে গেছেন (চট্টোপাধ্যায়, পার্থ ২০১১)।

আধুনিক ভারতের ইতিহাসের মূল ঐতিহাসিক গতিধারা একটু ভিন্নতর। কেননা এটি তৈরী হয়েছিল ব্রিটিশ শাসনের বিরুদ্ধে। একদিকে জাতীয়তাবাদী আন্দোলনের স্ফুরণ, বিকাশ ও তার পরিণতি অপর দিকে বিদেশী শাসনের শৃঙ্খল মোচনের জন্য মুক্তির পথে যাত্রা। সাধারণত তিনটি উপাদান এই গতিকে পরিচালিত করেছে যেমন-সাম্রাজ্যবাদ, জাতীয়তাবাদ এবং সাম্প্রদায়িকতা। এই তিনটি ঐতিহাসিক বৈশিষ্ট্যের পারস্পরিক দ্বন্দ্বকে কেন্দ্র করে আধুনিক ভারতের ইতিহাসের গতিধারা নির্ধারিত হয়েছে। দ্বন্দ্ব ছিলো মূলত দুইটি- মূল দ্বন্দ্বটি হল ব্রিটিশ সাম্রাজ্যবাদের বিরুদ্ধে ভারতীয় জাতীয়তাবাদের সংঘর্ষ। এক কথায় আধুনিক ভারতের ইতিহাসের মূল চরিত্র হল সাম্রাজ্যবাদ বিরোধী। অন্যদিকে দেশী ও বিদেশী প্রতিক্রিয়াশীল শক্তি ও গোষ্ঠীর হাতিয়ার হল সাম্প্রদায়িকতাবাদ। এই সাম্প্রদায়িক রাজনীতি জাতীয়তাবাদের অগ্রগতির পথে অন্তরায় সৃষ্টি করে এবং পরোক্ষভাবে সাম্রাজ্যবাদের শক্তি বৃদ্ধিতে সহায়তা করেছিল। বস্তুতঃপক্ষে সাম্রাজ্যবাদ ও সাম্প্রদায়িক রাজনীতির মধ্যে আশ্চর্য যোগসূত্র রচিত হয়েছিল এবং ব্রিটিশ সাম্রাজ্যবাদ 'বিভাজন ও প্রশাসন নীতি' অনুসরণ করে সাম্প্রদায়িকতাকে পরিপুষ্ট করে তোলে।

বেশিরভাগ আধুনিক ভারতীয় ঐতিহাসিকই জাতীয়তাবাদ সম্পর্কে সোজাসুজি, স্পষ্ট, প্রত্যক্ষ আগ্রহ দেখাননি। ১৮৭০ সন থেকে, বিশেষত ১০৯৫ থেকে ভারতবর্ষে শাসকের সঙ্গে শাসিতের, বিদেশী সাম্রাজ্যবাদের সঙ্গে উদীয়মান জাতীয় আন্দোলনের মৌলিক রাজনৈতিক সংগ্রাম চলছিল। এই তীব্র সজীব বিরোধের যুগেও অধিকাংশ ভারতীয় ঐতিহাসিক শাসিতের পক্ষে সক্রিয়ভাবে যোগ দিতে পারলেন না, কারন তারা প্রায় সকলেই সরকারী অথবা সরকার নিয়ন্ত্রিত প্রতিষ্ঠানে চাকরি করেছেন। অথচ নিতান্ত বংশবদ ছাড়া অন্যদের পক্ষে শাসকদের পক্ষে থাকাও শক্ত হয়ে দাঁড়াল। তাছাড়া তাঁরাও জাতীয় আন্দোলনের সময়কার মানুষ, তাই তাদের নিজস্ব জাতীয় অনুভূতিও প্রকাশের পথ খুঁজতে লাগল (বিপান চন্দ্র ও অন্যান্যরা ১৯৭৬)।

আধুনিক ভারতের ইতিহাস রচনায় ব্রিটিশ ঐতিহাসিকগন উনবিংশ শতাব্দীর দৃশ্যবাদ আদর্শ দ্বারা প্রভাবিত হয়েছিলেন। তাঁরা ইতিহাস চর্চায় সম্পুর্ন ভাবে তথ্য ভিত্তিক ও বাস্তব সম্মত পদ্ধতি প্রয়োগ করেন। রক্ষণশীল ঔপনিবেশিক প্রশাসকরা ও কেমব্রিজ ঘরানা বলে পরিচিত সাম্রাজ্যবাদী চিন্তাধারার ইতিহাসবিদরা ভারতের একটা অর্থনৈতিক, রাজনৈতিক, সামাজিক, সাংস্কৃতিক কাঠামো হিসাবে উপনিবেশবাদের অস্তিত্বই স্বীকার করতে চাননা। তারা উপনিবেশবাদকে মূলত দেখেন বিদেশী শাসন হিসেবে, ভারতের অর্থনৈতিক, সামাজিক, সাংস্কৃতিক ও রাজনৈতিক স্বার্থে উপনিবেশবাদী শাসনের উচ্ছেদ ঘটানো যে ছিল তারা সেটা দেখেননি, - না হয় কিছুতেই দেখতে চাননি (বিপানচন্দ্র ১৯৯৪)। সাম্রাজ্যবাদের বিরুদ্ধে

ভারতের সংগ্রামকে তারা দেখেন নকল লড়াই ('কৃত্রিম যুদ্ধ'), 'উদ্দেশ্যহীন ও নকল লড়াইতে ব্যস্ত দুই ছায়া মূর্তির মধ্যে দশেরার দ্বন্দ্ব যুদ্ধ হিসেবে' (শীল ১৯৬৮)।

ভারত যে একটি জাতি-রাষ্ট্র হয়ে ওঠার প্রক্রিয়ার মধ্যে দিয়ে চলছিল সাম্রাজ্যবাদীরা লেখকরা মানেন না। তারা মনে করেন যাকে ভারত বলা হয়ে থাকে তা বাস্তবিক পক্ষে নানা ধর্ম, জাত পাত, জনগোষ্ঠী ও স্বার্থ নিয়ে গঠিত। জাতপাত ভিত্তিক ও ধর্ম ভিত্তিক রাজনীতিই মুখ্য, জাতীয়তাবাদ নিছক একটা আবরণ মাত্র (শীল ১৯৬৮)। শীল ব্যপারটিকে উপস্থিত করেছেন এইভাবেঃ 'দূর থেকে দেখলে যেগুলোকে তাদের রাজনৈতিক সংগ্রাম বলে মনে হয় খুঁটিয়ে দেখলে দেখা যাবে সেগুলো হামেশাই ওই সব প্রচলিত প্রথাগত গোষ্ঠীর নিজস্ব অবস্থান বজায় রাখা বা উন্নত করার প্রয়াস। স্বাধীনতা সংগ্রাম নিছক একটা হাতিয়ার।উচ্চকোটির গোষ্ঠীগুলো এই হাতিয়ারকে কাজে লাগিয়েছে জনগণকে সংগঠিত করার ও তাদের আত্মস্বার্থ চরিতার্থ করার কাজে'। গল্লাঘের, অনিল শীল, গ্যালহার ও রবিনসন এই মতবাদ জনপ্রিয় করে তোলেন। প্রসঙ্গত বলা যায়, লুই নেমিয়ার এর পদ্ধতি গ্রহন করে তাঁরা ভারতীয় জাতীয়বাদকে আদর্শবোধহীন, নীতিহীন স্বার্থ প্রণোদিত অভিব্যক্তির বহিঃপ্রকাশ বলে মনে করেন।

জাতীয়তাবাদী ইতিহাস রচনার দৃষ্টিভঙ্গি থেকে ঔপনিবেশিক যুগে এই ঘরানার প্রতিনিধিত্ব করেছেন লাজপত রায়, আর জি প্রধান, পট্টভি সীতারামাইয়া, সুরেন্দ্রানাথ ব্যানার্জি, সি.এফ এন্ড্রুজ ও গিরিজা মুখার্জি এর মত নেতারা। হাল আমলে এই কাঠামোতে বিশেষ অবদান রেখেছেন বি. আর. নন্দা, বিশ্বেশ্বর প্রসাদ, ও অমলেশ ত্রিপাঠী প্রমুখ ঐতিহাসিকরা। উপনিবেশবাদের শোষণ মূলক চরিত্র সম্পর্কে তারা সচেতনার পরিচয় দিয়েছেন। তারা ভারতের একটা জাতি রাষ্ট্র হয়ে ওঠার প্রক্রিয়াকে ও পুরোপুরিভাবে মানেন, স্বাধীনতা সংগ্রাম কে জনগনের সংগ্রাম হিসেবে দেখেন (বিপান চন্দ্র ১৯৯৪)।

মার্ক্সবাদী ঘরানার ঐতিহাসিকরা বিশেষ করে রজনীপাম দত্ত ও ভূপেন্দ্রনাথ দত্তের উদ্যেগ বিশেষ প্রশংসনীয়। সুমিত সরকার প্রমুখ ঐতিহাসিকগন ইতালীয় চিন্তাবিদ গ্রামশির 'আধিপত্য' (hegemony) বিষয়ক চিন্তাধারা প্রয়োগ করে ভারতের জাতীয় আন্দোলনের চরিত্র ব্যাখা করতে চেয়েছেন। তাঁর মতে গান্ধীজীর পরিচালিত আন্দোলনকে নিষ্ক্রিয় বিপ্লব বলা চলে, কেননা জাতীয় কংগ্রেস গ্রামীন ও শহরের বিত্তবান প্রভাবশালী গোষ্ঠীদের দ্বারা নিয়ন্ত্রিত এবং জাতীয় আন্দোলনকে প্রগতিশীল সামাজিক পরিবর্তনের দিকে মোড় নিতে দেয়নি। আবার শশী যোশী কিন্তু গান্ধীজী পরিচালিত আন্দোলনকে নিষ্ক্রিয় বিপ্লব বলতে রাজি নন। কারণ নিষ্ক্রিয় বিপ্লব বলতে সক্রিয় গন-আন্দোলনের অনুপস্থিতি বোঝায়। কিন্তু গান্ধিজীর নেতৃত্বে জাতীয় আন্দোলনে সর্বভারতীয় ভিত্তিতে সর্বস্তরের মানুষের যৌথ সমাবেশ দেখা যায় (চট্টোপাধ্যায় ২০১৪)।

আধুনিক ভারতের ইতিহাস চর্চায় নিম্ন বর্গের ইতিহাস সংক্রান্ত নূতন প্রবণতা শুরু হয়েছে। রণজিৎ গুহ সম্পাদিত 'subaltern studies' এর বিভিন্ন সংকলিত নিবন্ধে বিদ্রোহী চেতনায় উদ্বুদ্ধ নিম্নবর্গের এক সক্রিয় ভূমিকা তুলে ধরা হয়েছে। এই গোষ্ঠীর বক্তব্য হল- ঔপনিবেশিক পর্বে ভারতের ব্রিটিশ বিরোধী রাজনীতিতে দুটি আলাদা স্তরের গোষ্ঠী বিরাজমান ছিল। একটি উচ্চবর্গীয় স্তর ওপরটি জনগনের স্তর। এই দুটি স্তরের সম্পর্ক ছিল পরস্পর বিরোধী। ভারতের রাজনীতিতে দুটি স্তরের অবস্থান আলাদা হলেও জাতীয় আন্দোলন পরিচালনায় দুটি জগত অঙ্গীভূত হয়ে পরে। তবে অধিকাংশ ক্ষেত্রে আন্দোলনের উপর নিম্নবর্গের স্বতন্ত্র চেতনার প্রতিফলন দেখান হয়েছে। কিন্তু জাতীয় আন্দোলনে নিম্নবর্গের ভূমিকা থাকলে সমস্ত ক্ষেত্রে যেভাবে জাতীয় উচ্চবর্গের নেতৃত্বের সঙ্গে নিম্নবর্গের অবস্থানের স্ববিরোধিতা অকৃত্রিম পার্থক্য দেখান হয়েছে তা সম্পূর্ণভাবে গ্রহনযোগ্য নয়; কোনও কোনও ক্ষেত্রে জাতীয় নেতৃত্ব ও গন সমাবেশের মেলবন্ধন ঘটেছিল এর ফলে জাতীয় আন্দোলন গণমুখী হয়ে উঠেছিল (চট্টোপাধ্যায় ২০১৪)।

এবারে আসা যাক আধুনিক পর্বে মৃত্যুঞ্জয়ের কোনো ভাষ্য পাওয়া যায় কিনা। পলাশী যুদ্ধের ইতিহাস সম্বন্ধে তিনি লিখে গেছেন। যেহেতু মৃত্যুঞ্জয়ের জন্ম পলাশির যুদ্ধের সামান্য পরে, সুতরাং সেই সময়কার ইতিহাস তাঁর বাল্য-যৌবনের জনশ্রুতি। সিরাজউদ্দৌলার অত্যাচার সম্বন্ধে তাঁর ঘৃণা প্রবল। 'বিশিষ্ট লোকেদের ভার্য্যা ও বধূ ও কন্যা প্রভৃতিকে জোর করিয়া আনাইবাতে ও কৌতুক দেখিবার নিমিত্তে গর্ভিণী স্ত্রীদের উদর বিদারণ করানেতে ও লোকেতে ভরা নৌকা ডুবাইয়া দেওয়ানেতে দিনে দিনে অধর্ম্ম-বৃদ্ধি হইতে লাগিল'। সিরাজ যখন রাজা রাজবল্লভের 'জাতি ধ্বংস করিতে উদ্যত হইলেন' তখন রাজবল্লভ কলকাতায় ইংরেজদের শরণাপন্ন হলেন। ইংরেজরা তাঁকে নবাবের হাতে তুলে দিতে রাজি হল না। শহর লুট করিয়া আপন সর্ব্বনাশের হেতু করিয়া মুরশিদাবাদে[গেলেন]'। ইংরেজরা সাময়িকভাবে কলকাতা ত্যাগ করতে বাধ্য হল। এর পরের কাহিনী মৃত্যুঞ্জয় লিখেছেন এইভাবে-'[সাহেব লোকেরা] পুনরায়…আসিয়া কলিকাতা শহরের লুটেতে মহাজন ও মুদি বকালি গৃহস্থ প্রভৃতি লোকেরদের মধ্যে যাহার যে ক্ষতি হইয়াছিল তাহার যে যেমন জায় করিয়া দিলেক তাহাকে তেমনি বেবাক দিয়া খ্বাজে পিত্রুস আরমানি দ্বারা মহারাজ দুর্লভ্রাম ও ফৌজ বকসী জাফরালী খাঁ ও জগত সেঠ মহতাবরায় ও তাহার ভ্রাতা মহারাজ স্বরূপচন্দ্র প্রভৃতি কথক প্রধান লোকেদের সহিত সাহিত্য করিয়া অর্থ ও কিঞ্চিৎ সৈন্য সংগ্রহ করিয়া শরণাগত প্রতিপালনরূপ ধর্ম্মপতাকা উঠাইয়া যুদ্ধার্থে পলশিতে গিয়ে উপস্থিত হইলেন'। যুদ্ধে যা হবার তা তো হল। সিরাজ যুদ্ধক্ষেত্র ছেড়ে পালালেন। পরে ধরা পড়লেন।

মনে রাখা যাক, ঈশ্বরেচ্ছায় কোম্পানির অধিকার লাভ। উদ্দেশ্য প্রজার প্রতিপালন। সেই উদ্দেশ্যে সাধিত না হলে, প্রজাপালনের পরিবর্তে উৎপীড়ন হলে, দৈবশক্তির ক্রিয়ায় রাজ্যাধিকার আবার অন্যের হাতে ন্যস্ত হবে, আবার ধর্মের জয় হবে। এইভাবে উনবিংশ শতকের ইতিহাস রচয়িতারা ধর্মীয় ভিত্তিকে কেন্দ্র করে অজান্তে যেমন সাম্প্রদায়িকতাকে পরবর্তী কালের ঐতিহাসিকদের জন্যে উন্মুক্ত করে দিয়েছিলেন। সেটা যেমন মৃত্যুঞ্জয়ের বেলায় সত্য তেমনি ঐ শতকের অন্যান্য ঐতিহাসিকদের বেলায় ও ততোটাই সত্য।

তাহলে উপরিক্ত আলোচনা থেকে এটা উপলব্ধি করতে পারি ভারতীয় ইতিহাসের গতিধারায় জাতীয়তাবাদ ও সাম্প্রদায়িকতা সময়ে সময়ে পরিবর্তিত হয়েছে। সাম্প্রদায়িকতা ভারতীয় ইতিহাসে বিভিন্ন রুপে, বিভিন্ন আঙ্গিকে ইতিহাসের ধারায় এটি ঢুকে পড়েছে। কিন্তু আধুনিক ইতিহাসের গতিধারা একটু স্বতত্র পথে হেঁটেছে অন্য দুটি ধারার থেকে।

তথ্যসুত্রঃ

১। চট্টোপাধ্যায়, গৌতম, ২০১১। ইতিহাস-চর্চা, জাতীয়তা ও সাম্প্রদায়িকতা, সেতু, পশ্চিমবঙ্গ ইতিহাস সংসদ।

২। চট্টোপাধ্যায়, পার্থ, ২০১১। ইতিহাসের উত্তরাধিকার আনদ, কলকাতা।

৩। চট্টোপাধ্যায়, প্রনবকুমার, ২০১৪। আধুনিক ভারত, পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ।

৪। চন্দ্র, বিপান, ১৯৮৯। আধুনিক ভারত ও সাম্প্রদায়িকতাবাদ, কে পি বাগচী অ্যান্ড কোম্পানী, কলকাতা।

৫। চন্দ্র বিপান, মুখার্জী আদিত্য, পানিক্কর, কে এন, মহাজন সুচেতা, ১৯৯৪। ভারতের স্বাধীনতা সংগ্রাম (১৮৫৭-১৯৪৭), কে পি বাগচী অ্যান্ড কোম্পানী, কলকাতা।

৬। চন্দ্র, বিপান, ২০১২। আধুনিক ভারতের ইতিহাস, ওরিয়েন্ট ব্লাকসোয়ান, কলকাতা।

৭। ত্রিপাঠী অমলেশ, ২০১৪। ইতিহাস ও ঐতিহাসিক, পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষদ।

৮। থাপার, রোমিলা।, মুখিয়া, হরবন্স।, চন্দ্র, বিপান, ১৯৭৬। সাম্প্রদায়িকতা ও ভারতের ইতিহাস রচনা, কে পি বাগচী অ্যান্ড কোম্পানী, কলকাতা।

৯। থাপার, রোমিলা, ২০১০। ভারতবর্ষের ইতিহাস, ওরিয়েন্ট ব্ল্যাকসোয়ান প্রাইভেট লিমিটেড, কলকাতা।

১০। দত্ত, শ্রীঅসীম কুমার, ২০০১। পরধর্ম সহিষ্ণুতা, শ্রীভূমি, কলকাতা।

১১। দেশাই, এ. আর, ২০০১। ভারতীয় জাতীয়তাবাদের সামাজিক পটভূমি, কে পি বাগচী অ্যান্ড কোম্পানী, কলকাতা।

১২। দুবে, এস. সি, ১৯৯০। ভারতীয় সমাজ, ন্যাশনাল বুক ট্রাস্ট, ইন্ডিয়া।

১৩। বন্দ্যোপাধ্যায়, শেখর, ২০১১। পলাশি থেকে পার্টিশান, ওরিয়েন্ট ব্লাকসোয়ান, কলকাতা।

১৪। বসাক প্রনব, ১৯৯৬। হিন্দু-মুসলমান- মৈত্রী, সুবর্ণরেখা, কলকাতা।

১৫। বসু, গৌতম এবং জানা, সত্যসৌরভ, ২০১০। ভারতবর্ষের ইতিহাস আদি মধ্যযুগ, প্রগতিশীল প্রকাশক, কলকাতা।

১৬। বিদ্যালঙ্কার, মৃত্যুঞ্জয়, ১৮০৮। রাজাবলি

১৭। ভট্টাচার্য, সুকুমার, ১৪২২ (বাংলা)। প্রাচীন ভারত সমাজ ও সাহিত্য, আনন্দ, কলকাতা।

১৮। রায়, অনিরুদ্ধ ও চট্টোপাধ্যায়, রত্নাবলী, ২০১২। মধ্যযুগে বাংলার সমাজ ও সংস্কৃতি, কে পি বাগচী অ্যান্ড কোম্পানী, কলকাতা।

১৯। রায়, মিহির কুমার, ২০১১। ভারতের ইতিহাস, প্রোগ্রেসিভ বুক ফোরাম, কলকাতা।

২০। শর্মা, রামশরণ, ২০০৭। ভারতের সামন্ততন্ত, কে পি বাগচী কোম্পানী, কলকাতা।

২১। সেন, সুজিত, ১৯৯১। সাম্প্রদায়িকতা সমস্যা ও উত্তরন, পুস্তক বিপণি, কলকাতা।

২২। হাবিব, ইরফান, ২০০৯। ভারতবর্ষের ইতিহাস প্রসঙ্গ, ন্যাশনাল বুক এজেন্সি প্রাইভেট লিমিটেড, কলকাতা।

২৩। শীল, অনীল, ১৯৬৮। দ্য ইমারজেন্স অব ইন্ডিয়ান ন্যাশনালিজম, কেমব্রিজ।

২৪। সরকার, সুমিত, ২০০৪। আধুনিক ভারত, কে পি বাগচী কোম্পানী, কলকাতা।

২৫। সরকার, সুমিত, ২০১৮। কলিযুগ চাকরি ভক্তি (রামকৃষ্ণ ও তাঁর সময়) সেরিবান, কলকাতা।

২৬। হলমেস, লেসলি, ২০০৯। কম্যুনিজম, অক্সফোর্ড।

Aditya Haldar

Aditya Haldar is an Assistant Professor in the Department of History, Jogamaya Devi College, Kolkata and is also pursuing research from Jadavpur University, Kolkata. His area of research is 'Evaluation of Environment Laws in India'.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 10-17

Smartphone: A convenient analytical measuring tool for chemical sensors

Amrita Ghosh[1] and D. Amilan Jose[2]
Department of Chemistry, National Institute of Technology, Kurukshetra, Haryana
[1]amritaghosh2003@gmail.org, [2]amilanjosenit@nitkkr.ac.in

Abstract: Smartphones are one of the essential devices in every human life. Recently, it is becoming a part of modern analytical methodology. The usage of a smartphone in chemical sensor research is attractive because it is cheap and affordable. From the point of the analytical device, it is portable, easy to use, and even an unskilled person can use without much problem. Therefore, smartphones have emerged as an efficient analytical tool that enables the interpretation of chemical sensing data without a sophisticated analytical instrument. In this article, we narrated the usage of smartphones in the field of chemical sensors. Critical recent examples of water contamination detection (chlorine and mercury), pH monitoring, glucose sensors (health monitoring), explosive sensors (defence research), and biological sensors were discussed. This chapter established the fact that apart from communication, entertainment, multimedia usage, browsing, etc. smartphones could be an essential and convenient analytical tool for chemical sensors and health monitoring.

Keywords: Smartphone, Colorimetric, Sensor, Analytical tool, Portable camera

1. Introduction

Smartphone has become an integral part of our everyday lives. Apart from entertainment, it has several advantages, including fast communication, convenient web surfing, portable cameras, GPS facilities as well as productivity apps. All these features create revolutions in smartphone technology and have made our lives more comfortable, faster, and better.

Smartphone technology has also gained attention to the researchers worldwide to utilize this as an analytical instrument in sensing applications. The conventional analytical tools are bigger or heavier, not portable, expensive, and mostly their settings are dependent on resources. Smartphone as an analytical tool has been developed as very suitable and promising in several fields such as microscopical and medical diagnosis (Contreras-Naranjo et al. 2016), analyzing water quality (Özdemir et al. 2017), agricultural studies (Intaravanne & Sumriddetchkajorn 2015) and mostly in the field of sensors. In the area of sensors, smartphone based analytical technology was utilized in various applications, which include chemical and bio-sensors (Grudpan et al. 2015, Huang et al. 2018), determination of pH (Dutta et al. 2015, Shen et al. 2012), glucose sensors (Wang et al. 2016), electrochemical sensors (Lillehoj et al. 2013); also, several reports are available in imaging science (Zhu et al. 2013, Coskun et al. 2013).

A smartphone has various features that contain different forms of sensors – for instance, accelerometer and thermometer to spot and distinguish information that is relevant for a particular purpose. The most extensively utilized sensor-device is the camera as an optical sensor. This portable camera is a powerful tool, along with audio and video accessories. Correspondingly, a smartphone possesses advanced devices such as a fast multicore processor, battery system, adequate

memory storage, touch screen facility, etc. To transfer the data, not only the USB port and portable power supply are necessary, but again, the wireless data transfer systems such as Bluetooth, Wi-Fi, and near-field communication (NFC) are added with the advanced technology. Accumulation of all these modern technologies in a simple smartphone, it could be an effective and efficient tool for modern analytical applications for the detection and monitoring of various biological and environmentally essential analytes.

2. Smartphone readable colorimetric sensor

The smartphone-based colorimetric sensors work on the principle of the color changes as well as variations in the color intensity of the particular sample. More or less, every smartphone has a dual-camera system- front and backside camera. With technology, these cameras are gradually becoming more and more advanced every day with a better focusing ability, high resolution of images, and also various photographic features to preserve better realism rang in skill. In the hardware part, each smartphone camera comprises a metal oxide semiconductor and image sensor, which usually has a photodiode pixel array. To convert images into electronic signals, peripheral readout circuits are also mandatory (Sumriddetchkajorn et al. 2013).

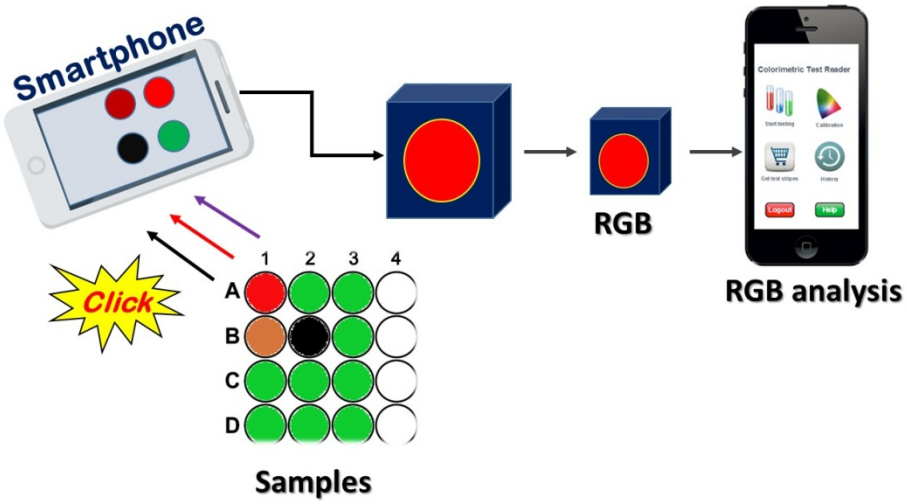


Figure 1
Schematic representation of smartphone-based colorimetric sensor (Part of the figure was used from the website:https://www.medgadget.com/2014/03/new-app-from-university-of-cambridge-accurately-reads-colorimetric-test-strips.html)

For the colorimetric detection of different analytes, the smartphone camera could be directly employed to capture images of color changes (Figure 1). External attachments may require to control the ambient light condition or camera position. Other apparatus may also include a battery, external LED illumination, or external lens. Though it is sometimes tough to get accurate quantitative measurements in minor changes in color shades, still most of the time, researchers can get significant color quantification as output signals with the help of recent smartphone apps.

Among various applications of smartphone-based colorimetric sensors, we are going to discuss few reported examples such as recognition of analytes in water, pH monitoring, glucose sensors, and

chemical as well as biological sensors.

3. Chlorine ion detection in water

A smartphone device-based colorimeter that could monitor the chlorine concentration in water was reported by Sumriddetchkajorn et al. (Sumriddetchkajorn et al. 2013). This article proposes a self-referencing colorimeter by using a smartphone device and a tablet. The main aim was to use the digital camera and the 2D image of both the reference material and the sample. Samples were prepared using different concentrations of chlorine, and the same KI–starch solution was added in all the sample bottles. Under the white reference background, as the chlorine concentration of the water gets increased, a gradual color change was observed from white to light blue and then dark blue with the same KI–starch solution. To determine the concentration of chlorine, each of the bottles was monitored with the smartphone with an Android operating system and white A4 paper as background reference. Both the reference and the sample were placed in front of the camera, and the photo was captured. The color image that was taken under the white light concurrently has two portions- one from the reference material and the other is from the sample bottle. A precise color ratio from these two parts/images were processed to specify the conversion of watercolor inside the container into its corresponding concentration of chlorine. The chlorine concentrations were found in 0.3–1.0 ppm (with <7% standard deviation error), which is a reasonable data.

The same group again experimentally demonstrated (Sumriddetchkajorn et al. 2014) another self-referencing smartphone-based to monitor the concentration of chlorine in the aqueous medium. In this report, o-tolidine was selected as a chemical indicator as it was used in fishery farms. The same principle was applied to test in local baby shrimp farms. It showed a positive result in establishing the chlorine concentration in the range of 0–2.0 ppm in water with a 0.02-ppm standard deviation. The response time was also measured as 2 Sec.

Furthermore, the chlorine concentration in water was also fixed by dividing it into three zones to make it easy for the farmworkers. Nevertheless, there was a drawback of the lack of linearity in response. This problem could be solved by taking more number of standard solutions for a more reliable calibration.

4. Mercury ion detection in water

Garćıa and co-workers (Kaoutit et al. 2013) detected mercury in water by a smartphone-based colorimetric membrane that could recognize Hg(II) in the naked eye. The change in color was recorded with the change in Hg(II) concentrations. The sensory membrane configuration was made in such a way that could fit in special detection requirements such as the sample with different Hg(II) concentrations exceeded the legal limits. The smartphone camera took the pictures of the Hg(II) contaminated membranes after reasonable exposure to the solutions. Moreover, these pictures were used to quantify the mercury from the digital parameters within the photographs. They were able to get exceptional results by dipping the sensory membranes for ~25 min in contaminated water and then by taking the pictures with the smartphone camera placed over a white

paper.

Wei et al. (Wei et al. 2014) proposed another smartphone-based detector platform that could quantify the mercury(II) ions in aqueous solution. The main advantage of this system is the quantification of Hg(II) in water could be measured in parts per billion (ppb) level. This refers to the high sensitivity of this system. An optomechanical attachment was combined with the digital camera of a smartphone, which could quantify the concentration of mercury digitally. A plasmonic gold nanoparticle (Au-NP) and the aptamer-based colorimetric assay was utilized. The concentration of Hg(II) was quantified in water by a two-color ratiometric method. The light-emitting diodes (LEDs) at 523 and 625 nm was used where a custom-developed android application for the rapid digital image was operated. The limit of detection (LOD) of Hg(II) ions with this smartphone device is established to be 3.5 ppb. They also created geospatial mercury(II) contamination maps and collected water samples from over 50 locations in California (USA). The water samples are taken from city tap sources, rivers, lakes, and beaches. This low cost, portable, and highly sensitive system work as an efficient platform to detect mercury ion in the aqueous medium.

5. pH and nitrite ion analyzer

Nuria et al. (Lopez-Ruiz et al. 2014) developed an android based sensory application and the paper-based microfluidic device, which was used for the simultaneous detection of pH and nitrite concentration. They have used seven sensing areas, including the parallel immobilized reagents, to exhibit selective color changes in the presence of the sample solution, which is positioned in the sampling region. Under the flashlight of the smartphone, which is the primary light source, the images were captured with the in-built camera. A customized algorithm was used for the image-processing of the colored sensing areas. The results were in good agreement under controlled conditions of light. The sensing membranes were characterized and checked thoroughly at the important range. It was found that for the pH, the resolution obtained is 0.04 units with 0.09 accuracy, where the mean squared error is ~0.167. For the nitrite, the values of resolution and LOD were found as 0.51% at 4.0 mg L^{-1} and 0.52 mg $L^{-1,}$ respectively. Similar results were reproduced with a second smartphone and different light sources. Hence they concluded that the developed algorithm was not influenced by the light sources, and any smartphone could be used as a portable analytical instrument for the detection of pH.

6. Smartphone-based spectrometer for Glucose monitoring

Liedberg and coworkers (Wang et al. 2016, *Analyst*) developed a new economical and convenient smartphone that could be used as a spectrometer for monitoring the optical changes in real-time. The built-in LED was used as the light source and camera as the signal detector. A well-known glucose assay was used and analyzed by this smartphone spectrometer. The smartphone spectrometer displays two-fold higher sensitivity, which is remarkable compared to the commercial plate-reader. They have also demonstrated the application of the smartphone as a localized surface plasmon resonance biosensor. The smartphone was utilized for the heart disease biomarker, cardiac

human troponin I. The smartphone as a spectrometer, always allows quick response time, more sensitive and real-time recording of the binding of troponin I. The achieved LOD for troponin I is in good agreement with the Surface plasmon resonance (SPR) measurement and commercial X-Nano instrument.

This smartphone spectrometer is much economical, compact, and transportable than the other conventional instruments. Furthermore, the monitoring of the total spectrum of the sample was possible instantaneously in a short time. This smartphone spectrometer has several advantages, such as in-field analysis, routine monitoring, and home diagnostics.

7. Chemical sensors for catechol

Wang et al. (Wang et al. 2016, *Talanta*) reported a cost-effective, simple, designed colorimetric sensor ensembled with a smartphone and a remote server and studied a fast analysis of catechol. The smallest-scale (2x2) array could distinguish among all 13 catechols calorimetrically at six serial concentrations. It was done with the help of principal component analysis, hierarchical cluster analysis, and linear discriminant analysis. The outcomes from the data analysis showed the capability of the suggested colorimetric array for consistent detection and classification of the catechols.

Most importantly, this work demonstrated a unique coupling of a smartphone and the remote server, which permits the onsite classification and study. The quantitative analysis of the unknown samples is also possible by this system. With the help of the portable smartphone, it could be possible to read the array, data upload, and to obtain the results in real-time. This simple, useful device is suitable in a real-life example as well as the qualitative and quantitative onsite study of catechol.

8. Smartphone-based explosive detection

Reed and coworkers reported (Tang et al. 2017), a smartphone-based platform that was utilized for the convenient colorimetric investigation of 2,4,6-trinitrotoluene (TNT). It was done by means of amine-trapped polydimethylsiloxane (PDMS), which was suitably designed and applied. When the colorless PDMS comes in contact with the TNT-containing solutions, it showed a noticeable and quick naked eye color change. The PDMS was sensibly optimized to attain a noticeable detection of TNT even at a very low concentration, such as 1μM. The integrated camera of the smartphone could be convenient for taking photos of colored PDMS membranes. This suitable portable technique could be useful in the real application by precisely measuring and quantifying of the TNT. TNT recognition in drinking water, tap water, and lake waters were also successfully validated. This efficient approach is suitable for the field of TNT detections.

In another study of colorimetric detection of explosives, Salles et al. (Salles et al. 2014) effectively showed a disposable device containing colorimetric wax paper, which could distinguish five explosives such as triacetone triperoxide, hexamethylene triperoxide diamine, 4-amino-2-nitrophenol, nitrobenzene, and picric acid. This one-use paper array was made-up of the wax printer

as well as reagents, for example, KI, creatinine, and aniline. This method generated unique color patterns for each explosive, which was created based on chemical reactions between the explosives and the reagents. The output signal/information was extracted by the smartphone-enabled device, which evaluated the RGB values of each spot using custom software. The LOD was found to be at the ranges of ~0.2 µg of the explosives. This device is inexpensive and highly efficient in detecting these explosives for home security applications.

9. Smartphone-based volatile organic components detection

In a very recent work of Owyeung et al. (Owyeung et al. 2019) developed a stable device that is entrapped with the optically responsive dyes on a thread substrate. The smartphone-enabled detection system was combined into clothing. The dyes 5,10,15,20-Tetraphenyl-21H,23H-porphine manganese(III) chloride (MnTPP), methyl red (MR), and bromothymol blue (BTB), were used. The smartphone was capable of the excerpt and to identify the changes in the red, green, and blue channels. The smartphone could capture the images of the thread to sense the particular analyte. This technique was applied mainly for sensing gases. The sensing of the vapors of ammonia and hydrogen chloride; constituents obtained in cleaning supplies, fertilizers, and the dissolved gas sensing of ammonia was successfully demonstrated. The detection was performed even when the analytes were present in the range of 50–1000 ppm. The facile construction of the colorimetric sensing of various gases in washable threads is a novel idea for the next generation textile industries.

10. Conclusion

In summary, we have explained several examples of chemical sensors using a smartphone as a smart analytical tool for the colorimetric detection of different analytes. The main advantages of utilizing a smartphone as a detector device includes the low price compared to other sophisticated instrumentation, portability, ease to operate, and the possibility of enormous distribution in the markets. The smartphone-enabled sensors have other benefits such as cost-effective design, wireless data connectivity, user-friendly high-resolution digital camera, and sensitive and specific to the particular analytes. For example, contamination of harmful chemicals in drinking water or tap water could be detected easily even in a home with the help of a smartphone. We foresee various developments where the smartphone spectrometer could find applications in field testing, health monitoring, and home diagnostics. The smartphone-based colorimetric detection will open up new avenues in the field of sensing devices, and this uniquely practical, portable device with convenient apps will be suitable in real-life applications.

Acknowledgement

AG acknowledges the financial support from the CSIR for SRA fellowship. DAJ thanks DST-SERB, Core Research Grant, no. EMR/2017/004085 for financial help.

REFERENCES

1. Contreras-Naranjo, J.C., Wei, Q., Ozcan, A., 2016. Mobile phone-based microscopy, sensing, and diagnostics. IEEE Journal of Selected Topics in Quantum Electronics, 22, 1-14.
2. Özdemir, G. K., Bayram, A., Kılıç, V., Horzum, N., Solmaz, M. E., 2017, Smartphone-based detection of dyes in water for environmental sustainability. Analytical Methods, 9, 579-585.
3. Intaravanne, Y., Sumriddetchkajorn, S., 2015, Android-based rice leaf color analyzer for estimating the needed amount of nitrogen fertilizer. Computers and Electronics in Agriculture, 116, 228-233.
4. Grudpan, K., Kolev, S.D., Lapanantnopakhun, S., McKelvie, I.D., Wongwilai, W., 2015, Applications of everyday IT and communications devices in modern analytical chemistry: A review. Talanta. 136, 84-94.
5. Huang, X., Xu, D., Chen, J., Liu, J., Li, Y., Song, J., Ma, X., Guo, J., 2018, Smartphone-based analytical biosensors., Analyst, 143, 5339–5351
6. Dutta, S., Sarma, D., Patel, A., Nath, P., 2015, Dye-Assisted pH Sensing Using a Smartphone. Photonics Technology Letters., 27, 2363-2366;
7. Shen, L., Hagen, J.A., Papautsky, I., 2012, Point-of-care colorimetric detection with a smartphone. Lab on a Chip, 12, 4240-4243
8. Wang, Y., Liu, X., Chen, P., Tran, N.T., Zhang, J., Chia, W.S., Boujday, S., Liedberg, B., 2016, Smartphone spectrometer for colorimetric biosensing. Analyst, 141, 3233-3238.
9. Lillehoj, P. B., Huang, M.-C., Truong, N., Ho, C.-M., 2013, Rapid electrochemical detection on a mobile phone. Lab on a Chip, 13, 2950-2955.
10. Zhu, H., Isikman, S.O., Mudanyali, O., Greenbaum, A., Ozcan, A., 2013, Optical imaging techniques for point-of-care diagnostics. Lab on a Chip, 13, 51-67.
11. Coskun, A.F., Nagi, R., Sadeghi, K., Phillips, S., Ozcan, A., 2013, Albumin testing in urine using a smartphone. Lab on a Chip., 13, 4231-4238.
12. Sumriddetchkajorn, S., Chaitavon, K., Intaravanne, Y., 2013, Mobile device-based self-referencing colorimeter for monitoring chlorine concentration in water. Sensors and Actuators B 182, 592– 597.
13. Sumriddetchkajorn, S., Chaitavon, K., Intaravanne, Y., 2014, Mobile-platform based colorimeter for monitoring chlorine concentration in water. Sensors and Actuators B, 191, 561– 566.
14. Kaoutit, H.E., Estévez, P., García, F.C., Sernaa, F., García, J.M., 2013, Sub-ppm quantification of Hg(ii) in aqueous media using both the naked eye and digital information from pictures of a colorimetric sensory polymer membrane taken with the digital camera of a conventional mobile phone. Anal. Methods, 5, 54–58.
15. Wei, O., Nagi, R., Sadeghi, K., Feng, S., Yan, E., Ki, S.J., Caire, R., Tseng, D., Ozcan, A., 2014, Detection and Spatial Mapping of Mercury Contamination in Water Samples Using a Smart-Phone. ACS Nano, 8, 1121–1129.
16. Lopez-Ruiz, N., Curto, V.F., Erenas, M.M., Benito-Lopez, F., Diamond, D., Palma, A.J., Capitan-Vallvey, L.F., 2014, Smartphone-based simultaneous pH and nitrite colorimetric

determination for paper microfluidic devices. Analytical Chemistry, 86, 9554-9562.

17. Wang, Y., Li, Y., Bao, X., Han, J., Xia, J., Tian, X., Ni, L., 2016, A smartphone-based colorimetric reader coupled with a remote server for rapid onsite catechols analysis. Talanta, 160, 194–204.
18. Tang, N., Mu, L., Qu, H., Wang, Y., Duan, X., Reed, M.A., 2017, Smartphone-Enabled Colorimetric Trinitrotoluene Detection Using Amine-Trapped Polydimethylsiloxane Membranes. ACS Appl. Mater. Interfaces, 9, 14445-14452.
19. Salles, M.O., Meloni, G.N., de Araujoa, W.R., Paixão, T.R.L.C., 2014, Explosive colorimetric discrimination using a smartphone, paper device and chemometrical approach. Anal. Methods, 6, 2047-2052.
20. Owyeung, R.E., Panzer, M.J., Sonkusale, S.R., 2019 Colorimetric Gas Sensing Washable Threads for Smart Textiles. Sci. Rep. 9, 5607-5614.

Dr. Amrita Ghosh

Dr. Amrita Ghosh is presently working as a CSIR-Scientist pool officer in the Department of Chemistry at the National Institute of Technology Kurukshetra, Haryana, India. Amrita was awarded a Ph.D. degree from Central Salt and Marine Chemicals Research Institute (CSIR-CSMCRI) in Bhavnagar, India, and conducted postdoctoral research work at Uppsala University in Sweden and the University of Bielefeld (Humboldt fellow) in Germany. She has published 43 research articles in international peer-reviewed journals (H-index 23), one book chapter, and one patent. Her main research interest includes Artificial Photosynthesis, Sensor for anions, Supramolecular Chemistry, and Inorganic Clusters based on polyoxometalates.

Dr. D. Amilan Jose

Dr. D. Amilan Jose is presently working as an Assistant Professor in the Department of Chemistry at the National Institute of Technology(NIT) Kurukshetra, Haryana, India. He received his Ph.D. degree from Central Salt and Marine Chemicals Research Institute (CSIR- CSMCRI) in Bhavnagar, Gujarat, India. He has completed his postdoctoral research at the University of Regensburg (Humboldt fellow), the University of Jena, the University of Bielefeld in Germany, and ICIQ, Tarragona, in Spain. He has published 55 research articles in international peer-reviewed journals with H-index 27; and one book chapter. His research interest includes Supramolecular Analytical Chemistry, Functional soft nanomaterials for sensors, and light-induced Bio-nanotechnology for drug delivery.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 18-28

Advancement of Display Technology: From CRT to Quantum Dot and Micro LED

Amrita Mukherjee
Department of Physics, Jogamaya Devi College
amritaiacs@gmail.com

Abstract: With the initiation of modern display technology, the amount of time average people employs sitting on TV, calculator, computer and mobile has increased over the past two decades. In every aspect of our life from morning to night we are dependent on various display devices. The cathode ray tube (CRT) was the pillar of text and video display technology for several decades until being replaced by plasma, liquid crystal and solid state devices such as LEDs and OLEDS. CRT was very popular due to its high resolution, aspect ratio, high contrast and cost effectiveness. But with the progress of technology the urge to remove different disadvantages like imperfect sharpness, low brightness, flat screen shape, large shape etc. leads to the invention of liquid crystal displays. Again with the rapid use of mobile phone different LCD display technology evolved for example IPS-LCD (In-Plane Switching Liquid Crystal Display), OLED (Organic Light-Emitting Diode), AMOLED (Active-Matrix Organic Light-Emitting Diode) etc. Again special type of display technology was invented for electronic paper like display, 3D display etc. Quantum LED is essentially a fancy version of an LED-backlit LCD TV, boasting exceptional image quality and vivid hues. In this article the way of rapidly changing world of displays to meet the evolving needs of the electronic devices has been discussed.

Keywords: Display, CRT, LCD, Plasma Display, OLED

1. Introduction

Display technology plays a critical role in information conveyance. In general displays are used in television set, computer monitors, head-mounted display, broadcast reference monitor, medical monitors, mobile displays (for mobile devices), smartphone displays (for smartphones). Since its commercialization in 1922 up until the late 20th century, Cathode Ray Tube technology (CRT) has dominated the display industry. However, new trends such as the desire for mobile electronics have increased demand for displays that rival and surpass CRTs in areas such as picture quality, size, and power consumption. One of the devices likely to replace CRTs is Liquid Crystal Displays (LCD) due to their lightweight, low operating power, and compact design. LCDs allowed devices such as digital watches, cell phones, laptops, and any small screened electronics to be possible. Although LCDs were initially created for handheld and portable devices, they have expanded into areas previously monopolized by CRTs such as computer monitors and televisions. Other contenders for leadership in display technology are Organic LEDs, DLP technology, Plasma Displays, Field Emission Displays, and Electronic Paper. Organic LEDs, being composed of light emitting polymers, can emit their own light to offer thin and power-saving displays. Using many microscopic mirrors, DLP technology can generate large bright projections on screens with up to 35 trillion colours. Plasma Displays generate excellent quality images on very large screens. Field Emission Displays can produce high resolution images like CRTs without the bulky appearance. The makers of Electronic Paper are trying to replace print by developing displays with many paper-like properties. Beside these segment displays are very popular because of its use in digital watches and pocket calculators are made of single LED or liquid crystals. In modern time touchscreen

displays are very widespread in which is a both input and output device and normally layered on the top of an electronic visual display of an information processing system. Demand for higher quality displays will drive technology evolution; this evolution will require new approaches and innovative ideas in information presentation. In this article the evolution process of large display devices to meet the evolving needs of the electronic devices has been discussed in brief.

2.1. Cathode Ray Tube (CRT)

The Cathode Ray Tube (CRT) (Moss 1950) was the first display technology and it had an incredibly long run despite being inefficient, bulky, heavy and full of hazardous waste materials. It pretty much owned the 20th century. A cathode ray tube consists of several basic components, as illustrated in Figure 1. The electron gun generates a beam of electrons. The anodes accelerate the electrons. Deflecting coils produce an extremely low frequency electromagnetic field that allows for constant adjustment of the direction of the electron beam. There are two sets of deflecting coils viz. horizontal and vertical. The intensity of the beam can be varied. The electron beam produces a tiny, bright visible spot when it strikes the phosphor-coated screen. To produce an image on the screen, complex signals are applied to the deflecting coils, and also to the apparatus that controls the intensity of the electron beam. This causes the spot to race across the screen from right to left, and from top to bottom, in a sequence of horizontal lines called the raster. As viewed from the front of the CRT, the spot moves in a pattern similar to the way your eyes move when you read a single-column page of text. But the scanning takes place at such a rapid rate that your eye sees a constant image over the entire screen. The illustration shows only one electron gun. This is typical of a monochrome, or single-colour, CRT. However, virtually all CRTs today render colour images. These devices have three electron guns, one for the primary colour red, one for the primary colour green, and one for the primary colour blue. The CRT thus produces three overlapping images: one in red (R), one in green (G), and one in blue (B). This is the so-called RGB colour model.

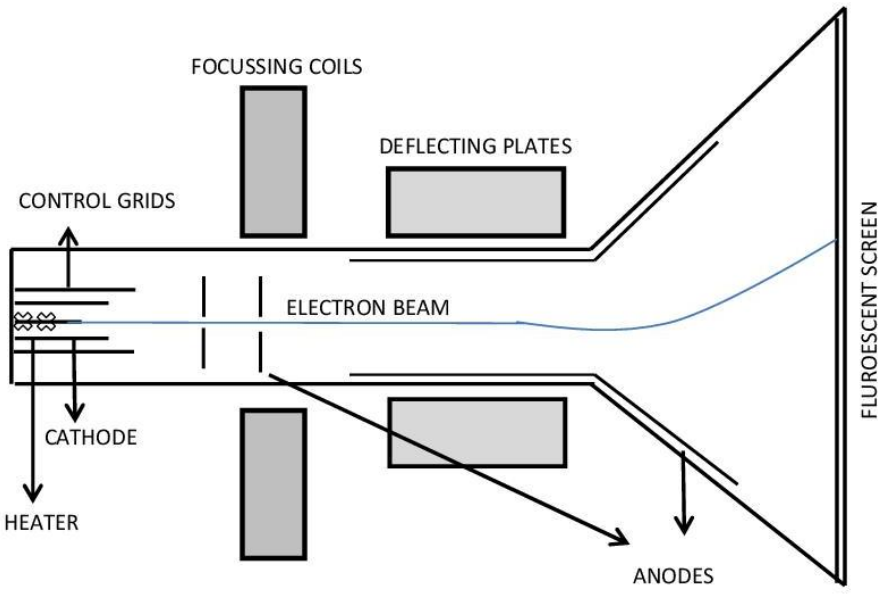


Figure 1: Basic stricture of a cathode ray tube

As time progresses the shape of the CRT s also evolved. The oldest and most inexpensive CRT

monitors are spherical. Further development results cylindrical (a section of a cylinder, used in aperture-grille CRTs), and flat square (a section of a sphere large enough to make the screen nearly flat) CRT monitor. Flat square tube (FST), developed in 1997, have a larger display area – closer to the tube size – and nearly square corners. By 2000, CRT monitors that used unconventional mask technologies were available with completely flat screens. The major benefit of a perfect flat surface is that they have minimal glare and display images that have a more realistic appearance.

2.2 Advantages of CRT

1. CRT operates at any resolution, geometry and aspect ratio without the need for rescaling the image.
2. CRTs run at the highest pixel resolutions generally available.
3. Produce a very dark black and the highest contrast levels normally available. Thus it is suitable for use even in dimly lit or dark environments.
4. CRTs produce the very best colour and gray-scale and are the reference standard for all professional calibrations. They have a perfectly smooth gray-scale with an infinite number of intensity levels. Other display technologies are expected to reproduce the natural power-law Gamma curve of a CRT, but can only do so approximately.
5. CRTs have fast response times and no motion artefacts. Thus it is best for rapidly moving or changing images.
6. CRTs are less expensive than comparable displays using other display technologies.

2.3 Disadvantages of CRT

1. The CRT's Gaussian beam profile produces images with softer edges that are not as sharp as an LCD at its native resolution. Imperfect focus and colour registration also reduce sharpness.
2. All colour CRTs produce annoying Moiré patterns. Many monitors include Moiré reduction, which normally doesn't eliminate the Moiré interference patterns entirely.
3. Subject to geometric distortion and screen regulation problems. Also affected by magnetic fields from other equipment including other CRTs.
4. Relatively bright but not as bright as LCDs. Not suitable for very brightly lit environments.
5. Some CRTs have a rounded spherical or cylindrical shape screen. Newer CRTs are flat.
6. CRTs give off electric, magnetic and electromagnetic fields. There is considerable controversy as to whether any of these pose a health hazard, particularly magnetic fields. The most authoritative scientific studies conclude that they are not harmful but some people remain unconvinced.
7. They are large, heavy, and bulky. They consume a lot of electricity and produce a lot of heat.

3.1 Liquid Crystal Display (LCD)

Different disadvantages of CRT display leads to the invention of liquid crystal displays. Liquid crystals were discovered in 1888, but their potential application in display technology was not realized until 1968 when researchers from the RCA's David Sarnoff Research Centre developed the first liquid crystal display. Since then, LCDs have revolutionized the small screen and portable

electronic market offering an alternative to CRTs and making devices like calculators, cell phones, PDAs, and laptops possible. As LCD designs advance, they will remain a popular part of home entertainment systems and continue to dominate handheld electronics especially mobile phones.

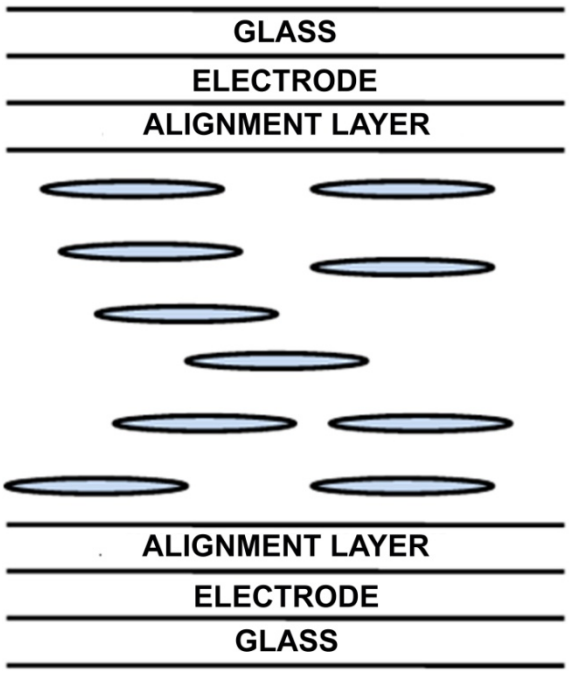


Figure 2: Basic Liquid Crystal Display Structure

Simple LCDs consist of a liquid crystal cell, conductive electrodes and a set of polarizing lenses. The basic structure for a simple LCD cell is shown in Figure 2. To form a working LCD the individual components (glass casing, liquid crystal cell, alignment layer, conductive electrodes, and polarisers) are combined. Light entering the display is guided by the orientation of the liquid crystal molecules that are twisted by ninety degrees from the top plate to the bottom. This twist allows incoming light to pass through the second polarizer. When voltage is applied, the liquid crystal molecules straighten out and stop redirecting light. As a result light travels straight through and is filtered out by the second polarizer. Consequently, no light can pass through, making this region darker compared to the rest of the screen. To display characters or graphics, voltage is applied to the desired regions making them dark and visible to the eye. High-end displays today allow for 256 different levels of light or shades. This allows for a gray scale in which graphics and characters can be displayed in many varying intensities.

3.2 Different types of LCDs

For several years now the twisted nematic (TN) panel monitor has been the most abundant on the market (Mosley 1993, Emerging Display Technologies, “LCD Basics”, 2005). Figure 3 illustrates the basic construction of TN display. Although it has improved leaps and bounds in this department over the years the image performance is often considered a relative weakness of TN technology. The main drawback comes with relatively restricted viewing angles. If an LCD monitor is trying to display black then the colour filter will be positioned such that as little light as possible (of any colour) from the backlight will get through. A definite strength of the vertically aligned (VA) panel is its efficiency at blocking light from the backlight when it’s not wanted. Another key advantage of

VA is the improved viewing angles and colour reproduction compared to TN. Some of the modern VA panel types used on PC monitors include Samsung SVA ('Super' Vertical Alignment), MVA (Multi-domain Vertical Alignment), AMVA (Advanced MVA) or AMVA+ (a now defunct additional panel type indicating AMVA with slightly enhanced viewing angles – now standard for AMVA panels). The real selling point of these is their superior colour accuracy, consistency and viewing angles when compared to the other LCD technologies. Each colour shade remains distinct with its own 'identity' regardless of its position on the screen. Some of the higher-end IPS and PLS models take things even further by offering support for extended colour gamuts (increasing potential shade range) and higher colour depths (increasing potential accuracy). This makes IPS and PLS panels good candidates for 'colour critical' work in particular. It is also common for larger IPS monitors to feature higher resolutions than most of their TN and VA counterparts; although a good range of resolutions for all panel types is now available.

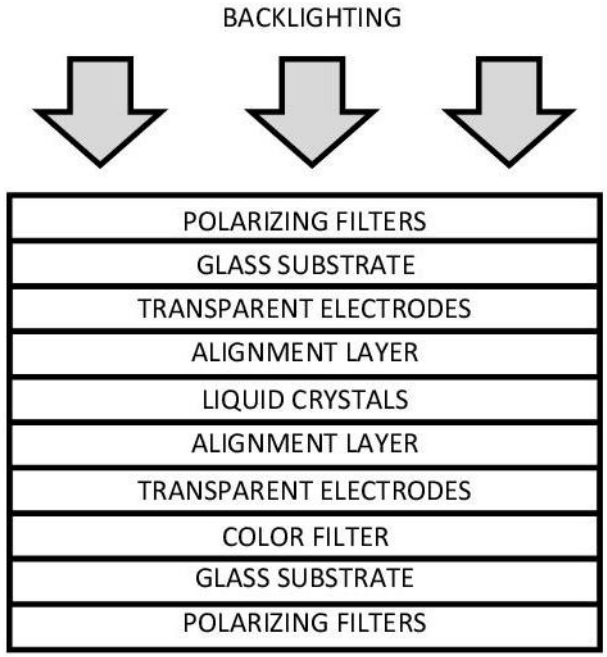


Figure 3: Twisted nematic panel display

3.3. Disadvantages of LCD

The colour and contrast from various viewing angles is inconsistent

1. Features poor black on dark imagery
2. Motion blur is common
3. Fixed resolution
4. With brightness from backlighting, imagery may appear flat
5. Pixel based display may be stuck on screen
6. Newer technology costs more
7. Imagery not as good with analog interface

Sometime around 2007, LCD televisions beat out Plasma as the consumer choice due to their large size and lower cost. LED technologies continue to improve, and LED-backlit LCD displays win the market. OLED technologies also continue to improve, and are getting ready to challenge LCD with

better blacks (even better than Plasma) and thinner less rigid profiles, however LCDs continue to offer lower manufacturing costs, longer lifetimes, and greater durability.

4.1. Plasma Display

Plasma screens are composed of millions of cells sandwiched between two panels of glass. Placed between the glass plates extending across the entire screen, are long electrodes known as address electrodes and display electrodes which form a grid. The address electrodes are printed onto the rear glass plate. The transparent display electrodes, insulated by a dielectric material and covered by a protective magnesium oxide layer, are located above the cells along the front glass plate. The electrodes intersecting a specific cell are charged in order to excite a xenon and neon gas mixture contained within each cell. When the gas mixture is excited creating a plasma, it releases ultraviolet light which then excites the phosphor electrons located on the sides of the cells. When those electrons revert back to their original lower energy state, visible light is emitted. Each PDP pixel is composed of three cells containing red, green, and blue phosphors respectively. The phosphors are separated by ribs which prevent the phosphors from chemically contaminating each other (crosstalk). Activating these colour combinations at varying intensities, by the amount of current generated, results in the colour generation as seen on the display. (Weston 1989, Boeuf 2003) Plasma displays are noted for their flat screen presentation and large screen sizes. They are able to generate excellent image quality in large scales, and consequently are the leading display technology when it comes to HDTV (high definition television).

4.2. Advantages of Plasma Display

1. Slim profile
2. Can be wall mounted
3. Less bulky than rear-projection televisions
4. Produces deep blacks allowing for superior contrast ratio
5. Wider viewing angles than those of LCD; images do not suffer from degradation at high angles unlike LCD's.
6. Less susceptible to reflection glare in bright rooms due to not needing back lighting.
7. Virtually no motion blur, thanks in large part to very high refresh rates and a faster response time, contributing to superior performance when displaying content with significant amounts of rapid motion.

4.3. Disadvantages of Plasma Display

1. Heavier screen-door effect when compared to LCD or OLED based TVs.
2. Susceptible to screen burn-in and image retention, although most recent models have a pixel orbiter that moves the entire picture faster than is noticeable to the human eye, which reduces the effect of burn-in but does not prevent burn-in. However, turning off individual pixels does counteract screen burn-in on modern plasma displays.
3. Phosphors lose luminosity over time, resulting in gradual decline of absolute image brightness (newer models are less susceptible to this, having lifespan exceeding 100,000 hours, far longer than

older CRT technology.
4. Susceptible to "large area flicker".
5. Generally do not come in smaller sizes than 37 inches.
6. Heavier than LCD due to the requirement of a glass screen to hold the gases
7. Use more electricity, on average, than an LCD TV
8. Do not work as well at high altitudes due to pressure differential between the gases inside the screen and the air pressure at altitude. It may cause a buzzing noise. Manufacturers rate their screens to indicate the altitude parameters.

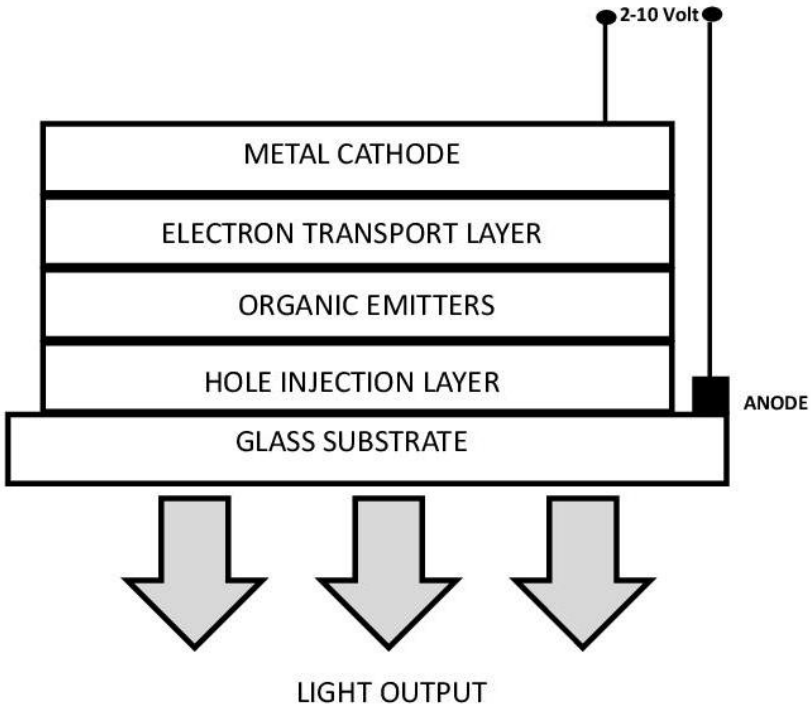


Figure 4: Basic structure of OLED display

5.1 Organic Light Emitting Diode (OLED) Display

Organic light-emitting diodes (OLEDs) are thin, flexible display in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current (Chen et. al. 2018). But OLEDs are still costly to manufacture and have limited lifetimes compared to LCD and LED technology. OLEDs were first developed by Eastman Kodak in 1987 using small Molecular method.

Display technology must evolve to keep pace with advances in other areas of technology. OLEDs are composed of light-emitting organic material sandwiched between two conducting plates, one of n-type material and one of p-type material. The molecular structure in n-type material, although electrically neutral, has an extra electron that is relatively free to move around the material. Figure 4 illustrates the basic structure of an OLED display. In p-type material the opposite is true. The lack of an electron creates a hole that is free to move about. The creation of the extra electron or the hole comes about because of the mismatch of valence electrons in the molecular structure of the p or n-type material. Applying a voltage between the two plates causes holes to be injected from the p-type substrate and electrons to be injected from the n-type substrate. When an electron fills in a hole, it

drops from a higher energy level to a lower one; consequently, this difference in energy is released as a photon of light (light particle). The wavelength of the light generated is dependent on the energy gaps of the emitting material. In order to produce visible light, these energy gaps have to be within 1.5 to 3.5 electron volts (eV) because of that we get light of visible range. Therefore, the colours emitted are dependent on the molecular composition of the organic emissive material chosen for the OLED.

5.1.1 Advantages of OLED

1. Thin structure and excellent display qualities, ideal for use in flat-panel displays.
2. OLEDs are emissive displays (meaning they generate their own light), and as a result require no backlighting.
3. OLED displays have extremely high switching speeds and as a result can handle high refresh rates required for full-motion video.
4. OLEDs also have a large viewing angle as a result of its self-luminous effect.

5.1.2 Disadvantages of OLED

1. Degradation of the organic material affects the lifespan of OLED displays. These materials can degrade through chemical processes such as oxidation and lose their light-emitting properties.

5.2 Small Molecule Light Emitting Diodes (SMOLEDS)

One of the next trends in display technology is Polymer Light Emitting Diodes (PLEDs), Small Molecule Light Emitting Diodes (SMOLEDS) and dendrimer technology are all variations of OLEDs. The structure of a basic SMOLED (Shaw-Stewart 2013) contains multiple layers of organic material. Depending on the organic chemicals that are used to generate the display, different manufacturing techniques can be used. The p-type layer, known as the anode, is made from a high work function material such as indium tin oxide (ITO) – used in optical devices for its conductive and transparent properties. The next layer is an organic material which aids in the transportation of holes known as normal-propyl bromide (NPB). Following this layer is one which aids in the transport of electrons; tris-8-hydroxyquinoline aluminium is generally used to form it. Lastly, the n-type layer, known as the cathode, is made from a low work-function material such as MgAg (magnesium silver) to produce the electrons. In order to improve efficiency, a luminescent layer is normally added in between the two layers of organic material. SMOLEDs require a complicated process of vacuum vapour deposition, where the deposition method involves sublimating the material in a vacuum. This process allows for a more accurate and better controlled application of these layers onto the display substrate; however, vapour vacuum deposition is also very complex, and as a result, this renders to higher manufacturing costs. Therefore, SMOLEDs are more suited for smaller displays such as cell phones, camera displays, etc. where they can produce excellent colour displays with a long lifetime.

5.3 Polymer Light Emitting Diodes (PLEDS)

PLEDs (Low et al. 2019) were developed approximately two years after SMOLEDs. It utilizes polymers made from chains of smaller organic molecules, an example being polyphenylene vinylene (PPV). PLEDs differ from SMOLEDs because the organic material is water soluble and consequently can be applied onto a substrate by common industrial processes such as spin-coating or ink-jet printing. In spin-coating, liquefied organic material is applied to a substrate which is then spun, at rates of 1200-1500 revolutions per minute, to uniformly spread the organic material and it may then be patterned as required. With ink-jet printing techniques, the substrates can be made more flexible while keeping the production costs low. This means that PLEDs can be used for larger displays such as monitors or television sets. However, the lifetimes of PLEDs are still not comparable to those of SMOLEDs as of this time.

5.4 Dendrimer Technology

A dendrimer is a hyper branched polymer. The structure of a dendrimer is comprised of a central core, and from this core many branching polymers called dendrons. What allows dendrimers the ability to combine the benefits of both SMOLEDs and PLEDs is the fact that the central core can be tailored to determine the amounts of light emission, while surface groups located at the end of the dendrons can be modified so that the molecule can be soluble for ink-jet printing techniques. Therefore, dendrimer technology retains the control of Small Molecular technology, yet also maintains the required solubility of PLEDs.

5.5. Active-Matrix Organic Light-Emitting Diode

AMOLED, or active-matrix organic light-emitting diode, brings OLEDs a big step further with increased resolution and infinite contrast ratio (Choi et al. 2018). When you read about OLED TVs and phones this is the technology that’s being used. The backlight is gone and the display is no longer rigid, but organic materials tend to die out, and that becomes the technology's most worrisome flaw for any device designed to last more than a couple years.

6. E-Paper Technology

E-Paper technology was actually invented forty years ago, but its rise in popularity in eReaders and other devices has happened in recent times (Hagedon et al. 2012). There are three big things eReaders solve for users, the inability to read LCD and OLED screens in direct sunlight, the irritation to the eyes caused by excessive viewing of transmissive or emissive displays, and longer battery life between charges.

7. Touchscreen Display

A touch screen is an electronic visual display that can detect and sense the finger touch or other passive objects within the display area. In 1971 Dr. Sam Hurst, founder of ELOGRAPHICS developed the first touch opaque sensor ELAGRAPH at the University of Kentucky and in 1974 he

developed the first real touch screen. Apple was the first with a touch screen telephone in the year of 1983. This type of display allows a user to interact with the computer by touching pictures or words on the screen and thus it becomes very popular (Krithikaa 2016).

8. Conclusions: What is next

Micro LED could oust OLED as the next big display technology, but it won't be easy (Wu et al., 2018). Samsung has already demonstrated this emerging technology called Micro LED with a wall-size TV, which uses millions of tiny LEDs to improve on the advantages of OLED without OLED's limitations. Micro LED has the potential for the same perfect black levels as OLED with no danger of burn-in. It can provide higher brightness than any current display technology, excellent colour and doesn't suffer the viewing angle and uniformity issues of LCD. Right now the issue with Micro LED isn't image quality, its manufacturing. Apple report says the screens are more difficult to produce than OLED displays, to the extent that Apple almost pulled out of development a year ago. Also the unique features of solution-processed quantum dots (QDs) including emission tunability in the visible range, high-quality saturated colour and outstanding intrinsic stability in environment are highly desired in various application fields (Sun et al. 2019).

REFERENCES

1. Boeuf J. P., 2003, Plasma display panels: physics, recent developments and key issues, Journal of Physics D: Applied Physics, 36,R53-R79
2. Chen H.-W., Lee J.-H., Lin B. Y., Chen S., Wu S. T.,2018, Liquid crystal display and organic light-emitting diode display: present status and future perspectives, Light Sci Appl.; 7: 17168
3. Choi M, Park Y. J., Sharma1 B. K., Bae S.R, Kim S. Y., Ahn J. H Choi, 2018, Flexible active-matrix organic light-emitting diode display enabled by MoS2 thin-film transistor, Sci. Adv.;4, 1-7
4. Emerging Display Technologies, “LCD Basics”, 2005, Available HTTP: http://www.edtc.com/edt/news/docs/Basics.pdf
5. Hagedon M., Yang S., Russell A., Heikenfeld J., 2012, Bright e-Paper by transport of ink through a white electrofluidic imaging film, Nature Communications, 3, 1173.
6. Krithikaa M., 2016 Touch Screen Technology – A Review, International Journal of Trend in Research and Development, 3(1), 74-77
7. Low J Y, Merican Z., Merican A, Hamza M. F., 2019, Polymer light emitting diodes (PLEDs): An update review on current innovation and performance of material properties, Materials Today, 16, 1909-1918.
8. Mosley A., 1993, Liquid crystal displays—an overview, Displays, 14, 67-73
9. Moss H., 1950, Cathode Ray Tube Progress in the Past Decade with Special Reference to Manufacture and Design, Advances in Electronics and Electron Physics, 2, 1-45.
10. Shaw-Stewart J. R. H., Mattle T.,. Lippert T. K, Nagel M, Nüesch F. A., Wokaun A, 2013, The fabrication of small molecule organic light-emitting diode pixels by laser-induced

forward transfer Journal of Applied Physics 113, 043104.

11. Sun Y, Jiang Y, Sun X. W.,Zhang S.,Chen S.; Chem Rec.2019 Beyond OLED: Efficient Quantum Dot Light-Emitting Diodes for Display and Lighting Application; The Chemical Record, 19(8):1729-1752
12. Weston G. F., 1989, Plasma panel displays, Journal of Physics E: Scientific Instruments,8, 981-991
13. Wu T, Sher C.-W., Lin Y., Lee C. -F., Liang S., Lu Y., Chen S.-W. H., Guo W.,. Kuo H.-C, Chen Z., Mini-LED and Micro-LED, 2018, Promising Candidates for the Next Generation, Display Technology, Appl. Sci., 8(9), 1557

Dr. Amrita Mukherjee

Dr. Amrita Mukherjee is an Assistant Professor in Department of Physics, Jogamaya Devi College since May, 2017. She received her M.Sc from Calcutta University in 2005 and Ph.D in Soft Condensed Matter Physics from Jadavpur University in 2010. She did her postdoctoral research work in Chonbuk National University, South Korea and IPCMS, Strasbourg, France for 2 years. She also has 3 years of teaching experience in various academic institutions in Kolkata before joining to her current position. She has 21 research publications in various esteemed journals.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 29-47

Scientific advancements leading to the evolution of the periodic table and discovery of new elements after Mendeleev

Bhaskar Ghosh
Department of Geology, Jogamaya Devi College
bghosh2006@gmail.com

Abstract: Technological advancements provide more effective instruments and procedures for scientific investigations, and progresses in one branch of science may enrich the other branches. After the first publication of the periodic table of elements by Mendeleev in 1869, human perceptions on the structures and properties of atoms evolved remarkably, and the development of new analytical techniques facilitated the detection of a host of new elements. As a consequence, Mendeleev's successors progressively came up with new, improved versions of the periodic table, based on more appropriate laws of periodicity and much larger databases of element properties. A number of scientific innovations from the late nineteenth century to the mid-twentieth century gave the scientists a clearer understanding on the nature of elements and their internal constitutions, and there was near-concurrent expansion of the element database with progressive discovery and synthesis of many new elements which is still continuing. This article presents a brief overview of the gradual evolution of the periodic table of elements and the discovery of new elements after Mendeleev, along with a glimpse of the scientific innovations on which they are based.

Keywords: Periodic Table, Periodic Law, Discovery of Elements, Synthesis of Elements, Actinides, Super Heavy Elements (SHE)

1. Introduction

Rapid advancements in analytical chemistry from late eighteenth to mid-nineteenth century facilitated the discovery of many new chemical elements and compilation of a large database of their properties. The chemists of that era were trying to formulate a scientific scheme of classification to promote a systematic study of these elements and easy dissemination of their knowledge to the succeeding scientists. Among a number of classification schemes proposed during this time, the periodic table published by D. I. Mendeleev in 1869 was irrefutably the most efficacious and universally accepted one. Based on the periodic law that the properties of elements are the periodic functions of their atomic weight; it featured 17 columns or groups, each comprising elements of similar properties, and 7 incomplete rows or periods (Quam & Quam 1934a, Scerri 2020).

Subsequent endeavours of chemists and physicists throughout the world led to further elucidation of the major properties of elements in the last three decades of the nineteenth century. Several new elements were detected during this period which includes the consecutive discoveries of the noble gases argon, helium, neon, krypton, and xenon by Sir William Ramsay and Lord Rayleigh from 1895 to 1900 (Giunta 1998), and discovery of the radioactive elements like polonium, radium and radon during 1898 – 1900 (briefly described in Section 2.2). All these new findings enabled Mendeleev to revise his table a number of times from 1871 to 1903 – the later versions contained eight groups and an additional 'zero' group for the noble gases, and the places of some elements were progressively corrected in them (Quam & Quam 1934a, 1934b, Lagowski & Pauling 2020).

But owing to the limitations of the contemporary state of knowledge in chemistry, there were a number of inconsistencies in Mendeleev's table and it was far from complete – many of the elements predicted by him were not discovered in his lifetime. It took several decades for progressive upgradation of the periodic table, during which a phenomenal advancement in the physical sciences originating from a host of discoveries not only revolutionized the notions and concepts on matter and energy; it would not be an overstatement to mention that it changed the course of human civilization by its immense socio-economic impacts. These innovations, taking place from the end of the nineteenth century to the first half of the twentieth century, brought about unprecedented progress in almost all the branches of science and technology. This work presents a brief account of how these scientific advancements changed the perception of classification of chemical elements in the post-Mendeleev era, and led to the discovery of new ones.

2. Small steps and giant leaps in physical sciences from late 19th to mid-20th Century

2.1. A ray that helped to throw light inside atoms

An innovation by the British physicist William Crookes nearly contemporaneous to Mendeleev's periodic table brought about a number of discoveries in the three subsequent decades. Crookes developed a method of evacuation to create very low pressure (~10^{-6} atmosphere) in a glass tube, and by inserting positive and negative electrodes at its two ends he produced an arrangement for electric discharge which was named 'Crookes Tube' after him. He found that during high-voltage electric discharge the entire tube was totally dark, but there was a bluish green incandescence in the glass wall behind anode; indicating emission of a ray from the cathode to the anode, which on striking the inner wall of the glass tube near anode produced incandescence. He later suggested in 1874 that the ray was composed of negatively charged "gaseous molecules" flowing from cathode to anode (Whittaker 1951, Leicester 1971). In 1876, the German physicist Eugen Goldstein showed that the rays were emitted perpendicular to the cathode surface, and named it 'kathodenstrahlen' or 'cathode ray' (Goldstein 1876). Further investigations on cathode ray facilitated the discovery of X-ray in 1895 and sub-atomic particles in 1897, as described in sections 2.2 and 2.3 respectively.

2.2. Small accidents with not-so-small consequences

Two accidental discoveries, taking place at two different laboratories of Europe at the end of the Nineteenth Century, opened a new horizon of knowledge. The first one occurred at the University of Wurzburg, Germany in 1895, where W. C. Roentgen observed that an unknown fluorescence originating from an evacuated Crookes tube penetrated the opaque black paper covering the tube. Thus he discovered X-ray, an electromagnetic wave with very small wavelength, which paved the way for the chance discovery of radioactivity by Henri Becquerel within a few months.

Earlier in 1789 M. H. Klaproth of Germany discovered the first radioactive element, uranium (U), from pitchblende ore, and named it after the planet Uranus (Greenwood & Earnshaw 1997). Thorium was discovered in 1828 by the Swedish chemist Jöns Jacob Berzelius, who separated it from a mineral collected by Morten Thrane Esmark, an amateur mineralogist from Norway (Wickleder et al. 2006). The common physical and chemical properties of these two elements were known to Mendeleev who placed them in the early versions of the periodic table. However, it took

more than a hundred years to understand the unique properties of these elements when Becquerel, working in the National Museum of Natural History of Paris, learned about Roentgen's findings and intended to study the relation of phosphorescence with the newly discovered X-ray (Chodos 2008). To determine whether the phosphorescent salts emit X-ray on absorbing sunlight, he covered some photographic plates with black paper, placed over it some crystals of uranium salts, and intended to put the entire set-up to bright sunlight. However, due to cloudy weather, he had to delay this experiment for a few days and kept the concealed photographic plates with salt crystals over them inside a drawer. After a few days, he opened the drawer to find that some unknown emission from those salt crystals created distinct imprints on the photographic plates, penetrating through their opaque covers. Thus the uranium salts showed a unique property of emitting some low-wavelength rays spontaneously, without any stimulation from sunlight or any other external radiation. This newly discovered phenomenon, hitherto unknown to the scientific community, was further studied by Pierre and Marie Curie in 1898, and the latter coined the term 'radioactivity' for it. In the same year, they identified radioactivity in thorium.

Shortly after the commencement of their investigations on radioactivity, the Curies found a substance more radioactive than uranium and thorium in the residual pitchblende after removal of these two elements. They could separate a new element from that residue in July 1898 (Kabzinska 1998), which they named 'polonium' (Po) after Poland (Latin 'Polonia'), the native land of Marie Curie. Five months later, they identified another radioactive element in the residue of uraninite (UO_2) mineral after removal of uranium from it (Hammond 2011). The strong radioactivity of this new element imparted to it the distinctive property of bright green radiance, which inspired the Curies to name it 'radium' (Ra), the French for ray derived from Latin 'radius' (Ball 1985, Carvalho 2011).

Ernest Rutherford and Robert B. Owens, in their investigations with radioactive substances during 1899 – 1900, observed continuous emission of a radioactive gas from thorium oxide, which they named 'emanation' (Rutherford 1900, Partington 1957). Sir William Ramsay categorised it as a noble gas owing to its chemical inertness and similarity of its spectral lines to those of argon, krypton, and xenon (Ramsay and Collie 1904); and the name 'radon' (Rn) was later ascribed to it (Adams 1920).

2.3. 1897 – 1911: atoms are 'atomos' no longer

Nearly two decades after the investigations on cathode ray by Crookes and Goldstein, the experiments carried out by J. J. Thomson and his co-workers in Cambridge University indicated that cathode ray was composed of distinctive 'corpuscles' or particles which were different from atoms or molecules (Thomson 1904). He estimated the mass of these negatively charged corpuscles to be 0.1% of that of a hydrogen atom.

The above findings led Thomson to infer that the corpuscles were separated from the remnant gas atoms inside Crookes tube by the high voltage electric discharge, which proved that atom, contrary to its etymology, was not indivisible ('atomos' in Greek). He proposed in 1904 a paradigm for the internal structure of atoms known as 'plum pudding model' (Thomson 1904), which visualizes an atom as a sphere of positive matter in which the negative corpuscles move in orbits to maintain the

electrical neutrality (Thomson 1912, Dahl 1997). This corpuscle thus described by him, the first sub-atomic particle to be discovered, was later named as 'electron' by the scientific community.

Though the discovery of electron was a significant progress to understand the nature of atoms, it did not take long to replace the plum pudding model of Thomson with a more appropriate paradigm when Ernest Rutherford, a New Zealand-born physicist of the University of Manchester, demonstrated experimentally in 1911 that the charge of an atom is concentrated in a very small nucleus in its centre. The internal structure of the atom proposed by him, which came to be known as Rutherford's model of atom, suggested the presence of a very small positively charged nucleus at the centre of an atom, around which the negatively charged electrons of much lower mass revolve. He further opined that the positive charge of an atom is approximately half of its atomic weight.

It did not take long to find out the limitation of Rutherford's model, as the laws of classical mechanics predicted that the electrons moving in orbit would lose energy by releasing electromagnetic radiation, and consequently would collide with the nucleus. Niels Bohr put forward a new model in 1913 which postulated that the electrons can revolve in definite orbits around the nucleus without radiating any energy (Bohr 1913). These are called stationary orbits, and are situated at distances for which the angular momentum of the revolving electron is an integral multiple of the reduced Planck's constant. Electrons can gain energy by moving from an inner to an outer stationary orbit, and lose energy by moving from an outer to an inner stationary orbit, through absorbing and emitting electromagnetic radiation respectively. Bohr also estimated the energy difference between the stationary orbits using Planck's constant (Bohr 1923, 1924). This model proposed by Bohr greatly helped in the formulation of later versions of the periodic table.

2.4. The true significance of atomic number: invaluable contributions of van den Broek and Moseley

Anthonius van den Broek, a lawyer by profession with a passion for physics, hypothesized the direct correlation of the position of an element in the periodic table and the charge in its nucleus (van den Broek 1913, Scerri 2016, 2020). Rutherford had suggested earlier that the charge in an atom's nucleus is nearly half of its atomic weight. This proposition was valid for smaller atoms, but deviated significantly in larger ones, e.g. the nuclear charge of gold (79) is considerably smaller than half of its atomic weight (196/2=98). Shortly after the publication of Rutherford's model of atom, Van den Broek put forward the idea that the number of charges in the atom's nucleus was not half of its atomic weight, but exactly the same as its place in the periodic table (Scerri 2016).

At this point of time, Rutherford coined the term 'atomic number' to denote the serial number of that atom in the periodic table (Scerri 2020), and opined that van den Broek's suggestion seemed very promising to him (Rutherford 1913).

Van den Broek's proposition was experimentally established by Henry G. J. Moseley in 1913 – 1914 through a series of experiments on X-ray spectral analysis of elements. Measuring the X-ray spectra of several metals produced by X-ray diffraction through crystals, Moseley discovered a systematic mathematical relationship between the wavelengths of the X-rays produced and the atomic numbers of those metals (Moseley 1913). His works ascertained that the major chemical and

physical properties of elements are the periodic functions of their atomic numbers, not of their atomic weights; as the atomic number of each and every element in the periodic table is greater than its previous one, while the same is not always true for atomic weight (explained in Section 3.1).

Furthermore, Moseley's works heralded the discovery of four missing elements with atomic numbers 43, 61, 72, and 75, and proved that there were no missing elements in the existing periodic table between the atomic numbers 13 and 79. The places of these four missing elements were filled up in later years (described in Section 4.1) following the synthesis of technetium and promethium, and the discovery of hafnium and rhenium (Weeks 1956, Cantrill 2018), long after the untimely demise of this towering physicist in the First World War. He was also able to show conclusively that there are exactly fifteen lanthanide elements, thus solving a long-standing problem of contemporary chemists (Laing 2005, Marshall & Marshall 2015, 2016).

The new perception originating from van den Broek's hypothesis and Moseley's experiments brought about a significant amendment of the periodic law and reorganisation of the periodic table, and helped to eliminate some of its inconsistencies as explained in Section 3.1.

3. Restructuring and extension of the periodic table

3.1. From atomic weight to atomic number: a landmark in the understanding of element periodicity

Since the inception of the periodic table, the following irregularities were identified in it.

Firstly, the positions of a number of elements based on their respective atomic weights did not conform to the positions predicted by their properties. Such elements were placed in the table in accordance with their chemical properties instead of their atomic weights, e.g. cobalt (58.9), tellurium (127.6) and argon (39.9) were placed before nickel (58.6), iodine (126.9), and potassium (39.1) respectively, in spite of their greater atomic weights.

Secondly, if the periodic law used by Mendeleev is to be followed, each isotope of an element must be allotted a separate position in the table based on its atomic weight. But such an arrangement was not practicable, and would have resulted in the inclusion of elements with dissimilar properties in the same group.

The above discrepancies could be addressed appropriately after van den Broek's hypothesis and Moseley's experimental works revealed that the position of an element in the periodic table is equal to the positive charge in its nucleus (Section 2.4), as described below.

(i) When the elements are placed in the periodic table in ascending order of their atomic numbers rather than atomic weights, their major properties conform to their positions in the table, e.g. based on atomic number potassium (19) comes after argon (18).
(ii) All the isotopes of an element, having the same atomic number, can logically be placed at the same position in compliance with the new periodic law.
(iii) When rearranged in order of atomic number, the elements not only showed periodicity in their

major chemical properties, but there was also a conspicuous regularity in their physical states and some physical properties like melting point, density, and hardness (Lagowski & Pauling 2020, Scerri 2020). For example, the inert gases of Group zero have very low boiling point and always tend to occur in the gaseous state. While the elements of Group IA are soft metallic solids with low melting points, those belonging to Group IIA are harder and have higher melting points. Hardness and melting point of the elements increase gradually in Group IIIA and Group IVA, then continuously decrease through Groups VA, VIA, and VIIA.

3.2. Development of the long periodic table

To rectify the imperfections of Mendeleev's table a number of subsequent workers attempted to develop new tables of classification, among which those given by Werner in 1905 and Bury in 1921 are noteworthy (Gilreath 1958). Quam and Quam (1934b) provided an elaborate description of the development of these tables from 1892 (Basset) to 1931 (Leroy). These tables have the general characteristics of eliminating the subgroups of Mendeleev's table and reorganizing the elements into 18 columns. Owing to their larger number of columns than Mendeleev's table of 1972, they are called 'long charts' (Quam and Quam 1934), 'extended table' or 'Bohr table' (Gilreath 1958). Breaking the first two periods, the elements were placed in the groups based on similarities of properties. In this form of the table, the transition elements were placed adjacently in the middle of 4^{th} period. Gilreath (1958) noted many advantages of these tables over that of Mendeleev's, like placing Fe, Co and Ni, the platinum group of metals and the noble gases in more appropriate positions, but noted that they failed to provide satisfactory positions for lanthanides and actinides.

3.3. Periodic table based on electronic configuration

The limitations of Mendeleev's table and its extended versions (Section 3.2) induced the investigators to look for a more appropriate scheme for classification of elements, and Bohr's model along with subsequent perceptions on the electronic configuration of atoms provided the necessary tool for it. Gardner proposed a table based on the electronic configuration in 1930. The place of an element in this table was determined by the number of electron shells in its atom, the number of incomplete shells and the quantum number of electrons which differentiate an element from its adjacent ones (Gardner 1930, Gilreath 1958). It contained 7 periods and 32 columns classified into the following three major divisions from left to right:

(i) The representative elements, differentiating electrons in the highest energy level or shell, comprising columns 1 to 8.
(ii) The related or transitional elements, differentiating electrons in the second highest energy level, comprising columns 9 to 18.
(iii) The lanthanum and actinium series of elements, differentiating electrons in the third highest energy level, comprising columns 19 to 32.

This table was later improved by Luder and then by Babor (Luder 1943, Babor 1944, Shoemaker 1958), hence received the appellation 'Gardner-Luder-Babor Table'. Though it was free of many of the irregularities of its predecessors, its expansion made it inconvenient for use, and some authors opined that it does not reflect the periodic iteration of the properties of elements, therefore is not suitable as a periodic table (Gilreath 1958).

4. Discovery of new elements, completion and further extension of the periodic table

Of the large number of missing elements in Mendeleev's table of 1969, some were discovered during his lifetime and accommodated in the revised versions of his table. He predicted the major chemical properties of the others based on their places in the periodic table. Moseley, his co-workers and later investigators accurately measured the atomic numbers of some of the undiscovered elements of their time. This section presents a brief overview of successive detection of these elusive elements and gradual filling up of the gaps in the periodic table.

4.1. Discovery of six elements lighter than actinides

Mendeleev left a place for the missing 72nd element in his table and predicted some of its properties, which was discovered in 1923 by Dirk Coster and Georg von Hevesy. They detected it by X-ray spectroscopic analysis of zircon crystals and named it '**hafnium**' after the city of Copenhagen (Latin name: Hafnia) where it was discovered (Coster & Hevesy 1923, Weeks 1956, Authier 2013). **Rhenium**, the 75th element, was discovered in 1925 by Walter Noddack, Ida Noddack, and Otto Berg in Germany from platinum ore and the mineral columbite (Noddack et al. 1925). It is a third-row transition metal, placed in the 7th group of the periodic table.

In 1937, Emilio Segrè and his co-worker Carlo Perrier synthesized two isotopes of the 43rd element at the University of Palermo in Sicily. Being the first element to be artificially synthesized, it was named '**technetium**' (Tc) from Greek 'teknitios' (artificial) in 1947 (Perrier & Segrè 1947, Weeks 1956, Emsley 2011).

The element with atomic number 87, named as 'eka-caesium' by Mendeleev, was discovered in 1939 by Marguerite Perey of the Curie Institute in Paris from an actinium sample. She renamed it as '**francium**' (Fr) after her native country France, which was recognised by IUPAC) in 1949 (Weeks 1956, Adloff & Kauffman 2005).

Astatine (At), the radioactive element with atomic number 85 and designated as eka-iodine by Mendeleev, was synthesized in 1940 by Emilio G. Segrè, Dale R. Corson, and Kenneth Ross McKenzie at the University of California, Berkeley, who named it after Greek 'astatos' (unstable) due to its strong tendency of radioactive decay (Weeks 1956, Burdette & Thornton 2010, Scerri 2013).

The 61st element was first detected in the fission products of uranium fuel in 1945 at Oak Ridge National Laboratory, by Jacob A. Marinsky, Lawrence E. Glendenin and Charles D. Coryell, and was named '**promethium**' (Pm) after Prometheus of Greek mythology who stole fire for mankind (Marinsky et al. 1947, Emsley 2011, Scerri 2013, Cantrill 2018).

4.2. Detection of actinides (89 to 103) and completion of the row below the lanthanides

In 1899, André-Louis Debierne claimed to discover a new radioactive metallic element from a pitchblende residue after separation of radium. He named it 'actinium' (Ac) from Greek 'aktinos' (beam or ray), as it glowed in the dark with a pale blue light due to its strong radioactivity

(Hammond 2005). Though Debierne is widely credited as the discoverer of this element, some of the chemical properties described by him in 1899, 1900 and 1904 were incorrect and in some cases, self-contradictory (Kirby 1971, Adloff 2000). For this reason, some authors have credited Friedrich Oskar Giesel of Germany for its discovery, who discovered it independently in 1902 and recorded its properties more accurately (Kirby and Morss 2006). Actinium, having atomic number 89, is the first element in the actinide series which is placed in a separate row in the periodic table below the lanthanides, with which it shows similarities in chemical properties (Stites et al. 1955).

Mendeleev predicted the existence of an element between thorium and uranium, which was presumably the 91st element in the table. William Crookes, during his investigations on radioactive elements in 1899 – 1900, isolated a strongly radioactive material from uranium but could not identify it as a new chemical element (Crookes 1899, Emsley 2011). Kasimir Fajans and Oswald Helmuth Göhring are credited for discovering in 1913 the element of atomic number 91, and they named it brevium due to the very short half-life (Latin 'brevis': brief or short) of the isotope they studied. In 1917 – 1918, Otto Hahn and Lise Meitner of Germany discovered another isotope (having atomic weight 231) of this element with a long half-life of about 32000 years, which prompted them to rename it as 'protoactinium' (Greek: 'prôtos': first or before) as it is transformed to actinium by radioactive disintegration in the decay chain of ^{235}U (Scerri 2013). In 1949, IUPAC shortened the name to '**protactinium**' (Pa) for the ease of pronunciation (Hammond 2004).

But the scientific community had to wait for 27 years more to find out the 93rd element to fill up the vacant place after uranium in Mendeleev's table, and it was preceded by a series of events that took place in between the two world wars. Neutron was discovered in 1932 by James Chadwick at the Cavendish Laboratory, which gave a complete picture of the atoms. In 1933, Irène Curie and Frédéric Joliot Curie were successful in synthesizing the radioactive isotope of phosphorous (^{30}P) by bombarding ^{27}Al with alpha particles, thus innovating induced radioactivity which opened up an entirely new research methodology. Enrico Fermi and his co-workers in Italy soon realized that the newly discovered neutrons, which are electrically neutral, will be more effective than the positively charged alpha particle to produce induced radioactivity in the elements (Fermi 1934, Rhodes 2012). Following this line of investigation, Edwin McMillan and Philip H. Abelson discovered the 93rd element in 1940 by bombarding ^{238}U with neutrons in a cyclotron at the Berkeley Radiation Laboratory of the University of California, Berkeley. Since in the periodic table it comes after uranium, which was named after the planet Uranus, they later named it 'neptunium' (Np) after the planet Neptune which comes after Uranus in the solar system (Stewart 2012). Following the same logic, Glenn T. Seaborg and his team ascribed the name '**plutonium**' (Pt) to the 94th element of periodic table, which they discovered in 1941 by beta decay of neptunium (^{238}Np).

The 95th and 96th elements were discovered in 1944 by Glenn T. Seaborg, Ralph A. James, and Albert Ghiorso at the Lawrence Berkeley National Laboratory of University of California, Berkeley. The heavier of the two was synthesized by bombarding the oxide of newly discovered ^{239}Pu with alpha particles; and following a long, painstaking chemical procedure, they were able to separate an isotope of this element (Scerri 2020). The one with atomic number 95 was soon to follow – discovered in the same laboratory by a similar procedure. The extremely tiresome and time-consuming procedures of the synthesis of these two elements and further troubles involved in

separating them from one another tempted the discoverers to name them 'pandemonium' and 'delirium' (Harper 2020), but later they decided to name the 96th element as 'curium' ($_{96}$Cm) to honour the invaluable contributions of Marie Skłodowska-Curie and Pierre Curie (Krebs 2006, Scerri 2020). The other, owing to its position below europium (Eu) of lanthanide series, was analogously named '**americium**' ($_{95}$Am) (Seaborg et al. 1949).

The element with atomic number 97 was synthesized in 1949 by Glenn T. Seaborg, Albert Ghiorso, Stanley G. Thompson, and Kenneth Street, who irradiated the oxide of ^{241}Am with alpha particles for a long time to produce an isotope of this new element. They named it '**berkelium**' (Bk) after the city of Berkeley where their laboratory was situated (Thompson et al. 1950). Interestingly the rare earth element terbium ($_{65}$Tb), which is placed in the row of lanthanide series just above Bk, was also named in a similar way after the town of Ytterby, Sweden where it was first found. When these investigators synthesized the 98th element of the periodic table by bombarding $^{242}{}_{96}$Cm with alpha particles in 1950, they decided to name it 'californium' (Cf) after the state of California where Berkeley is situated.

The next three elements of the periodic table, **einsteinium** ($_{99}$En), **fermium** ($_{100}$Fm) and **mendelevium** ($_{101}$Md) were also synthesized in the same laboratory by the relentless efforts of Albert Ghiorso, Glenn T. Seaborg, Gregory Robert Choppin, Bernard G. Harvey, and Stanley G. Thompson from 1952 to 1955. These prodigious investigators chose to pay homage to three of their predecessors, Albert Einstein, Enrico Fermi and Dmitry Mendeleev by naming these three elements after them. It may be worth mentioning that on naming the third one, Glenn T. Seaborg commented in his autobiography that they had considered it appropriate to name an element after the eminent chemist, Dmitri Mendeleev, although naming an element after a Russian was not easy in the peak of Cold War and was not acceptable to many American critics (Van der Krogt, https://www.vanderkrogt.net/elements/ element.php?sym=Md).

This liberal, open-minded attitude of the western scientists was graciously reciprocated by their Soviet counterparts when they convincingly detected the element 102 at the Joint Institute for Nuclear Research of Dubna of erstwhile USSR, and named it 'rutherfordium' (Barber et al. 1993) to pay a fitting homage to the highly esteemed British scientist. Following a prolonged controversy arising from some other laboratories claiming the credit for its detection, the compatriots of Mendeleev were finally recognised by the IUPAC as the discoverers of this element. The IUPAC, however, decided to name it '**nobelium'** ($_{102}$No) in 1997 (IUPAC Recommendations 1997) after Alfred Nobel, the famous Swedish philanthropist and researcher and subsequently named the 104th element after Rutherford.

The last of the actinides, **lawrencium** ($_{103}$Lr) was named by the Berkeley scientists after Ernest Orlando Lawrence, inventor of the cyclotron. Its synthesis and investigation were complete after a long series of experiments carried out at the laboratories of Berkeley, USA and Dubna, USSR from 1961 to 1971. Therefore the IUPAC Trans-fermium Working Group (TWG) in 1992 officially recognized both the laboratories as the co-discoverers of this element (Greenwood 1997, Emsley 2011).

4.3. Synthesis of the Super Heavy Elements (SHE)

The investigations of Richard Swinne in 1914 on cosmic radiations indicated the existence of elements with atomic numbers as high as 100 or 108, which was corroborated in 1955 by Wheeler who coined the terms super heavy nuclei and super heavy elements (SHE) (Wheeler 1955, Werner & Wheeler 1958, Kragh 2017, 2018). These elements, also known as transactinides, do not occur in nature – all of them are synthesized in the laboratory. Fifteen such elements have been discovered so far, from atomic number 104 (rutherfordium) to 118 (oganesson).

In the middle of 20th Century, the shell model of the nucleus was gradually taking shape as a unified view of nuclear structure (Mayer 1949, Caurier et al. 2005) which postulated that the protons and neutrons occupy separate systems of shells, which are gradually filled up separately from the lighter nuclei to the heavy nuclei like the energy shells of electrons. The numbers of neutrons that complete a shell are 2, 8, 20, 28, 50, 82 and 126 which are known as 'magic numbers' (Haxel et al. 1949 Satake 2010, Oganessian & Rykaczewski 2015). The magic numbers for protons are also the same (Ebbing & Gammon 2007, Kragh 2018). The elements in which both proton and neutron are present in magic numbers, e.g. $^{16}_{8}O$ (proton = 8, neutron = 8), $^{132}_{50}Sn$ (proton = 50, neutron = 82), and $^{208}_{82}Pb$ (proton = 82, neutron = 126) have greater binding energies in their nuclei, and are therefore relatively more stable than the others (Blank & Regan 2000, Dumé 2005).

A set of isotopes of superheavy elements, owing to their proton and neutron numbers approaching the predicted magic numbers, are considerably more stable than the other isotopes of the same elements. The zone of occurrence of these isotopes in the chart of nuclides (with the numbers of neutron and proton plotted in the abscissa and ordinate respectively) is known as the island of stability (Moskowitz 2014, Roberts 2019).

Owing to their instability, it has not been possible to study any of the short-lived SHE isotopes with the conventional physical and chemical methodologies – all their properties are predicted from theoretical computations. Their instability also prevents their application in the industries or synthesis of any socio-economically important materials from them.

Of these fifteen elements, six were synthesized in the Helmholtz Centre for Heavy Ion Research, Hassen, Darmstadt, Germany (GSI), one each in the Lawrence Berkeley National Laboratory (LBNL), Berkeley, USA and the Rikagaku Kenkyūsho (RIKEN), Wakō, Saitama, Japan. Two elements were produced independently, by different nuclear reactions, in LBNL and in the Joint Institute for Nuclear Research (JINR), Dubna, near Moscow Oblast, Russia (erstwhile USSR) and the credit for their synthesis is jointly shared by these two institutions. The remaining five were synthesized in JINR by joint collaboration of the Russian scientists with their U.S. counterparts from the Lawrence Livermore National Laboratory (LLNL), Livermore, Tennessee, USA.

A brief outline of these elements is given below.

Rutherfordium ($_{104}Rf$) has sixteen isotopes with atomic masses 253 – 270, except 264 and 269. $^{267}_{104}Rf$, the most stable of the sixteen, has 1.3 hours half-life (Sonzogni, https//www.nndc.bnl.gov/nudat2/). Named after Ernest Rutherford, the credit of its discovery is shared jointly by LBNL and JINR. It is a heavy metal with a density of 23.2 g/cm^3, expected to be a

solid in NTP, having a hexagonal close-packed (HCP) crystal structure.

Dubnium ($_{105}$Db) has 13 isotopes with atomic masses between 255 and 270. $^{268}_{105}$Db, the most stable isotope, has a half-life of ~28 hours (Audi et al. 2012). The credit of its discovery is shared by LBNL and JINR, and it was named after the city of Dubna where the JINR is located. It is a heavy metal with a density of 29 g/cm^3 (Hoffman et al. 2006) and a body-centered cubic crystal structure (Östlin & Vitos 2011). The +5 oxidation state is most stable, though the less stable +3 and +4 states may also exist. Contrary to the periodic trends, its chemical properties resemble more to those of niobium than tantalum (Hoffman et al. 2006).

Seaborgium ($_{106}$Sg) has 12 unstable isotopes with atomic masses from 258 to 271, except 268 and 270. The most stable among them, $^{269}_{106}$Sg, has a half-life of 14 minutes (Utyonkov et al. 2018). Discovered in LBNL, it was named after Glenn T. Seaborg, who led the team of scientists in the discovery of 10 elements. It is a heavy metal with an expected density of 35 g/cm^3 (Hoffman et al. 2006) and a body-centered cubic crystal structure (Östlin & Vitos 2011). Its most stable oxidation state is expected to be +6, and stability decreasing from +5 to +3 (Hoffman et al. 2006).

Bohrium ($_{107}$Bh) has 12 isotopes with atomic masses 260, 261, 262, 264 – 267, 270, 271, 272, 274, 278 (unconfirmed); the most stable being $^{270}_{107}$Bh with ~61seconds half-life (Audi et al. 2012). Discovered in the GSI, it was named after Niels Bohr. Its density is estimated to be as high as 37 g/cm^3, with a hexagonal closed packed crystal structure (Östlin & Vitos 2011).

Hassium ($_{108}$Hs) has 12 isotopes with mass numbers from 263 to 277 (except 272, 274, and 276). $^{269}_{108}$Hs, with a half-life of ~16 seconds, is the most stable (Audi et al. 2012). Its name is the Latin form of Hessen where the GSI, its place of discovery, is located. Hassium is predicted to be the heaviest element in the periodic table with an estimated density of 41 g/cm^3 (Hoffman et al. 2006) and it is expected to have a hexagonal close-packed structure (Östlin 2013).

Meitnerium ($_{109}$Mt) was discovered in the GSI and named after Lise Meitner, the leading nuclear physicist of early 20th Century, who is credited as one of the discoverers of nuclear fission. $^{278}_{109}$Mt, with 7.6 seconds half-life (Oganessian 2010), is the most stable of the 8 isotopes with atomic masses 266, 268, 270, 274, 275, 276, 277, 278. There may also be another with 282 (unconfirmed). Its crystal structure is predicted to be face-centered cube (Östlin & Vitos 2011), and is expected to be the second heaviest of the 118 known elements (after hassium) with a density of 37.4 g/cm^3 (Hoffman et al. 2006).

Darmstadtium ($_{110}$Ds) has 9 isotopes with mass numbers 267, 269, 270, 271, 273, 277, 279, 280, and 281, among which $^{281}_{110}$Ds, with a half-life of ~12.7 seconds, is the most stable (Oganessian 2015). It was discovered in the GSI and named after the town of Darmstadt where GSI is located. The density of darmstadtium is expected to be 34.8 g/cm^3 (Hoffman et al. 2006), and is predicted to be a solid in NTP with body-centered cubic crystal structure (Östlin & Vitos 2011).

Roentgenium ($_{111}$Rg) was discovered in the GSI and named after Wilhelm Conrad Röntgen, the inventor of X-Ray. $^{282}_{111}$Rg, with 100 seconds half-life (Oganessian 2015), is the most stable among

9 isotopes with mass numbers 272, 274, 278, 279, 280, 281, 282, 283, and 286. It is predicted to have a density of around 28.7 g/cm^3 (Hoffman et al. 2006) and to exist as a solid at NTP with the crystal structure of body-centered cube (Östlin & Vitos 2011).

Copernicium ($_{112}$Cn) has 7 unstable isotopes with atomic masses 277 and 281–286. $^{285}_{112}$Cn, the most stable one, has a half-life of 28s (Oganessian 2015). It was discovered by the scientists of GSI, and named after Nicolaus Copernicus, the great 13th Century astronomer. The density of copernicium is expected to be 14.0 g/cm^3 in the liquid state at 300 K, and 14.7 g/cm^3 in solid state (Mewes et al. 2019). This is much less than the other super heavy elements and not much different from that of mercury at the same temperature, though the latter has much less atomic mass. This can be explained by the fact that density of an element is a function of two factors: its atomic mass and inter-atomic distances. In spite of its high atomic mass, copernicium has a low density owing to its large inter-atomic distances. This element is considered as one of the two gaseous metals in the periodic table (Hoffman et al. 2006, Kratz 2011).

Nihonium ($_{113}$Nh), earlier predicted as eka-thallium, is the first SHE to be synthesized in RIKEN, and its discoverers decided to name it after their native country Nihon (Japan). $^{286}_{113}$Nh, having a half-life of ~10s (Oganessian 2015), is the most stable of 8 isotopes with atomic masses 278, 282–287, and 290. It is predicted to have a density in between 16 to 18 g/cm3 (Hoffman et al. 2006, Styszíński 2010) and a hexagonal close-packed crystal structure (Keller et al. 1969).

Flerovium ($_{114}$Fl), named earlier as eka-lead, has 7 unstable isotopes with atomic masses from 284 to 290. $^{289}_{114}$Fl has a half-life of around 1.9 seconds (Oganessian 2015), which is the most stable. This element was the first one to be synthesized in the JINR by collaboration of the Russian researchers with their U.S. counterparts from the LLNL. It has been named after the Soviet physicist Georgy Flyorov, the founder of JINR. Latest studies predict a face-centred cubic crystal structure for this element (Ahmed et al. 2017) and a density of either 22 g/cm^3 or 14 g/cm^3 (Hoffman et al. 2006).

$^{290}_{115}$Mo, with a half-life of 0.65s (Oganessian 2015), is the most stable among the 4 reported isotopes of **moscovium** with atomic masses 287 – 290. It was named after Moscow Oblast of Russia, where it was synthesized, by collaboration of the scientists from the JINR the LLNL. Its density is predicted to be 13.5 g/cm^3 (Fricke 1975).

Livermorium ($_{116}$Lv) 4 isotopes are reported with atomic masses from 290 to 293, among which $^{293}_{116}$Lv has the longest half-life of ~53 milliseconds (Holden 2004). It was synthesized in the JINR in collaboration with the LLNL, and has been named after the town Livermore, where the latter institution is located. Its density is predicted to be 12.9 g/cm^3 (Fricke 1975, Eichler 2015).

Tennessine ($_{117}$Ts) was synthesized in the JINR in collaboration with the LLNL, and was named after the state of Tennessee, USA. It has 2 isotopes with atomic masses 293 and 294 could be synthesized, of which $^{294}_{117}$Ts has the longer half-life of 51 milliseconds (Khuyagbaatar et al. 2014, Universitaet Mainz 2014). It belongs to the halogen group, and its density is estimated to be 7.1 – 7.3 g/cm^3 (Bonchev & Kamenska 1981) which is greater than astatine, and thus continues the trend

of increasing density of the halogens. This continuity is expected to be exhibited in its chemical properties also – the ability of halogens to accept one electron to achieve the noble gas configuration gradually decreases in fluorine, chlorine, bromine, and iodine with their increasing atomic weight, and tennessine is predicted to have the lowest electron affinity in this group (Hoffman et al. 2006, Moody 2013).

Oganesson ($_{118}$Og) was synthesized in the JINR, in collaboration with the LLNL, and has been named after Yuri Oganessian, the leading nuclear physicist of JINR, in recognition of his contribution in the discovery of many super heavy elements. It is thus the second element, after seaborgium, to be named after a person who was alive at the time of naming. It is the first synthetic element that belongs to group 18. It has 2 isotopes of atomic masses 294 and 295, the latter having the longer half-life of 181 milliseconds (Hofmann et al. 2016). This extremely unstable nature of oganesson greatly hinders the study of its physical and chemical properties, and the theoretical predictions in many cases produce contradictory and even unexpected results. Earlier it was thought to be a gas at NTP with a boiling point as low as 247 Kelvin (Takahashi 2002), thus being the densest gaseous substance in the periodic table. But the later researchers predicted it to be a solid at NTP owing to relativistic effects (Nash 2005). Furthermore, in spite of belonging to the group of noble gases, it has been predicted to be considerably reactive (Nash 2005).

6. The concluding remarks

Since its inception, the periodic table of elements has been periodically reconstructed and expanded following the propositions and innovations of new scientific theories and the modernisation of research techniques. With further technological advancement and consequential progress in scientific methodologies, the coming decades are likely to witness the synthesis of new elements and the creation of a larger and more precise database of properties for the existing ones. This is expected to bring about a further revision of the classification scheme of elements and formulation of more appropriate periodic tables in future.

ACKNOWLEDGEMENT

The author is thankful to Dr. Nandini Bhattacharjee, Assistant Professor of Chemistry, Jogamaya Devi College, who has reviewed some sections of this article and shared her valuable suggestions. The apt guidance of an anonymous reviewer, who has meticulously studied the entire manuscript and suggested necessary corrections, is also gratefully acknowledged.

REFERENCES

1. Adams, E. Q., 1920. The Independent Origin of Actinium. Journal of the American Chemical Society 42, 2205. doi:10.1021/ja01456a010.
2. Adloff, J.-P., 2000. The centenary of a controversial discovery: actinium. Radiochim. Acta,

88, 3123–3128. doi:10.1524/ract.2000.88.3-4.123.

3. Adloff, J.-P., Kauffman, G.B., 2005. Francium, Atomic Number 87, the Last Discovered Natural Element. The Chemical Educator, 10, 387–394. doi:10.1333/s00897050956a.
4. Ahmed, M. H., Zaoui, A., Ferhat, M., 2017. Revisiting the ground state phase stability of super-heavy element Flerovium. Cogent Physics, 4, 1. doi:10.1080/23311940. 2017.1380454.
5. Audi, G., Kondev, F. G., Wang, M., Pfeiffer, B., Sun, X, Blachot, J., McCormick, M., 2012. The NUBASE2012 evaluation of nuclear properties. Chinese Physics C. 36, 1157–1286.
6. Authier, A., 2013. Early Days of X-ray Crystallography. Oxford University Press, Oxford.
7. Axel, O., Jensen, J. H. D., Suess, H. E., 1949. On the "Magic Numbers" in Nuclear Structure. Physical Review 75, 1766.
8. Babor, J. A., 1944. A periodic table based on atomic number and electron configuration. Journal of Chemical Education, 21, 25 – 26.
9. Ball, David W., 1985. Elemental etymology: What's in a name? Journal of Chemical Education, 62, 787–788. doi:10.1021/ed062p787.
10. Barber, R. C., Greenwood, N. N., Hrynkiewicz, A. Z., Jeannin, Y. P., Lefort, M., Sakai, M., Úlehla, I. M., Wapstra, A. H., Wilkinson, D. H., 1993. Discovery of the transfermium elements. Pure and Applied Chemistry, 65, 1757. doi:10.1351/pac199365081757.
11. Blank, B., Regan, P. H., 2000. Magic and Doubly-Magic Nuclei. Nuclear Physics News, 10, 20–27. doi:10.1080/10506890109411553.
12. Bohr, N., 1913. On the Constitution of Atoms and Molecules. Philosophical Magazine, 26, 1–25, 476–502, 857–875.
13. Bohr, N., 1923. The Structure of the Atom. Nature, 112, 29 – 44.
14. Bohr, N., 1924. The Theory of Spectra and Atomic Constitution, 2nd ed. Cambridge University Press, Cambridge.
15. Bonchev, D., Kamenska, V., 1981. Predicting the Properties of the 113–120 Transactinide Elements. Journal of Physical Chemistry, 85, 1177–1186. doi:10.1021/j150609a021.
16. Burdette, S. C., Thornton, B. F., 2010. Finding Eka-Iodine: Discovery Priority in Modern Times. Bulletin for the History of Chemistry, 35, 86–96.
17. Cantrill, S., 2018. Promethium unbound. Chemical connections. URL: https://stuartcantrill.com/2018/11/21/promethium-unbound/. Last visited on 11th January 2020.
18. Carvalho, F. P., 2011. Marie Curie and the Discovery of Radium. The New Uranium Mining Boom, 3–13. doi:10.1007/978-3-642-22122-4_1.
19. Caurier, E., Martínez-Pinedo, G., Nowacki, F.; Poves, A.; Zuker, A. P., 2005. The shell model as a unified view of nuclear structure. Reviews of Modern Physics, 77 (2), 427–488.
20. Chodos, A., 2008. March 1, 1896: Henri Becquerel Discovers Radioactivity. American Physical Society News, 17(3). URL: https://www.aps.org/publications/apsnews/200803/physicshistory.cfm. Last visited on 4th January 2020.
21. Colby, F. M., Churchill, A. L., 1911. New International Yearbook: A Compendium of the World's Progress. Dodd, Mead & Co.
22. Coster, D., Hevesy, G., 1923. On the Missing Element of Atomic Number 72. Nature, 111,

79. doi:10.1038/111079a0.

23. Crookes, W., 1899. Radio-Activity of Uranium. Proceedings of the Royal Society of London. 66, 409–433. doi:10.1098/rspl.1899.0120.
24. Dahl, P. F., 1997. Flash of the Cathode Rays: A History of J J Thomson's Electron. CRC Press Inc.
25. Dumé, B., 2005. Magic numbers remain magic. Physics World. IOP Publishing.
26. Ebbing, D., Gammon, S. D., 2007. General chemistry, 8th ed. Houghton Mifflin Publisher.
27. Eichler, R. 2015. Gas phase chemistry with SHE – Experiments. cyclotron.tamu.edu. Texas A & M University.
27. Emsley, J., 2011. Nature's Building Blocks: An A-Z Guide to the Elements. Oxford University Press.
28. Fermi, E., 1934. Possible Production of Elements of Atomic Number Higher than 92. Nature, 133, 898–899. doi:10.1038/133898a0.
29. Fricke, B., 1975. Superheavy elements: a prediction of their chemical and physical properties. Recent Impact of Physics on Inorganic Chemistry, 21, 89–144. doi:10.1007/BFb0116498.
30. Gardner, R., 1930. A table of electronic configurations of the elements. Nature, 125, 146.
31. Gilreath, E. S., 1958. Fundamental concepts of inorganic chemistry. McGraw-Hill Book Co., Inc., New York.
32. Giunta, C. J., 1998. Using History to Teach Scientific Method: The Case of Argon. Journal of Chemical Education, 75, 1322 – 1325.
33. Goldstein, E., 1876. Preliminary communications on electric discharges in rarefied gases. Monthly Reports of the Royal Prussian Academy of Science in Berlin, May 4, 1876, 279-295.
34. Greenwood, N. N., 1997. Recent developments concerning the discovery of elements 101–111, PDF. Pure Appl. Chem., 69, 179–184. doi:10.1351/pac199769010179.
35. Greenwood, N. N., Earnshaw, A., 1997. Chemistry of the Elements, 2nd ed. Butterworth-Heinemann.
36. Hammond, C. R., 2004. Handbook of Chemistry and Physics, 81st ed. CRC press.
37. Hammond, C. R., 2005. The Elements. In: Lide, D. R., (ed.), CRC Handbook of Chemistry and Physics, 86th ed. CRC Press, Boca Raton, FL.
38. Hammond, C. R., 2011. Radium. In: Haynes, W. M. (ed.), CRC Handbook of Chemistry and Physics, 92nd ed. CRC Press, Boca Raton, FL.
39. Harper, D. 2020. Pandemonium. Online Etymology Dictionary. URL: https://www. etymonline.com/word/pandemonium. Last visited on 2nd March 2020.
40. Hoffman, D. C., Lee, D. M., Pershina, V., 2006. Transactinides and the future elements. In Morss, L. R., Edelstein, N. M., Fuger, J., (eds.), The Chemistry of the Actinide and Transactinide Elements, 3rd ed. Springer Science+Business Media, 1652–1752.
41. Hofmann, S., Heinz, S., Mann, R., Maurer, J., Münzenberg, G., Antalic, S., Barth, W., Burkhard, H. G., Dahl, L., Eberhardt, K., Grzywacz, R., Hamilton, J. H., Henderson, R. A., Kenneally, J. M., Kindler, B., Kojouharov, I., Lang, R., Lommel, B., Miernik, K., Miller, D., Moody, K. J., Morita, K., Nishio, K., Popeko, A. G., Roberto, J. B., Runke, J., Rykaczewski,

K. P., Saro, S., Schneidenberger, C., Schött, H. J., Shaughnessy, D. A., Stoyer, M. A., Thörle-Pospiech, P., Tinschert, K., Trautmann, N., Uusitalo, J., Yeremin, A. V., 2016. Remarks on the Fission Barriers of SHN and Search for Element 120. In: Peninozhkevich, Yu. E., Sobolev, Yu. G., (eds.), Exotic Nuclei: EXON-2016 Proceedings of the International Symposium on Exotic Nuclei, 155–164.

42. Holden, N. E., 2004. 11. Table of the Isotopes. In: Lide, David R., (ed.), CRC Handbook of Chemistry and Physics, 85th ed.. CRC Press, Boca Raton, Florida.
43. IUPAC Recommendations 1997. Names and symbols of transfermium elements. Pure and Applied Chemistry, 69, 2471–2473. doi:10.1351/pac199769122471
44. Kabzinska, K., 1998. Chemical and Polish aspects of polonium and radium discovery. Przemysł Chemiczny, 77104–107
45. Keller, O. L., Jr., Burnett, J. L., Carlson, T. A., Nestor, C. W., Jr., 1969. Predicted Properties of the Super Heavy Elements. I. Elements 113 and 114, Eka-Thallium and Eka-Lead. The Journal of Physical Chemistry, 74, 5, 1127−1134.
46. Khuyagbaatar, J., Yakushev, A., Düllmann, Ch. E., 2014. 48Ca+249Bk Fusion Reaction Leading to Element Z=117: Long-Lived α-Decaying 270Db and Discovery of 266Lr. Physical Review Letters, 112, 172501.
47. Kirby, Harold W., 1971. The Discovery of Actinium. Isis, 62, 290–308. doi:10.1086/350760.
48. Kirby, Harold W., Morss, Lester R., 2006. Actinium. The Chemistry of the Actinide and Transactinide Elements. p. 18. doi:10.1007/1-4020-3598-5_2.
49. Kragh, H., 2017. The search for superheavy elements: Historical and philosophical perspectives. URL: https://arxiv.org/abs/1708.04064. Last visited on 22nd January 2020.
50. Kragh, H., 2018. From Transuranic to Superheavy Elements, A Story of Dispute and Creation. Springer, Switzerland.
51. Kratz, J. V., 2011. The Impact of Superheavy Elements on the Chemical and Physical Sciences. 4th International Conference on the Chemistry and Physics of the Transactinide Elements, 5 – 11 September 2011, Sochi, Russia
52. Krebs, R. E. 2006. The history and use of our earth's chemical elements: a reference guide. Greenwood Publishing Group.
53. Lagowski, J. J., Pauling, L. C., 2020. Periodic table. URL: https://www.britannica.com/science/periodic-table. Last updated: 3rd February 2020. Last visited on 7th February 2020.
54. Laing, M., 2005. A Revised Periodic Table: With the Lanthanides Repositioned. Foundations of Chemistry, 73, 203–233. doi:10.1007/s10698-004-5959-9.
55. Leicester, H.M. 1971. The Historical Background of Chemistry. Courier Publishers, Dover.
56. Luder, W. F., 1943. Electron configuration as the basis of the periodic table. Journal of Chemical Education, 20, 21 – 26.
57. Marinsky, J. A., Glendenin, L. E., Coryell, C. D., 1947. The chemical identification of radioisotopes of neodymium and of element 61. Journal of the American Chemical Society, 69, 2781–2785. doi:10.1021/ja01203a059.
58. Marshall, J. L., Marshall, V. L., 2015. Rediscovery of the elements: The Rare Earths–The

Confusing Years. URL: https://digital.library.unt.edu/ark:/67531/metadc827340/m2/1/high_res_d/winter-2015-72-77.pdf. Last visited on 9th January 2020.

59. Marshall, J. L., Marshall, V. L., 2016. Rediscovery of the elements: The Rare Earths–The Last Member. URL: https://chemistry.unt.edu/sites/default/files/users/owj0001/rare% 20earths% 20III_0.pdf. Last visited on 9th January 2020.
60. Mayer, M., 1949. On Closed Shells in Nuclei. II. Physical Review, 75, 1969 – 1970.
61. Mewes, J.-M., Smits, O. R., Kresse, G., Schwerdtfeger, P., 2019. Copernicium is a Relativistic Noble Liquid. Angewandte Chemie International Edition. doi:10.1002/anie. 201906966.
62. Moody, K., 2013. Synthesis of Superheavy Elements. In: Schädel, M., Shaughnessy, D., (eds.), The Chemistry of Superheavy Elements, 2nd ed. Springer Science & Business Media, 24–28.
63. Moseley, H. G. J., 1913. The high-frequency spectra of the elements. Philosophical Magazine 6th series, 26, 1024 – 1034.
64. Moskowitz, C., 2014. Superheavy Element 117 Points to Fabled Island of Stability on Periodic Table. Scientific American. URL: https://www.scientificamerican.com/article/superheavy-element-117-island-of-stability/. Last visited on 4th March 2020.
65. Nash, C. S., 2005. Atomic and Molecular Properties of Elements 112, 114, and 118. Journal of Physical Chemistry A, 109, 3493–3500.
66. Noddack, W., Tacke, I., Berg, O., 1925. Die Ekamangane. Naturwissenschaften, 13, 567–574. doi:10.1007/BF01558746.
67. Oganessian, Y. T., 2010. Synthesis of a New Element with Atomic Number Z = 117. Physical Review Letters, 104, 14: 142502.
68. Oganessian, Y. T., Rykaczewski, K., 2015. A beachhead on the island of stability. Physics Today, 68, 32–38. Bibcode: 2015PhT..68h.32O. doi:10.1063/PT.3.2880.
69. Oganessian, Y.T., 2015. Super-heavy element research. Reports on Progress in Physics, 78, 3: 036301.
70. Östlin, A., 2013. Electronic structure studies and method development for complex materials
71. Östlin, A., Vitos, L., 2011. First-principles calculation of the structural stability of 6d transition metals. Physical Review B., 84, 113104.
72. Partington, J. R., 1957. Discovery of Radon. Nature. 179, 912. doi:10.1038/179912a0
73. Perrier, C., Segrè, E., 1947. Technetium: The Element of Atomic Number 43. Nature, 159, 24. doi:10.1038/159024a0.
74. Quam, G. N. and Quam, M. B., 1934a. Types of graphic classifications of the elements: I. Introduction and Short Tables. Journal of Chemical Education, 13, 27 – 32.
75. Quam, G. N., Quam, M. B., 1934b. Types of graphic classifications of the elements: 11. Long Charts. Journal of Chemical Education, 13, 217 – 223.
76. Ramsay, W., Collie, J. N., 1904. The Spectrum of the Radium Emanation. Proceedings of the Royal Society, 73, 488–496.: 470–476. doi:10.1098/rspl.1904.0064
77. Rhodes, R., 2012. The Making of the Atomic Bomb, 25th Anniversary ed. Simon & Schuster,

New York.

78. Roberts, S., 2019. Is It Time to Upend the Periodic Table? The New York Times. URL: https://www.nytimes.com/2019/08/27/science/periodic-table-elements-chemistry.html. Last visited on 5th December 2019.
79. Rutherford, E., 1900. A radioactive substance emitted from thorium compounds. Phil. Mag. 40, 1–4. URL: https://www.chemteam.info/Chem-History/Rutherford-half-life.html. Last visited on 22nd January 2020.
80. Rutherford, E., 1913. The Structure of the Atom. Nature, 92, 423.
81. Satake, M., 2010. Introduction to nuclear chemistry. Discovery Publishing House.
82. Scerri, E., 2013. A tale of seven elements. Oxford University Press, New York.
83. Scerri, E., 2016. A Tale of Seven Scientists and a New Philosophy of Science, Oxford University Press, New York.
84. Scerri, E., 2020. The Periodic Table: Its Story and Its Significance, 2nd ed. Oxford University Press, New York.
85. Seaborg, G. T., James, R. A., Morgan, L. O., 1948. The New Element Americium (Atomic Number 95). United States Atomic Energy Commission, PPR Volume 14B, No. 22.1, 1 - 40.
86. Shoemaker, J. L., 1958. History of development of the periodic chart and its use as a teaching aid. Science Education, 42 (2), 142 – 151.
87. Sonzogni, A. 2008. Interactive Chart of Nuclides. National Nuclear Data Center, Brookhaven National Laboratory. URL: https://www.nndc.bnl.gov/nudat2/. Last visited on 8th December 2019.
88. Stewart, D., 2012. Neptunium. Chemicool Periodic Table. Chemicool.com. 07 Oct. 2012. Web. 3/5/2020. URL: https://www.chemicool.com/elements/neptunium.html. Last visited on 12th December 2019.
89. Stites, J. G., Salutsky, M. L., Stone, B. D., 1955. Preparation of Actinium Metal. J. Am. Chem. Soc., 77, 237–240. doi:10.1021/ja01606a085
90. Styszyński, J., 2010. Why do we Need Relativistic Computational Methods? In: Barysz M., Ishikawa Y., (eds.), Relativistic Methods for Chemists. Springer, Dordrecht, 99 - 164.
91. Takahashi, N., 2002. Boiling points of the superheavy elements 117 and 118. Journal of Radioanalytical and Nuclear Chemistry, 251, 299–301.
92. Thompson, S., Ghiorso, A., Seaborg, G., 1950. The New Element Berkelium, Atomic Number 97. Physical Review, 80, 781. doi:10.1103/PhysRev.80.781.
93. Thomson, J. J., 1904. On the Structure of the Atom: An Investigation of the Stability and Periods of Oscillation of a Number of Corpuscles Arranged at Equal Intervals Around the Circumference of a Circle; with Application of the Results to the Theory of Atomic Structure. Philosophical Magazine, 7, 237–265.
94. Thomson, J. J., 1912. Further experiments on positive rays. Philosophical Magazine series 6, 24, 209–253.
95. Universitaet Mainz 2014. Superheavy element 117 confirmed. URL: https://phys.org/news/2014-05-superheavy-element.html. Last visited on 4th March 2020.

96. Utyonkov, V. K., Brewer, N. T., Oganessian, Yu. Ts., Rykaczewski, K. P., Abdullin, F. Sh., Dimitriev, S. N., Grzywacz, R. K., Itkis, M. G., Miernik, K., Polyakov, A. N., Roberto, J. B., Sagaidak, R. N., Shirokovsky, I. V., Shumeiko, M. V., Tsyganov, Yu. S., Voinov, A. A., Subbotin, V. G., Sukhov, A. M., Karpov, A. V., Popeko, A. G., Sabel'nikov, A. V., Svirikhin, A. I., Vostokin, G. K., Hamilton, J. H., Kovrinzhykh, N. D., Schlattauer, L., Stoyer, M. A., Gan, Z., Huang, W. X., Ma, L., 2018. Neutron-deficient superheavy nuclei obtained in the 240Pu+48Ca reaction. Physical Review C., 97, 1–10.

97. Van den Broek, A.J., 1913. Intra-atomic Charge. Nature, 92, 372–373.

98. Van der Krogt, P. URL: https://www.vanderkrogt.net/elements/element.php?sym=Md. Last visited on 05 March 2020.

99. Weeks, M. E., 1956. The discovery of the elements, 6th ed. Electronic version published by Journal of Chemical Education, URL: https://archive.org/details/discoveryofthe el002045mbp/page/n33/mode/2up. Last visited on 15th February 2020.

100. Werner, F. G., Wheeler, J. A., 1958. Superheavy nuclei. Physical Review 109, 126-143.

101. Wheeler, J. A., 1955. Nuclear fission and nuclear stability. In: Pauli, W. (ed.), Niels Bohr and the Development of Physics. Pergamon Press, London, 163-184.

102. Whittaker, E. T, 1951. A history of the theories of aether and electricity, vol. 1. Nelson Publishers, London

103. Wickleder, M. S., Fourest, B., Dorhout, P. K., 2006. Thorium. In: Morss, L. R., Edelstein, N. M., Fuger, J., (eds.), The Chemistry of the Actinide and Transactinide Elements. Springer-Verlag, 52–160.

Dr. Bhaskar Ghosh

Dr. Bhaskar Ghosh is presently working as an Assistant Professor in the department of Geology at Jogamaya Devi College, Kolkata. His areas of interest include the analyses of field structures and microstructures of deformed rocks, and the studies of the compositions, structures and socio-economic applications clay minerals. He received Ph. D. degree from the University of Calcutta for his research on stratigraphy and tectonics of Precambrian rocks of the Singhbhum Craton, Eastern India.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 48-60

Marble: Geology with Special Reference to Makrana Deposit of Rajasthan and Elegance of Marble Structures through Ages

Chandrabali Mukhopadhyay
Department of Geology, Jogamaya Devi College
chandrabali@yahoo.com

Abstract: Marble occurs in all the countries of the world and ranges in age from Archean to Pliocene-Pliestocene. The beauty of white, nearly pure marble with its lustre has touched the human sensitivity and drove the man to the world of aesthetics and symmetry since early days. As the favourite medium for the Greek and Roman sculptures and architects, it has become a cultural symbol. In this paper I have described the properties of marble (for which it was favourite to the sculptures and architects) with special reference to the Makrana marble of Rajasthan. The difference between the geological set-up of Mesoproterozoic Makrana marble (about 1400 Ma) formed under greenschist-amphibolite facies and marble of the Carrara region of Italy formed by greenschist facies metamorphism of calcite shell marine Tethyan limestone has been described in brief. Brief notes pertaining to the elegance and unique creations of Michelangelo's David, a biblical hero from a Carrara marble of Italy, Taj Mahal and Victoria Memorial (Kolkata) from Makrana marble, India, Abraham Lincoln Memorial from marbles of Colorado, USA and few others are presented. The necessity for artificial marble and the environmental impact of marble mining industry on the toiling workers have been briefly described.

Keywords: lustre, greenschist facies, amphibolite facies

1. Introduction

1.1 Origin of the term "Marble"

The word "marble" derives from the Ancient Greek word *μάρμαρον* (*mármaron*) from *μάρμαρος* (*mármaros*) "crystalline rock"/ "shining stone". R. S. P. Beekes has suggested that a "Pre-Greek origin is probable". The game of "marbles" (toy) which dated as 13th century had been played with little round balls of polished marble or alabaster (gypsum: $CaSO_4$, $2H_2O$) for hundreds of years before glass-production evolved (marble games are popular in some countries and even world championship game is held) (en.wikipedia.org/wiki/ Marble_(toy)). It is interesting to note that "Mar" of marble is used to mean the rock in some flourished languages of the world such as Marmaros or Marmarons (root names in Greek), Marble (English), Marbre (French), Marmor (Latin, German, Swedish), Marmo (Italian), Marbre (French), Mpamop (Mramor, Russian),. Marmore (Portuguese), Marmol (Spanish), Mamar (Arabic), Marmar (Persian) and Marbleo (Esperanto).

1.2 Naming a rock as marble

Marble has been found in the ashes of Pompeii and the tombs of ancient Egyptians. A marble temple called Parthenon, whose impressive columns and tiles were crafted from Pentelic marble was built on a rocky mound above the city of Athens between the period 447 and 438 B.C. when the ancient Greek Empire was at its height. It is believed that this was the first use of this marble which is also used as a symbol of purity and immortality till date. The popularity of marble began in ancient Rome and Greece, where white and off-white marble was used to construct a variety of structures due to its beauty. Besides statues and buildings, coloured marble was used to create

beautiful tile of flooring. Thus although marble was popularly used in ancient times its petrographic naming as 'marble' is thought to have been made by Sylvester Richardson in 1873 from Gunnison country, Colorado and subsequently rediscovered by George Yule and accordingly the marble has been known as Yule Marble of Colorado. Marble is the State Rock of Colorado.

1.3 Occurrence and age of marble

Although marble occurs all over the world, four countries account for half of its production. These are Italy, China, Spain and India. The formation of marble ranges in age from Archean to Miocene to even Pliocene-Pliestocene.

2. Properties of Marble

2. 1 Petrographic classification

Marble is a fine to medium to coarse grained metamorphic rock formed by metamorphism of sedimentary rocks, most recently it has been claimed by Chen et el. (2020) that the ore bearing dolomite marble from inner Mongolia is a metacarbonatite (igneous rock). The dominant mineral(s) are calcite and / or dolomite and /or aragonite which constitute more than 50% (vol) of the rock. The marble having greater than 95% of any one or more of the above minerals is called "pure marble", monomineralic rock or simply "marble". If the carbonate minerals have modal content lying between 95%-50%, the rock is called "impure marble" which is indicated by a prefix such as diopside marble, forsterite marble etc. Marbles have also been classified as

i) Calcite marble (more than 95% calcite and less than 5% $MgCO_3$)
ii) Dolomitic marble (5%-25% dolomite)
iii) Dolomite marble (marble containing >20% dolomite).

In the commercial world, however, all calcareous rocks, be marble or limestone, which take good polish are marbles. For example, several varieties of limestones, onyx and travertine are considered as marbles. In this context it may be mentioned that onyx is considered by some to be a type of agate composed of cryptocrystalline silica (chalcedony) with black and white bands. Its brown variety is named "sardonyx". Further, agate is said to contain curved bands and onyx parallel bands (Kushwah et al 2015). In the trade world a serpentine-rich rock with or without little Ca or Mg carbonates is called "green marble" if it is attractive and capable of taking good polish. It is interesting to report that a green coloured fuchsite (Cr -mica) bearing mica-schist with a good polish from Western Vermont was called marble (Dale 1912).

2.2 Colour and lustre

The colour of marble is highly variable such as white, milk white, pearly white, off-white, grey, greyish black, black, yellow, red, brown, violet, pink, green, blue and variegated colour. These colours other than pure white are due to presence of impurities of other minerals in variable amounts. For example, black, yellow-brown-red-pink-purple, and green colours are due to the presence of carbonaceous material (graphites), iron oxides, manganese oxides and serpentine-chlorite-epidote-actinolite respectively. Lustre of colourless marbles is vitreous to subviterous to pearly to dull. The entry of light rays a few millimeter through the polished surface gives a glowing

lustre.

2.3 Minerals

The common minerals other than calcite, dolomite and aragonite, comprise clay, micas, quartz, pyrite, hematite, magnetite, limonite, pyrolusite, graphite, diopside-forsterite, serpentine, chlorite, actinolite, spinel, talc, epidote, visuvianite, grossular, sphene, humite, clinohumite, wallastonite, scapolite, feldspars etc. As many as 350 minerals have so far been reported to be present in marble (Volkert 2013)

2.4 Textures

The pure marble is massive, granoblastic, equigranular, generally without any foliation. Grain size generally increases with the grade of metamorphism. Due to stress the carbonate grains, commonly interlocked may show the elongation along a particular direction giving rise to schistosity. Even in some pure marbles, not to speak of the impure ones the preferred orientation of the minor platy minerals such as micas or the thin veins or lenses of coloured minerals occasionally give rise to gneissosity. When the pure marble composed of aggregates of granoblastic equigranular carbonate minerals is subjected to shearing mosaics of coarse grains may be enclosed in the granulated finer grained groundmass.

Study of polished slabs of world famous Carrara marble, Italy, shows gneissic texture, the gneissosity being defined by lines of fine linear subparallel striations of blue grey colour through the dominant white coloured mass. In some cases the lighter bands are composed of elongated lenses with parallel impersistent layers as well as transverse veins of coloured minerals. The polished slabs of Carrara marbles of Italy are characterised by oriented lensoids of pseudoporphyroblastic white marble with trimordial distribution of more white and greyish lenses giving rise to a brecciated appearance. Another type of marble called staurolite marble of Carrara region is predominantly composed of white coloured carbonate mass with minor transverse darker veins.

3. Engineering / Geotechnical Properties

Apart from the above petrographic properties some other important properties are studied for testing the suitability of marble (or any other rock) for construction of building, memorials, monuments, slabs and tiles. These properties include hardness, density, different types of strength -controlled by mineral composition, textures and structures, heat effect, cementation, density, porosity, permeabilty, solubility, water absorption capacity, cavities, weathering impact and few other engineering properties. (Kesavulu 2009, US Department of Agriculture 2012, Garg et al. 2019, Gautam et al 2020).

4. Characteristics of marble for its popularity in architectures and sculptures

The following characteristics of marble are thought to be main causes for its popularity:

I. The beauty of white colour of pure marble and lustre is believed to provide clarity, self-control and both physical and emotional stability.
II. The low hardness of calcite (Mohs scale: 3) and dolomite (H: 3-3.5) and presence of three

sets of rhombohedral cleavages (related to atomic arrangements) are advantageous for the sculptures and architects for easier curving of the marble.

III. The heat resistant capacity and very low porosity (due to interlocking grain boundaries) and adequate mechanical strength cause less probability of entry of water molecules in the pores (causing weathering and disintegration of the coherent grains) impart durability to the rock

IV. It adds a tame look and sophistication to a room

V. It is easy to clean

5. Occurrences of marble in India

Although marble occurs in almost all the states of India, Marble deposit of economic importance are localised in Rajasthan, Gujarat, Haryana and Madhya Pradesh. Rajasthan is the richest high quality marble producing state contributing about 90% of the marble produced in India. Out of 30 districts of the state 20 district have marbles in one or the other forms. Important occurrences of marbles of Rajasthan are at

1) Udaipur-Rajsamand-Chittorgarh regions 2) Makarana-Kishangarh regions 3) Banswara-Dongarpur regions and 4) Andhi (Jaipur) -Jhiri (Alwar) regions and 5) Jaisalmer region

5.1 Geologic set-up of Makrana marble

Makrana marble is world famous for its pure white crystalline variety which has been used, as already mentioned in the construction of TajMahal at Agra and Victoria Memorial in Kolkata and few other places both in India and abroad. Makrana town (Lat. 27°02'25"N, Long 74°43'44" E) in the Nagaur district of Rajasthan, India and is situated about 100km WNW of Jaipur. At present about 800 quarries are present over an area of about 30 km sq. near Makrana town. For overall detailed Geological account of Rajasthan the reader is referred to the publications of Heron (1953), Gupta and Bose (2000) and Roy and Jakhar (2016) and references there in. Makrana marble deposits belong to Ras and Ajmer Formations of Kumbhalgarh Group of the Mesoproterozoic (1650-1950 Ma) Delhi Supergroup. The statrigraphic sequence of Makrana rocks is given below (after Bhadra et al. 2007 and Garg et al. 2019):

Table: 1 The statrigraphic sequence of Makrana rocks (after Bhadra et al. 2007 and Garg et al. 2019):

Age	Intrusive Supergroup	Group	Formation	Lithology
Quaternary				Aeolian mobile sand with calcareous clay or silt with polymictic conglomerate and grit
Upper Proterozoic	Erinpura Igneous suite			Biotite granite, pegmatite, amphibolite
Lower to Middle Proterozoic	Delhi Supergroup	Punagarh Group	Bambolai Formation	Phyllite, impure limestone, calc-silicate rock
		Kumbalgarh/Ajabgarh Group	Ras/Ajmer Formation	Makrana marble and dolomitic limestone/quartzite

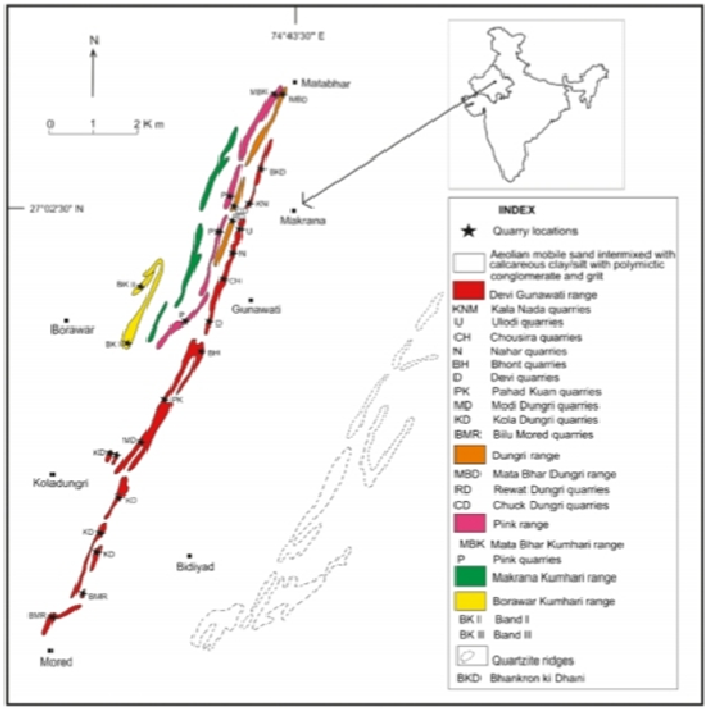


Fig. 1: Map showing five bands of Makrana marble Naugar district Rajasthan (modified after Natani and Raghav 2003)

In Rajasthan statigraphy the Banded Gneissic Complex (BGC) is of Archean age. It is overlain by Aravalli (2100-1600 Ma) and Meso-Neo proterozic Delhi Supergroup. The Aravalli Supergroup occupies the southern and south-eastern part of the Aravalli Mountain Range whereas Delhi Supergroup occurs in the southwestern, central and north-eastern part. The Delhi Supergroup is geographically subdivided into North Delhi Fold Belt and South Delhi Fold Belt. The Kumbhal group composed of pelitic schist and gneiss, quarzite, phyllite, greywacke and pure/impure marble and calc-silicate rocks has been assigned to Ajabgarh Group of North Delhi Fold Belt. The Makrana marble deposits occur in the northern part of the South Delhi Fold Belt and is reported to Ras Formation of Kumbhal Group (Garg et al. 2019). Figure 1 shows the occurrences of five lensoid NNE-SSW trending lensoid bands of Makrana marble deposits situated to the west of Makrana within a country of mixtures of aeolian sands -calcareous clay/silt-conglomerate-grit (Natani and Raghav 2003, Garg et al. 2019).The five bands differently named are separated from one another by the country rocks and are distributed over a strike length of about 14km. The maximum length of the bands is 13 Km. (Davi-Gunawati Band) and the minimum length is 1.7 km (Pina Band) and the width varies from 30 meter to 150 meter. Each band is constituted of massive marbles interlayered with calc-silicate and/or calcareous quartzite. Bhadra et al.2007 however reported ten bands or ridges in which marble quarries are active. The dimensions of each of the five NNE-SSW trending bands of Makrana marbles are (Natani 2000, Natani and Raghav 2003, Bhadra et al. 2007, Garg et al. 2019)

1) Devi-Gunawati Band (13km X 90-150 m);
2) Dungri Band (4km X 60-80 m)
3) Pink Band (1.7 km X 35-70 m)
4) Makrana Kumhari Band (3.5 km X 40-50 m)

5) Borawar Kumhari Bands I & II (2.5 km X 30-40 m)

The characteristics of each of the five bands are described by Garg et al 2019. The super white best quality Makrana white and variegated white marbles are present in Dungri Band which is about 4 km long and 60-80 m wide. These marble bands are due to isoclinal folding with steep dip and were formed by metamorphism of limestones during the Delhi orogeny. These marbles were regionally metamorphosed under green schist to amphibolite facies condition.

5.2 Petrography of Makrana Marble

The characteristic colours of each of the 5 bands of Makrana marbles as mentioned above are as follows (Garg et al. 2019)

I. Devi-Gunawati Band: Pink, white, multi-coloured and pure white (Makrana white marble)
II. Dungri Band: Super white (Makrana white marble) and variegated white.
III. Pink Band: Light pink (pink variety)
IV. Makrana Kumhari Band: Greyish-bluish white (Dungri variety)
V. Borawar Kumarhi Bands I & II: Greyish white (Dungri variety) for Band 1 and dark grey and greyish green (Kumhari variety) for Band II.

The marbles are well jointed. The typical texture is medium to coarse grained granoblastic showing interlocked recrystallised calcites which impart high bearing strength to the marbles. Makrana white marble is nearly100% calcitic and hence it is monomineralic. Apart from the very high grade flawless white variety, there are high grade marbles having huge of grey, pink and brown and also having bands layers and veins of grey, greyish black and bluish grey colours that exhibit good looking structural patterns to the marbles (bhandarim_marbleworld.com/makrana-marble-2/) occasionaly with tight isoclinal folding. The minor accessory minerals include quartz, biotite, muscovite, diopside, tremolite, actinolite, olivine and serpentine, talc and wallastonite. These silicate impurities impart the above textural / structural patterns.

Makrana marbles are harder compared to other Indian marbles and those imported from Greece and Italy. The porosity is less than other Indian and imported marbles and this is one of the reasons for its durability. The slightly higher hardness, interlocking texture, less porosity and solubility impart some unique characters to Makrana marble such as resistant to abrasion, capability of taking good polish due to the negligible impurities and strength for durability (Table 2)

Table 2. Geotechnical properties of Makrana marbles (Garg et al. 2019. Table 6)

Properties	Values
Bulk specific gravity	2.68-2.72
Bulk density (kg/m3)	2600-2700
Absorption by weight (%)	0.04
Compressive strength (MPa)	Dry: 83-96 Wet: 67-85
Flexural strength (MPa)	16-17
Modulus of rupture (MPa)	Dry: 14-15 Wet: 16-18
Abrasion resistance	64-172

5.3 Chemical composition of Makrana marble

The ranges of chemical composition (wt %) of Makrana marble are reproduced below (after Garg et al. 2019): CaO 50-56, MgO 0.8-1.8, SiO_2 0.33-1.20, Fe_2O_3 0.10-0.28, LOI (Loss on ignition) 34.8-43.2.

5.4. Commercial names of Makrana marbles

The trading community has subdivided the Makrana marbles into five catergories on the basis of variation of colour, patterns and specific usuage: Albeta marble, Kumhari marble, Dungri marble, Makrana pink marble and Makrana white marble. The Makrana white marble popularly known as "Sang-e-Marmar" is elegant and expensive, represents the super quality marble from India which is comparable with the finest European Marble from Italy and Greece (Garg et al. 2019, p 918: see also Dube 2008).

5.5 A note on the Geological set-up of Carrara marble of Italy vis-à-vis Makrana marble of India.

The Mesoproterozoic geological set-up of Makrana marble of India has already been described. The Geological set-up of Carrara marble represents one of the youngest metamorphic events in the geological history of the Earth. Here, during late Triassic to early Jurassic period there was prolonged and substantial carbonate deposition (hundreds of meter thick) along with other sediments in the Tethyan Ocean of the Apuan Alps unconformably on a basement of metasediments-metavolcanics probably of Paleozoic age. The calcite rich marine shells after the death of marine organisms formed the carbonate sediments which were subjected to Green schist facies metamorphism and isoclinal folding during Oligocene to probably Lower Miocene (about 17 Ma -23 Ma) of Alpine Orogeny and gave rise to marble formation of Carrara of Apuan region.

6. Elegance of marble through ages

I have already described the charcteristics of marble and its elegance for which it was loved by the ancient sculptures and architects for the construction of statues, monuments, temples and buildings during the historical period. I submit now brief notes on some of the world famous marble constructions.

a) Leaning Tower of Pisa, Italy: Carrara marble used, construction commenced in 1173 and continued for 200 years with two long interruptions
b) Statue of Biblical hero David: Carrara marble of Italy used between 1501-1504 by the great architect Michelangelo. Michelangelo and Galileo Galilei buried in the famous Santa Croce Church, Florence, Italy which was constructed of white, green and pink marble of Italy and Greece. David statue is one of the most celebrated and recognised works of Renaissance sculpture and it represents a symbol of strength and beauty. It is exhibited in the Academy gallery of Firenze in Florence.
c) Taj Mahal: This mausoleum of 'Mumtaz', beloved wife of Shah Jahan, the Mughal Emperor, was built of Makrana marble of Rajasthan between 1631 to 1648 A.D. This was a symbol of love to Shah Jahan and 'a drop of tear on the cheek of history', to Rabindranath Tagore. In

1983, the Taj Mahal was listed as a UNESCO World Heritage Site and in 2007, it was selected as one of the Seven Wonders of the World. One of the designers of Taj Mahal, be he Muhammad Effendi (Ustad Isa) or Ustad Ahmed Lahauri, both Persian, went to Makrana marble quarries to test its quality in the sun rays. There is a misconception among some people that Taj Mahal is built solely of Makrana marble. The fact is that although the overwhelming construction material is Makrana marble, some sandstones (grey, red, yellow) and black slate were also used in foundations and finishing external surface. Apart from these, for decorative purpose, several semi-precious stones used include Aquiq (agate), Firoza (turquoise: hydrated Cu-Al-phosphate), Lajwad (lapis-lazuli), Moonga (coral), Sulaimani (onyx: SiO_2), Lashunia (cat's eye: chrysoberyl, $BeO.Al_2O_3$), Yasheb (jade), Petunia (bloodstone: one type of green chalcedony streaked with red) etc. and some rare man-made stones e.g.: goldstone which is a coloured glass that contains abundant flat shaped highly reflective tiny inclusions of metallic copper/ cobalt giving rise to a glittering lustre.

d) Moti Masjid: Constructed by Makrana Marble both in Lahore and in Agra Red Fort Premises (1630 -1654).

e) Victoria Memorial: After the death of Queen Victoria in 1901, the Victoria Memorial was constructed (1906 - 1921) as a tribute to the success of British Empire in India. Here also the Makrana marble was used from the same quarries for Taj Mahal. Lord Curzon, the then Viceroy of India (1898 to 1905) was highly impressed by the beauty of the Greek and Italian marbles and desired these marbles to be used for Victoria Memorial. However, Thomas Henry Holland (who named charnockite), the then Director of Geological Survey of India (GSI) suggested that Makrana marble is equally of high quality as the European marble and hence it should be used for Victoria Memorial. Lord Curzon then asked Holland to make a report after testing a large number of samples, both from Makrana and Europe. Holland asked L.L. Fermor to perform several kinds of tests of these samples in the laboratory of the GSI, Kolkata. The test results showed that Makrana marbles are superior in quality than the European marbles and finally Lord Curzon was convinced in favour of Makrana marble (Dubey 2008). Recently, while repairing it has been discovered that the so long hidden walls and windows of Victoria Memorial are constructed of red sandstone (indianexpress.com./Cities/Kolkata,Shodhganga. inflibnet.se.in/bitstream/10603/185963/14/14_chapter%204.pdf)

f) Lincoln National Memorial (Abraham Lincoln): Perhaps the greatest President (16^{th} Century) of USA. The memorial symbolizes his belief in the freedom and dignity of all people. The Memorial was built between 1914-22. Marble from the state of Colorado was used for the building and that from the state of Georgia for the statue.

g) Sheikh Zayed Grand: Mosque (Abu Dhabi, UAE): Constructed between 1996-2007 mainly from marble of Macedonia and also Makrana; gold, semi-precious stones and ceramics came from many countries. It is one of the largest mosques in the world.

h) Dukhnivaravan Sahib Gurdwara (Ludhiana, India): Constructed around 1932. Makrana marble is used.

Fig 2: Carrara marble, Italy (Wikipedia) (Source: wikipedia, Marmo z17.JPG, 2004)

Fig 3: Sculpture made up of marble The Unbelievably Delicate Marble Sculptures at Cappella (Patowary, 2019)

Fig 4: Architecture made up of Marble, The TajMahal, Agra, India (Source: Marbleindia, 2014)

7. Necessity of artificial marble

The decreasing resource of high quality marble in the earth and its increasing price and living standard of a section of people have prompted to prepare artificial marble with desirable properties such as high mechanical strength, excellent weather resistance, flexural strength, improved surface hardness, heat resistance and an excellent processability. Cultured marble offers a number of advantages over natural marble. These include lesser cost and incredible design flexibility compared to natural marble. This price for the marble is gradually increasing with the uprise of living standard. To overcome the difficulties, synthetic marble is produced artificially.

8. Advantages of artificial marble

The artificial marbles are of beige, grey and white colour. The main advantages of them are the colour homogeneity and the resistance in an acidic environment**,** in particular in an environment where the pH is significantly low. Moreover, the large proportion of resin (7%) contained in artificial marbles composition contributes to their greater flexural (bending) strength compared to all other rocks.

9. Disadvantage of artificial marble

High percentage of resin contained in artificial marbles composition is a significant disadvantage. Due to the resin the bonding of artificial marble in a high-temperature environment, such as the Mediterranean, is considered as a difficult and complicated process. Therefore, the use of artificial marble is restricted to decorating pool copings and drain grates, always accompanied by high quality adhesives, while it should be avoided in cases of outdoor floor decking.(Ref: https://www.poolstones.com/bwl-knowledge-base/artificial-engineering-marbles-advantages-and-disadvantages/).

10. Impact of marble mining and processing on health

In open-cast mining huge amount of silica/silicate dusts are produced during removal of overburdened silicate rocks. Inhalation of these dusts (very often protective masks are not provided)

for years causes silicosis among the workers. Moreover excessive marble dust is generated by dry cutting of marble causing air pollution in the vicinity of industrial units. The use of excessive water in the processing of marble cutting plants yields slurry of marble. In Rajasthan, which is the largest producer of marble in India, about 5 to 6 million tonnes of marble slurry are generated every year from more than 2000 processing units (IBM 2018). The dumped slurry adversely affects the crop productivity of the land by reducing porosity of soil and lowering the ground water level. After drying the finer fraction of slurry pollutes the air which is harmful not only for the human beings but also for the vegetation and machineries (Kushwah et al 2015).

In the marble industry, the workers have to handle heavy machinery used for cutting, crushing, polishing and finishing. These machineries have exposed sharp edges of blades which can cause physical hazards such as loss of body parts of the operating workers. Further the workers have to carry heavy slabs and hazardous chemicals used for polishing. Further they have to work in environments of excessive noise and vibration, excessive dusts generated by dry crushing, electrical hazards etc. in such industrial units the workers are exposed to several health risks like problems of eye, skin and respiratory trouble. Reflection of solar radiation from the furnished white marble affects the eyesight of the workers and may cause temporary blindness with major risks of accidents, photoconjunctivitus and photokeratitis and dermatitis (Zahra et al. 2014). The workers are affected by hearing loss due to industrial noise, nausea and hypertension due to whole body vibration plus prolonged standing, asthma, muscle strain with back stress, and headaches.

11. Effect of air pollutants and acid rain on marble sculptures and structures

Acid mists (H_2SO_4, HCl, HNO_3) in the atmosphere cause deterioration of structural materials (and also flora-fauna, soil qualities agricultural crops). Sulphuric acid mist in the atmosphere causes deterioration of structural materials. Marble sculptures and architectures have suffered damage in the last 30 years as a result of increased SO_2 content in the atmosphere. To be more precise the destructive forms of pollution is acid rain. Acid rain occurs when fossil fuel emissions containing sulphur dioxide combine with moisture in the air to form acidic precipitation. When acid rain falls on historical monuments of limestone or marble, a chemical reaction takes place which has a corrosive effect on these structures.
For example, the following reaction is illustrative:

$$CaCO_3 + HCl^- \rightarrow CaCl_2 + CO_2.$$

The reaction dissolves the material, leading to permanent damage. (Ref: https://sciencing.com/about-6372037-pollution-s-impact-historical-monuments.html).

12. Protection and preservation of marble structures

It is strongly recommended in case of marble structures that to seal all sides of the surface by applying a pre-treatment even before laying. This will prevent irreversible damage such as internal rust, discoloration or internal stains.

13. A case study

The Yamuna is an integral part of the Taj Mahals design and there was no anticipation that it would dry or become narrow. But the river has narrowed and it is polluted. The wooden foundations are likely to become brittle and might disintegrate When the wood is not exposed to oxygen there are no microorganisms to promote decay. A dry Yamuna could promote disintegration of the wooden foundations, the corrosive effect of the polluted water adding to the decay. Thus, to retain the structural integrity of the Taj Mahal, a free-flowing Yamuna in its original form is a must.(Ref: https://www.hindustantimes.com/analysis/a-free-flowing-yamuna-is-critical-to-the-taj-mahal-s-future/story-N0XchAw5AvUhI4x6C2AS4I.html). The Mathura Oil Refinery is located about 50 kilometres away from the Taj Mahal. It releases toxic gases and disposes waste into the rivers making the area dirty and unhealthy. Even the Taj Mahal is getting affected because of this. The Indian government hired a panel to examine the effects of the refinery on the Taj Mahal where it is found that the air has high levels of suspended particulate matter due to factory emissions, dust, construction, and exhaust from automobiles. These are causing the Taj Mahal to change colour from white to yellow. (https://en.wikipedia.org/wiki/Mathura_Refinery).

14. Protective measures

The Archaeological Survey of India (ASI) is looking at scientific methods to protect the Taj Mahal from pollution. According to the experts, the changes in the colour of the Taj Mahal over time can be accessed through spectrography. The Ministry of Culture has given this responsibility to the Survey Science Branch of ASI and the ASI had started the mudpack treatment of the Taj Mahal. In the first stage, the minarets and the four small domes on the top of the monument were cleaned using layers of Fuller's Earth. No chemicals were used in cleaning the marble to preserve the monument's marble surface. Now this 'cleaned' surface will be documented through spectrography so that the ASI can have a complete record of how the Taj Mahal changes colour with time. This report will also be placed before the Supreme Court. Notably, ASI will be doing the spectrography project through its science branch. (https://www.indiatoday.in/india/story/asi-looking-for-scientific-methods-to-protect-taj-mahal-from-pollution-1474984-2019-03-11)

ACKNOWLEDGEMENT

I am greatly indebted to my Head of the Department, Dr. Abhijit Chakroborty and my collegue Dr. Bhaskar Ghosh for their constant moral support. Also I want to thank my husband and my daughter for sparing their time to comment on and improve my presentation.

REFERENCES

1. Bhadra B. K., Gupta, A. K., Sharma, J.R., Choudhary, B. R. (2007). Mining activity and its impact on the environment: study from Makrana marble and Jodhpur sandstone mining area of Rajasthan. J. Geol. Soc. India 70 (4), 557.

2. Beekes, R.S.P. 2009. Etymological Dictionary of Greek. Brill.
3. Chen, W., Liu, H.Y., Lu, J., Jiang, S.Y., Simonetti, A, Xu, C., Zhang, W. 2020. The formation of the ore-bearing dolomite marble from the giant Bayan Obo REE-Nb-Fe deposit, Inner Mongolia: insights from micron-scale geochemical data. Mineralium Deposita, 55, 131–146
4. Dale, T.N. 2012. The commercial marbles of western Vermont. RareBooksClub.com
5. Dubey, R. K. (2008): Superiority of Makrana (Rajasthan) Marble: Ind.J.HIS.Sci 43(2), 285-288.
6. Gupta P and Bose, U (2000). An update on Geology of the Delhi Supergroup in Rajasthan Geol. Surv. Ind., pub no. 55, 287-366
7. Heron, A.M.(1953): The geology of central Rajasthan, Mem. Geol. Surv. India 79, 1-389
8. IBM (2018): Marble. Indian Minerals Year Book 2016, Part-III: Mineral Review, 55th Edn.
9. Kesavulu, 2009; US Department of Agriculture, 2012;Garg et al, 2019; Gautam et al, 2020.
10. Knottnerus R. Maas H. (2006): From quarry to graveyard CREM (Consultancy and Research for Environmental Management), India Committee of the Netherlands, SOMO (Centre for Research on Multinational Corporations), Francis Weyzig, 1-87
11. Natani, J.V. and Raghav, K.S. (2003): Environmental impact of marble mining around Makrana, Nagaur district, Rajasthan. J. Geol. Soc. India 62 (3) 369-376.
12. Oleg R., Jacqueline D., Douglas F. (2007): Metacarbonate and related rocks, Provisional recommendations by the SCMR (Subcommission on the systematics of metamorphic rocks, a unit of IUGS), 1-8
13. Roy, A.B. and Jakhar, S.R. (2016): Geology of Rajasthan (Northwest India): Precambrian to Recent. Scientific Publishers, Jodhpur 421p
14. Sanchita Garg, Perminder Kaur, Monoj Pandit, Fareeduddin, Gurmit Kaur, Asifa Kamboj, Som Nath Thakur (2019): Makrana Marble: a popular Heritage Stone Resource From North West India. Geoheritage 11, 909-925.
15. Saxena, Neha., Mohammed, Arif,, Yadav, Rajesh Kumar., 2016. A Real study of marble mining activities in district Nagaur (Rajasthan).
16. Williams, H., Turner, F., Gilbert, C., 1954. Petrography: An Introduction to the Study of Rocks in Thin Section (2nd Edition).
17. Zahra, Dr. Imran Hashmi, Nadia Akhtar (2014); Occupational health and safety issues in the marble industry and their potential measures. International Journal of Scientific and Engineering Research, 5(2), 1137-1140
18. Indianet.nl/pdf/fromquarrytograveyard.pdf
19. en.wikipedia.org/wiki/ Marble-(toy), Last visited on 21.05.2020.
20. bhandarim_marbleworld.com/makrana-marble-2/, Last visited on 21.05.2020.
21. http://indianexpress.com./Cities/Kolkata;Shodhganga.inflibnet.se.in/bitstream/10603/185963/14/14_chapter%204.pdf, Last visited on 21.05.2020.
22. http://www.amusingplanet.com/2019/12/the-unbelievably-delicate-marble.html, Last visited on 21.05.2020.
23. https://marbleindian.files.wordpress.com/2014/08/taj-mahal-agra.jpg, Last visited on

21.05.2020.

24. https://en.wikipedia.org/wiki/File:Marmo_z17.JPG, Last visited on 21.05.2020.
25. https://sciencing.com/about-6372037-pollution-s-impact-historical-monuments.html, Last visited on 21.05.2020.
26. https://www.hindustantimes.com/analysis/a-free-flowing-yamuna-is-critical-to-the-taj-mahal-s-future/story-N0XchAw5AvUhI4x6C2AS4I.html, Last visited on 21.05.2020.
27. https://en.wikipedia.org/wiki/Mathura_Refinery, Last visited on 21.05.2020.
28. https://www.indiatoday.in/india/story/asi-looking-for-scientific-methods-to-protect-taj-mahal-from-pollution-1474984-2019-03-11, Last visited on 21.05.2020.

Dr. Chandrabali Mukhopadhyay

Dr. Chandrabali Mukhopadhyay is presently working in the Department of Geology at Jogamaya Devi College, Kolkata. She was awarded with Ph.D. degree from the University of Calcutta in 2008. Her research interest includes Metamorphism and Structure of North Singhbhum Fold Belt of India. She is also interested in Mineralogy and Metamorphic Petrology.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 61-67

Changing Trends in Writing Autobiography: A Comparative Analysis of the Autobiographies of Gandhi, Nehru and Dr. Kalam

Juthika Biswakarma
Department of English, Jogamaya Devi College
juthika.chat@gmail.com

Abstract: Autobiography is a literary genre, traditionally rooted in the Western tradition of confession. The focus of any autobiography is the 'I', the protagonist of an autobiography is the authorial 'self' which, in this modern world of complexities, is always in a state of flux. Since autobiography is a genre of the self, so it too does not have a fixed form. Each author writes autobiography with a different purpose, and these differences in purpose along with the author's socio-cultural background largely influence the narration. With changing time, the genre has also evolved into different forms- earlier there was no distinction between the author and the narrator, and the author confessed to resolve the conflicts of his soul; but now it has come a long way from this tradition. In this paper, I shall explore the changing trends of this genre through three Indian autobiographies: The Story of My Experiments with Truth by Mahatma Gandhi, An Autobiography by Jawaharlal Nehru and Wings of Fire by APJ Abdul Kalam with Arun Tiwari. However, the aim of this paper is not to discuss the merits and demerits of these works or analyse the changes in content; it will rather limit itself to the discussion of the changing trends in the stylistic mechanics of the genre. I have also discussed the problematics of the genre and its relationship with memory.

Keywords: Genre, Confession, Memory, Self, Patterns of autobiography

1. Introduction

A God-fearing friend of Gandhiji once said to him:
"*Writing an autobiography is a practice peculiar to the West. I know of nobody in the East having written one, except amongst those who have come under Western influence*" (Gandhi 2009).

In these lines, the western origin of autobiography is evident. Its seeds lie in the Christian tradition of confessions. Saint Augustine's *Confessions* is widely regarded as the first autobiography revealing the self in the spirit of the Catholic ritual of confessions. Written in CE 397 in Latin, this book traces the psychological, spiritual and philosophical developments of Augustine from an ordinary child stealing fruits to an arrogant youth, lacking faith in Christ, to rising in spirituality and becoming an arch-believer in Christianity. This seminal work gave birth to a new genre which makes the author a 'historian of the self' (Anderson 2001) as he seemingly tries to present a truthful history of the self.

2. Different Forms of Autobiography

Originated in the West, it has been given diverse forms by autobiographers of different socio politico economic backgrounds and cultural ethos. Early European authors wrote autobiographies in the form of diaries, memoirs, chronicles, travel journals and letters. Eminent autobiographers like David Hume, Benjamin Franklin and Rousseau flourished in the West and left bare the

philosophical, spiritual and moral journey of their souls. Then with Mary Delariviere Manley's *Rivella* we got the first full length fictionalised autobiography. We also have fictional autobiographies in the form of novels like Thomas Mann's *Confessions of Felix Krull, Confidence Man* (1954) and Rainer Maria Rilke's *The Notebooks of Malte Laurids Brigge* (1910).Very recently, we observed another trend in the form of 'as-told-to' or collaborative autobiographies in which one person narrates the story of his life and the other person records, edits and gives shape to the story. Some prominent examples are *The Autobiography of Malcolm X: As Told to Alex Haley* (1965), *Bandit Queen of India: An Indian Woman's Amazing Journey from Peasant to International Legend* (2006) – the story of Phoolan Devi as-told-to authors Marie-Therese Cuny and Paul Rambali, *Wings of Fire: An Autobiography* of APJ Abdul Kalam as-told-to/ with Arun Tiwari (1999).

In this paper, I shall trace the changing trends in writing autobiography through the analysis of three great Indian autobiographies- *The Story of My Experiments with Truth* by Mahatma Gandhi, *An Autobiography* by Jawaharlal Nehru and *Wings of Fire* by APJ Abdul Kalam with Arun Tiwari. Before highlighting the diverse patterns followed by these writers, I would like to draw the attention of the readers to the problematics related to this genre.

3. Problematics of the genre

Confession is the keystone of the autobiographical arch. Most of the autobiographies are psychological self-revelation prompted by a traumatic experience or the desire to confess guilt or reveal the journey of the soul, and such writings lead both the author and the reader to experience catharsis. Since an autobiography is essentially the story of the self, which is always on the flux and which does not follow a set pattern of evolution, the genre also does not have a definite form. In any autobiography, the veracity of the account depends on the sincerity of the author on the journey of soul-searching. But is there any difference between confessing to God and confessing to the world publicly? Certainly, there is, and that is why, some critics refuse to classify the genre of autobiography as pure non-fiction, and prefer to describe it as creative non-fiction. In any autobiography, the author recreates a positive image of the self through the systematic and deliberate process of selection and omission, and for this reason Burton Pike observes: "All autobiography is fiction" (https://shodhganga.inflibnet.ac.in/bitstream/10603/107338/7/07_chapter%202.pdf). However, the author's sincerity alone cannot ensure the truthfulness of an autobiography, memory plays a crucial role here and that is evident in the following lines of Saint Augustine's *Confessions*:

"I enter the fields and spacious halls of memory where the countless images that have been brought into them from many things through the senses, are stored as though they were treasures....When I enter this storehouse, I ask that the thing I want be brought out to me. Some things appear immediately, but some things require a search, and are finally dragged out, as it were, from some hidden closet. Certain other things rush out in crowds, and while something else is being hunted out, they scramble around as if to say, "Perhaps we are the ones you wanted?"…The vast cave of the memory, with its numerous and mysterious recesses, receives all these things and stores them

away, to be later recalled as they are needed… This power of memory is great. It is very great, O God, it is an inner room that is vast and unbounded. Who has penetrated to its very bottom?" (Augustine 2001)

Thus, though the author recreates his self through an intensive and sincere churning of his memory, he could never reach the 'very bottom' of all his experiences, and so he sometimes has to rely on secondary data provided by close friends and relatives to fill the gaps, especially in the matter of childhood experiences. However, despite these limitations, the genre continues to attract men and women of all strata alike, and each one of them has contributed to the development of various patterns in the genre. Here I shall explore these patterns through the comparative analysis of the three autobiographies mentioned earlier.

4. Gandhi's *The Story of My Experiments with Truth*

Gandhi's autobiography is much in the line of Augustine's *Confessions*. The reader has been taken into confidence from the very beginning through the confessional tone of the title which declares the account of his life as a series of 'experiments' with 'truth'. A 'willing suspension of disbelief' is evoked in the reader through the witty use of the words 'experiments' and 'truth' and through his declaration in the introduction: "I am far from claiming any finality or infallibility about my conclusions" (Gandhi 2009). He further said, "I am not going either to conceal or understate any ugly things that must be told. I hope to acquaint the reader fully with all my faults and errors." His attempts at proving his truthfulness continues throughout the book as whenever his memory fails him, he mentions in parenthesis: "(I cannot now recall…)". Gandhi acknowledged the incommunicable nature of certain experiences which are known only to oneself and one's Maker. The goal that Gandhi wanted to achieve through the writing of his autobiography is "self-realization, to see God face to face, to attain moksha", and this he achieves through the narration of his experiments in the world of morality and spirituality.

Originally written in Gujarati and published serially in *Navjivan*, a Gujarati weekly, Gandhi's autobiography was translated into English by Mahadev Desai, his personal secretary. He started writing this in the seclusion of his years of imprisonment at Yeravda, when he embarked on a journey of self-discovery through the contemplation and introspection of his sins, faults and errors, moments of shame, personal crises and moral failings which he depicted in this book with utmost sincerity. This sincerity and devotion to truth give this book the tinge of morality. Born in the family of staunch Vaishnavas, Gandhi developed an interest in religion and spirituality. The regular reading of the Ramayana at his home during his childhood and later the reading of the Gita and the Bible during his student life in England left a deep impression on him and made him a lifelong votary of truth, humbleness and sincerity. His strong faith in religion made him so humble that even while pointing at the unethical behaviour of one of his schoolteachers, he said, "Yet the incident did not in the least diminish my respect for my teacher…my regard for him remained the same. For I had learnt to carry out the orders of elders, not to scan their actions". This humbleness had brought him closer to the common man; in spite of being educated in England, he was deeply moved by the plights of the poor to whom he was a saint, a spiritual healer. His strong desire to uplift the poor

both morally and spiritually through the story of his experiments in the spiritual field is evident in his declaration: "…I have all along believed that what is possible for one is possible for all". This desire prompted him to write in his native language, the language that would reach the masses.

Gandhi's language, his choice of words and sentence structure are distinguished with remarkable lucidity, simplicity, compactness and precision. At times his tone is didactic like moral precepts, at times prophetic and yet at some other times intensely personal. He has used quotations and allusions to prove the righteousness of his thoughts as they are rooted in traditional Indian culture and various scriptures. He quotes heavily from the Gita, and besides it he also draws from Surdas and some other spiritual writers, from Gujarati doggerels, from Sanskrit texts and ancient hymns. His quotations have a religious and moral bearing, and appeal to the conscience of the reader indulging him into spiritual analysis.

5. Nehru's *An Autobiography*

Nehru's *An Autobiography* is remarkably different from the confessional account of Gandhi's moral and spiritual journey where he gives utmost importance to truthfulness and simplicity. Nehru's autobiography is "a sketchy personal, and incomplete account of the past, verging on the present, but cautiously avoiding contact with it" (Nehru 2004). Nehru himself mentions in the Epilogue to his autobiography: "Perhaps what I have written is not so much an account of what I have been but of what I have sometimes wanted to be or imagined myself to be." This indicates how facts and fictions have been blended into his account, and this also raises doubts in the reader's mind regarding the veracity of his story. He also wrote in the Preface, "My attempt was to trace, as far as I could, my own mental development, and not to write a survey of recent Indian history. The fact that this account resembles superficially such a survey is apt to mislead the reader and lead him to attach a wider importance to it than it deserves." Thus he continuously played hide and seek with the reader. He begins his work in a mood of self-questioning and his mental conflict is not resolved till the end as in the epilogue he shows how he is a misfit:

"I have become a queer mixture of the East and West, out of place everywhere, at home nowhere… I cannot get rid of either that past inheritance or my recent acquisitions…they also create in me a feeling of spiritual loneliness not only in public activities but in life itself. I am a stranger and alien in the West. I cannot be of it. But in my own country also, sometimes, I have an exile's feeling."

His book is more than a personal document, the incorporation of a detailed account of recent Indian history makes it a historical one, but he makes it clear at the outset that "this account is wholly one-sided and, inevitably, egotistical". He presented a detailed analysis of India's inability to break the shackles of bondage. Written during the long solitudes of Dehradun gaol life from June 1934 to February 1935, this book was published in 1936, and was dedicated to his wife Kamala. The title was proposed by his publisher as Nehru prefers to call it an 'autobiographical narrative'. In his narration of the major political events, he comes out as an observer, a memoirist and an autobiographer. Apart from sharing the story of his own mental development, here he sometimes lashes out severe criticism against groups and individuals. He also voices his dissents against

different connotations of the word 'religion', quotes other's explanations of the concept and then expresses his points of dissents. He unabashedly expresses his attraction to the opposite sex and vehemently opposes Gandhiji's views on it saying:

"For my part I think Gandhiji is absolutely wrong in this matter… Sexual restraint is certainly desirable, but I doubt if Gandhiji's doctrine is likely to result in this to any widespread extent. It is too extreme, and most people decide that it is beyond their capacity and go their usual ways, or there is friction between husband and wife".

At times his tone is romantic and his prose becomes poetic expressing the romantic yearnings of Keats, Shelley and Wordsworth. His love for reading various books, his passion for learning, his relentless zeal to know the unknown is discernible in the pages of the book. He starts the first chapter with the following quotation from Abraham Cowley:

"It is a hard and nice subject for a man to write of himself: it grates his own heart to say anything of disparagement, and the reader's ears to hear anything of praise for him."

It truly sets the stage for what he is going to write in his 'autobiographical narrative'. He has quoted from William Blake, Matthew Arnold, Robert Browning, Alexander Pope, Thomas Moore, Walter De La Mare, Li Po, Swinburne, Shakespeare, Byron and many others. His quotations appeal to the aesthetic and the artistic sensibility of the readers. The amazing sights and sounds of nature, its myriad hues, ever-shifting monsoon clouds, a fine sunrise and sunset and mighty mountains filled his heart with delight and a sense of relief, and found its way through a rich aesthetic and poetic prose.

6. Kalam's *Wings of Fire*

Kalam's autobiography, an excellent example of as-told-to autobiography, forms a class of its own- each page has something new to offer starting from the dedication page. Kalam has dedicated this book to the memory of his parents; and Arun Tiwari has incorporated a poem 'My Mother' written by Dr. Kalam, a scientist and a poet par excellence, on the dedication page itself. The title of the book was neither given by Dr. Kalam nor Arun Tiwari; Madhu Reddy of University Press gave the book its title. Arun Tiwari revealed the story behind writing this book, "It took me close to six years to write this book, overcoming the resistance of Dr. APJ Abdul Kalam to share his story, stopping people close to him from inserting their own agendas into the book and finally, my own inadequacies as a writer" (http://aruntiwari.com/books/wings-of-fire/). Thus it was Tiwari who wanted to make his master, his spiritual guru known throughout the world. Kalam's professional responsibilities kept him busy for almost eighteen hours a day and so he did not ever think of writing about himself. He even expressed his doubts in the Introduction to the book regarding the relevance of his childhood memories or his struggles to others. He questioned, "Was it worth the reader's while, I wondered, to know about the tribulations and triumphs of a small-town boy?" Tiwari persuaded him to reveal everything as his story is not limited to the making of a world class scientist alone, it goes far beyond and narrates the story of the successes and setbacks of science in

modern India. It becomes 'the story of national aspiration and of co-operative endeavour' (Kalam & Tiwari 1999). The deliberate attempts at taking his readers into confidence, as practised by other autobiographers, are missing in his autobiography, but the deep spirituality on which Kalam's life is based since childhood awakens the faith in the reader's mind. A scientist, a poet, a rich repository of fresh ideas and a deeply spiritual man like Kalam had so many things to tell the youth, so his conversations were marked with various subplots and digressions, at times it became difficult for Tiwari to follow his narration. Kalam used to sit with Tiwari at an interval of a few months and talk; and Tiwari used to take notes diligently. At each of their meeting, Tiwari used to give him the manuscripts which he would return at the next meeting after correction. Tiwari did not simply transcribe whatever had been told to him. He went through Kalam's personal library meticulously; and selected and incorporated the poems that were behind the making of the man. How far he contributed to shape Kalam's autobiography could be realised through the following comment of Dr. Kalam: "Buddy, today people call you Kalam's man; later, when I would have gone, whenever they would see you, they would say I was your man" (http://aruntiwari.com/books/wings-of-fire/). Unlike other as-told-to autobiographies where the author mostly transcribes the narrator's story, Kalam's book is rather written by both the authors, and that is why the authorship of the book is denoted as APJ Abdul Kalam 'with' Arun Tiwari. The entire book is divided into four broad chapters and each chapter is aptly titled, mentioning the period: Chapter I- Orientation (1931-1963), Chapter II- Creation (1963-1980), Chapter III- Propitiation (1981-1991) and Chapter IV- Contemplation (1991-…). On the title page of three chapters, Tiwari quoted lines from the Atharva Veda (chapter I), Lewis Carroll (chapter III) and Al-Waquiah (chapter IV).

Kalam's journey throughout India brings him in touch with various cultures, food, landscapes and people which he describes with utmost gratitude and humbleness as each of these encounters contributed to the growth of a philosopher and a poet. His autobiography is replete with many such poems that flowed from his pen spontaneously at moments of joys, realisation and contemplation. Kalam believed that science and spirituality are complimentary to each other as the basic premise of science is truth which leads one to spirituality. His autobiography turns out to be a treatise on leadership, value based education, ethics and self-help; it is a celebration of all the religions of the world. He has quoted generously his teachers, great philosophers and renowned poets; and his quotations are a wellspring of motivation. Kalam consciously reduced the length of the book from 340 pages to about 200 by removing the portions wherein he shared his conflicts with people. His autobiography thus celebrates only the positive aspects of things and people.

7. Conclusion

In *The Story of My Experiments with Truth,* the centre of Gandhi's attention was always his inner world, his mental development; his experiments sometimes bring the larger issues of the day under his consideration but they remain only in the periphery. Gandhi's autobiography is the result of his intense introspection on the inner workings of his mind, it is a kind of moral and spiritual analysis. Nehru starts his autobiography with the nostalgic description of his origin, childhood, schooling and marriage, but it soon turned into a commentary on the contemporary socio-political and economic conditions prevailing in the pre-independence India. Nehru's autobiography is more of a personal

account of the contemporary events and it is rather secular in nature. Kalam's autobiography is meant to inspire the several-million mass of India- his personal story surpasses the narrow trifling concerns of his life and narrates only those events that can give wings to the divine fire present in every youth of India. The purpose of his autobiography is not to find his true self, not to come to terms with the conflicts of his mind, not to search his soul, which most autobiographies seek; his only aim is to give the youth a message: "With faith, you can change your destiny" (Kalam & Tiwari 1999).The three autobiographies highlight the changing trends in writing autobiography- Gandhi's autobiography is confessional, moral and spiritual, Nehru's is semi-confessional and a social commentary, and Kalam's is motivational and spiritual. Thus, starting with the confessional tone, autobiography as a genre has evolved and is continuously evolving, and keeping pace with this trend not only the purpose but also the mode of delivery has changed. Like the Freudian self, the genre too has no limitations in terms of form and content.

REFERENCES

1. Anderson, L., 2001. Autobiography. Routledge, New York.
2. Augustine, S., 2001. Confessions. Translated by Jay P. Green. Lightning Source, Inc., USA.
3. Gandhi, M., 2009. An Autobiography or The Story of My Experiments with Truth. Translated by Mahadev Desai. Fingerprint Classics, New Delhi.
4. Kalam, A.P.J.A., Tiwari, A., 1999. Wings of Fire: An Autobiography. Universities Press, Hyderabad.
5. Nehru, J., 2004. An Autobiography. Penguin Books, Gurgaon Haryana.
6. http://aruntiwari.com/books/wings-of-fire/. (Last visited on 6th March, 2020).
7. https://shodhganga.inflibnet.ac.in/bitstream/10603/107338/7/07_chapter%202.pdf. (Last visited on 6th March, 2020).

Juthika Biswakarma
Juthika Biswakarma has been teaching English Literature at Jogamaya Devi College as an Assistant Professor for five years. She has interest in diverse areas ranging from American English literature, Indian English literature and postcolonial literature to Human Resource Management, e-governance, disaster management and public policy analysis. She did her M.A. in English Literature from Visva Bharati University and M.A. in Public Administration from IGNOU.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 68-74

Section 377: Challenges and Changing Perspectives in the Indian Society

Nisha Tamang
Department of Political Science, Jogamaya Devi College
tamangnisha_11@rediffmail.com

Abstract: On September 6th2018, a historic judgement was made by the Supreme Court of India which scrapped down Article 377 that criminalized homosexuality. A lot of things have changed after the passing of the judgement. Many from the community have been able to come out to their families and in their workplaces. More open conversations about the queer community are happening now and people at large have started accepting these communities. Judicial reform may create an enabling platform to come out, but social realities do not necessarily change in sync. This paper thus aims at looking at various challenges faced by the community due to section 377 of the Indian Penal Code and how the verdict passed to scrap this section has affected the legal and social status of the said community.

Keywords: discrimination, equality, dignity, community, mental health

1. Introduction

The basic idea of human rights lies on the principle that all human beings should be treated equally and with same dignity. The violation of such principle and dignity paves the way for discrimination. Our constitution has recognised several equality rights for the different sections of society and it recognises the rights of gender as well. Indian constitution explicitly states that in Article 14 no state shall deny equality before the law and equal protection within the territory of India, Article 19(a) illustrates the right to freedom of speech and expression, and Article 21 guarantees the protection of life and personal liberty which also gives the right to live with dignity. But these basic fundamental rights are denied to some people just because of their sexual orientation.

'Homosexuality' is a sexual orientation characterised by sexual desire or romantic love exclusively, or almost exclusively, for people who are identified as being of the same sex. The word homosexual translates literally as "of the same sex," being a hybrid of the Greek prefix homo- meaning "same" (as distinguished from the Latin root homo meaning human) and the Latin root sex meaning "sex". People who are homosexual, particularly males, are also known as "Gay"; homosexual females are known as "Lesbians". The term homosexual can be used as a noun or adjective to describe same-sex oriented persons as well as their sexual attraction and behaviour. However the term homosexuality appears in print for the first time in 1869 in an anonymous German pamphlet, paragraph 142 of the Prussian penal Code and its maintenance paragraph 152 of the Draft of a Penal Code for North German Confederation written by Karl Maria Kertbeny. This pamplet advocated the repeal of Prussia's sodomy laws. Thus the homosexuality has its long-time presence.

The lesbian, gay, bisexual, transgender, queer (LGBTQ) couples do not share the same set of legal rights as enjoyed by the heterosexuals. They are also barred from child adoption and the discrimination at jobs, education, at homes still remains common. It has often been regarded as an

issue of mental health. However, homosexuality as some kind of mental disease ceased to be considered as an abnormal behaviour when The American Psychiatric Association, in 1973 and the World Health Organisation, in 1992 officially accepted its normal variant status. This led to the de-criminalisation of homosexuality in different countries. There are various states across the globe that enacted anti-discriminatory or equal opportunity laws and policies to protect the rights of gays and lesbian.

2. History:

Homosexuality has been the subject of discussion since ancient times to modern era and homosexual behavior is deeply rooted in Indian culture. Hindu Mythology positively illustrates the occurrence of homosexuality and same-sex activities in various literatures and ancient texts such as the Manu Smriti, Arthashastra, 2,000 years old Kamasutra, some erotic sculptures in old Khajurao temples, Upanishads and Puranas. As per Indian epics and Hinduism, the manifestations of different deities with the characteristics of both male and female genders such as Ardhanarishvara, who is the embodiment of both Shiva and his partner Parvati. The name Ardhanarishvara means "The Lord whose half is a woman". For the past 150 years an unusual practice of ritualistic transgender marriage in Angara, a village in Gujarat, during the time of Holi Festival can be observed. Every year this unique wedding is performed where Ishaak, the bridegroom and Ishakali, the bride are both men.

Historically, homosexual relationships were not outside the societal norm in the past even in the early western cultures of ancient Greece and same sex marriages were recurrent within the Christians and non –Christian communities for a long period of time. The historic figures, love poetry and paintings in pre modern era such as Alexander the great, Plato, Michelangelo, Leonardo Da Vinci, Christopher Marlowe have featured the homosexual orientation and the relationships of the people with their own gender.

3. Discriminatory Law:

Section 377 violates the right to life and personal liberty, the right to equality and the right to freedom guaranteed to all citizens as Fundamental right, Chapter III of Indian Constitution. Prior to British colonisation there were no laws against same-sex relations in India. Indeed, some Hindu traditions positively celebrated homosexuality alongside heterosexuality, as part of the spectrum of human sexuality and erotic desire. Homosexuality, however, was criminalised by the British during their rule in India under Section 377 of the Indian Penal Code (IPC) in 1861, inspired by the 1553 Buggery Act that outlawed homosexuality in England. As per Section 377, whoever voluntarily has carnal intercourse against the order of nature with any man, woman or animal, shall be punished with imprisonment for life, or with imprisonment of either description for a term which may extend to 10 years, and shall also be liable to pay a fine. Since then the LGBT community has been facing torture, imprisonment, fear etc. and are deprived of their basic rights. Interestingly, England (the country of origin of the sodomy law) has abolished the offence of homosexuality between consenting partners by the Sexual Offenders Act 1967 whereas in India, the consent is quiet

insignificant for constituting an offence as defined under this section. Therefore it is section 377 that defines the unnatural offences in India and makes homosexuality a punishable offence.

According to the figures submitted by the Government of India to The Supreme Court in 2012, there were about 2.5 million gay people recorded in India that is approximately about 8% of the total population. Lesbian, gay, bisexual, transgender and queer (LGBTQ) people in India faces legal and social difficulties; they remain victims of violence in different forms supported by the state and society and are deprived of social and legal recognition. On 23rd February 2012, the Ministry of Home Affairs expressed its opposition to the decriminalisation of homosexual activity, stating that in India, homosexuality is seen as being immoral.

4. Activists Movement:

In 1994, an organisation called AIDS Bhedbhav Virodhi Andolan (ABVA) filed a public interest litigation (PIL) in Delhi High Court, challenging the constitutional validity of Section 377 – it was one of the first legal protests against government repression of the LGBTQ community. The PIL also gave India its first champion of gay rights – the ABVA, which had published in 1991 a ground-breaking pamphlet, 'Less Than Gay', a citizens' report on the discrimination faced by the community in India. The second movement to repeal Section 377 led by the Naz Foundation (India) Trust, which is non-governmental organisation, filed a lawsuit in the Delhi High Court in 2001 in an attempt to legalise the homosexual intercourse between consenting adults. Various activists' movement supported the LGBTQ community. In 1994, lesbian and gay groups filed a petition challenging the law in the Delhi High Court. Gay rights activists have fought a long battle against section 377. Many other organisations, like the National AIDS Control Organisation, Law Commission of India, Union Health Ministry, National Human Rights Commission of India and the Planning Commission of India have expressed support for decriminalising homosexuality in India. A letter to the gay magazine Trikone said that a lesbian group's first attempt to create a public opinion on LGBTQ marriage and family law was made in the year 1996 by an Indian lesbian collective called Stree Sangam in a government conference. Similarly, other gay and lesbian groups like Humsafar of Mumbai, Sahayathrika of Kerala also raised gay issues in the mainstream. Efforts were made by different organisations to push through policy changes by organising workshops on gender and sexuality for young adults and millennials in local schools and colleges.

5. The Verdict:

The Delhi High Court struck down the law that considered consensual homosexual sex between adults as a crime as it violates the fundamental rights protected by Indian Constitution. The verdict issued by a two-judge bench of Delhi High Court on the landmark case of Naz Foundation v. Govt. of NCT(National Capital Territory) of Delhi decriminalised homosexual acts involving consenting adults throughout India. However, this was later overturned by the Supreme Court of India in Suresh Kumar Koushal v. Naz Foundation, in which a two judge bench reinstated section 377 of Indian Penal Code. On September 6th 2018 a landmark judgement was made by a bench of five judges in Navtej Singh Johar v. Union of India to revoke the provision of section 377 declaring that

it was unconstitutional and destructive to an individual's dignity and identity. The five-judge bench has partly struck down Section 377 as it violates the right to equality guaranteed by the Indian Constitution. The other aspects of Section 377 which deals with unnatural sex with animals and children remain in force and will be considered a penal offence. Justice Indu Malhotra, one of the five judges who read out four concurrent verdicts on 6 September 2018, also stated that the society owes the LGBTQ+ community an apology for the historical wrongs perpetrated against it. India has now joined 17 commonwealth nations that have overturned laws criminalising homosexuality.

6. Challenges and Changes After Section 377:

The recent Supreme Court order on Section 377 appears to be a step forward towards a more inclusive society. After the repeal of Section 377, many organisations have been supportive for decriminalising homosexuality in India and urged for tolerance and social equality for LGBTQ people. India is among countries with a social element of a third gender, but mental, physical, emotional and economic violence against LGBT community in India still prevails. Since homophobia is prevalent in India, homosexuality is rarely discussed openly. People from the LGBTQ community have finally started to come out freely and mainstream themselves. Some felt better equipped to battle the daily micro-aggressions they faced at schools, colleges or work. For others, the novelty of a post-377 world quickly wore off, as social structures, inflected by class, caste, and religion, cut into their hopes of a life of dignity and equality. As per sources Indians still face enormous pressure to conform, to comply with socially acceptable conventions and have to pretend to be someone else at work which takes a mental toll on them.

The Supreme Court ruling of Section 377 has helped many people to open up about their sexual orientation and speak freely about it on Social media as well. They were seen celebrating the victory after the verdict. Earlier being gay in India meant to be rejected by family, being ostracized by the community and even faced violence but with the passage of time the attitudes of family members have been gradually shifting towards a better side. The researches depict that it is still not easy for people to come out freely as LGBTQ+ even in the society that are protective and supportive of the community's rights unless they begin to accept themselves before asserting that identity to the world. Post the Section 377 verdict, the real fight has begun: to educate people, eradicate misconceptions, and to spread awareness about equality in smaller towns, so that more people from the rural area will have the courage to come out of the closet. The suicide rate among the LGBTQ people in rural areas is alarming, as many are forced to get married by family and society without their consent. Due to the lack of support from family, society and police, many rape victims stepped back from lodging a report. The verdict has clearly opened door for such trials. Homosexuality has often been considered as a mental disorder or a curable disease. The Indian Psychiatric Society has categorized homosexuality as a "stable" mental condition. Therefore changing families' attitudes becomes the key priority as viewed by a clinical psychologists Richa Vasishta, a research interventionist at the Humsafar Trust, a nonprofit organization in Mumbai and Delhi that provides counseling, health-care services and advocacy for the LGBTQ community. The struggle to sustain the momentum of the reading down of Section 377 must begin at all the levels including grass-roots. Reportedly, there are still cases of harassment by the police officials towards the members of the community (particularly transgender people) relying on Section 377 together

with other criminal offences, including offences addressing prostitution and public nuisance (Chandrachud 2019). Although more liberal attitudes are growing in the major cities, in rural and small-town India, where most of the population live, there is still much ignorance and prejudice. Ban on section 377 on homosexuality is just a beginning as the battle to be fought is still long with huge challenges to end the stigma, discrimination and crime that LGBT people suffer in India. The anti- homosexual attitudes of many religious and community leaders are mostly hostile to this reform and reflect the existence of widespread prejudice in India that risks the life of LGBT people particularly of so-called 'honour killing' by their families.

Despite the reading down of section 377 of the LGBTQ, the community still feels that the laws do not effectively protect them. Has it really changed anything in the life of the LGBTQ community? Actually nothing much because we still don't have a clause that recognises the sexual violence against men. However, the very fact that one's action that criminalises your love can have a very deep psychological impact, so the biggest impact would be psychological that one do not fear any kind of harassment that could possibly happen in a country like India. If a woman is raped, she can file a case because there are provisions for her. But if a gay or a transgender is raped by a man there is no place for them to file a complaint. There is no such law so far. There are people who are forced to have sex since they cannot file any complaint. Such cases are still happening and nothing much has changed at the ground level. Criminal prosecution record 377 was mostly used in this country to prosecute male rape because there was no systematized persecution.

The discrimination towards the community still exists even after the removal of section 377. Members of the Queer community feel that there is still a long way to go. There is still no policy or law that supports the homosexual or gay community, there are no syllabus that mentions about the LGBTQ, no science books to educate and explain the society about these communities. Basic things such as exclusion from the sources of livelihood, other than begging sex work, homelessness, lack of access to health care, these continue to be some basic things that plague the majority of people in our country but especially people from marginalised genders and sexuality.

As a part of the historic judgement on 6th September 2018 the Supreme Court of India also directed the State government to ensure that the judgement reaches to the farthest parts of the country. But even today only few people in some metropolitan cities know about it. The community feels let down in this aspect as well.

7. Conclusion:

People of the LGBTQ community have really come out and mainstreamed themselves and have taken places from work culture to cinema, to art, to fashion and music, but there is still lack of empathy for the people of the community. So, there is a need to make efforts to re-imagine our laws. Either discrimination can be because of invisibilisation (of the community) or we only recognize the male-female binary or, it can also be because we don't recognize non-heterosexual conduct since most of the laws are made with the assumption that only heterosexual relationship is a legitimate relationship. Thus even when we do not see gender in the laws, it will still discriminate against LGBTQ community people. So the attempts should be made to make them always inclusive

but it is not as simple because we cannot just add people to these laws. We need to re-imagine them completely. We all know that current sexual offence laws do not account for LGBTQ people but it is not simply changing the gender of the victim. That will not really solve the problem because we have the substantive criminal law, procedural law, evidence law. And when we think all of them together, they are made in a certain way that they assume only a woman can be a victim. So when we change these laws, we need to re-think some of these things.

There are other important issues as well that LGBTQ community needs to focus on which is financial inclusivity, recognition of property rights between homosexual couples, children adoption rights, surrogacy, implementation of marriage act, basic equality. All of these issues create a huge lacuna in India and it makes the life of LGBTQ couples in India a living hell. Let us hope that the equality in all forms reaches the community very soon.

REFERENCES

1. Chandrachud, C., 2019. The afterlife of setion 377.
2. Dean, T., Lane, C., 2001. Homosexuality And Psychoanalysis, The University of Chicago Press, Chicago
3. Kala, A., 1991. Invisible Minority: the unknown world of the Indian homosexual, Dynamic Books, Delhi.
4. Misra, G., 2009. Decriminalising homosexuality in India. [Reprod Health Matters.2009],
5. Narrain, A., 2004, Queer: Despised Sexuality, law and Social Change, Books for Change, New Delhi.
6. Narrain, A., Chandran, V., 2012, Medicalisation os sexual orientation and gender identity: A human rights resource book, Yoda Press, New Delhi.
7. Vanita, R., Kidwai, S. 2000. Same Sex Love In India: Readings From Literature And History,. Macmillan.
8. https://www.ncbi.nlm.nih.gov/pubmed?linkname=pubmed_pubmed&from_uid=20225520. Last accessed on 8th march 2020.
9. http://www.ilga.info/index.html. Last accessed on 29th February 2020.
10. https://indianexpress.com/article/opinion/columns/the-afterlife-of-section-377-gay-sex-lgbt-rights-supreme-court-judgment-5549111/. Last accessed on 4th March 2020.
11. http://www2.warwick.ac.uk/fac/soc/law/elj/lgd/2001_2/narrain. Last accessed on 29th February 2020.
12. http://www.umiacs.umd.edu/users/sawweb/sawnet/news/news337.txtg. Last accessed on 29th February 2020.
13. www.trikone.org. Last accessed on 20th January 2020.
14. https://en.wikipedia.org/wiki/LGBT_themes_in_Hindu_mythology. Last accessed on 6th March 2020.
15. https://en.wikipedia.org/wiki/Section_377_of_the_Indian_Penal_Code. Last accessed on 2nd

March 2020.

16. https://www.livemint.com/Leisure/o5TVfO7DY1vrs75aY94BTP/Life-after-Section-377.html. Last accessed on 5th March 2020.
17. http://www.hindu.com/2009/07/03stories/2009070358010100.htm. Last accessed on 28th January 2020.
18. http://nazindia.org/. Last accessed on 28th February 2020.
19. https://www.apa.org/monitor/2019/02/homosexuality-india. Last accessed on 27th January 2020.

Nisha Tamang

Nisha Tamang has been working as an Assistant Professor in the department of Political Science at Jogamaya Devi College for five years. She has completed her post graduation in Political Science with specialisation in Indian state and society from North Bengal University. Her areas of interest include Gender Politics, Sustainable Development, Environmental Protection, Ethnic Conflict, Political Behaviour, Political Participation and Policies as well.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 75-80

Hwær Sindon Seledreamas?: The Joyless Mead-hall of Late Anglo-Saxon Literature and the Politics of Absence and Disruption

Piali Mondal
Department of English, Jogamaya Devi College
iluvmizukamishin@gmail.com

Abstract: The mead-hall or winsele, usually portrayed as a place of cheer in Early Germanic Literature, seldom appears in such joyful forms in late Anglo-Saxon literature, and, when it does, is often interrupted by grim tidings, such as Heorot being laid to waste by a monstrous interloper like Grendel in *Beowulf* Even if we take the sceptic's view that Anglo-Saxon literature, owing to an early influx of Christian ideas, has acquired a Christian prudence that is at odds with celebratory inebriation, the extant texts give us reason to believe that the case is not so simple. *Guðlac* clearly speaks of a hero's welcome at a mead-hall in heaven, which infers that the heroic ideal in Anglo-Saxon poetry has not yet done away with a hero's place in the mead-hall. Even if *Guðlac*'s validity as a Christian text is brought into question, Bede himself compares human life to a sparrow flying through the king's mead-hall, where he sits with his retainers. In this paper, we hope to examine this probable cultural shift in light of literary evidence; we shall discuss why, and in what manner, the once joyful hall is becoming a place of sorrow and sin, and why the *seledreamas*, or revelry, is silenced.

Keywords: Heroic ideal, Anglo-Saxon literature, poetry, Christian text, cultural shift, literary evidence

The Early Germanic literature is not scant in the way of mead-hall stories; Thor's mead-hall exploits provide comic relief in many Norse sagas, and the Icelandic sagas are not lacking in their share of mead-hall revelry, the Scandinavian afterlife providing a heroic welcome for the fallen warriors in Valhalla.

However, the mead-hall or *winsele* seldom appears in such joyful forms in later Anglo-Saxon literature, and, when it does, is often interrupted by grim tidings, such as Heorot being laid to waste by a monstrous interloper like Grendel in *Beowulf* (date of manuscript: late 10th Century AD to early 11th Century AD). The Old English part of the title is a quote from the elegy *The Wanderer* (date of manuscript: late 10th Century AD), where the narrator bemoans the absence of revelry, or *seledreamas* (lit. hall-cheer). Even if we take the sceptic's view that Anglo-Saxon literature, owing to an early influx of Christian ideas, has acquired a Christian prudence that is at odds with even celebratory inebriation, the body of literature, itself, gives us reason to believe that the case is not so simple- *Guðlac* (date of manuscript: late 10th Century AD) clearly speaks of a hero's welcome at a mead-hall in heaven, which suggests that the heroic ideal in Anglo-Saxon poetry has not yet done away with a hero's place in the mead-hall. Even if *Guðlac*'s validity as a Christian text is brought into question, Bede himself, in his *Historia Ecclesiastica gentis Anglorum* (Ecclesiastical History of the English Nation, 731 AD approx.), compares human life to a sparrow flying through the king's mead-hall where he sits with his retainers. In this paper, we are to discuss why and in what manner the once joyful hall is becoming a place of sorrow and sin, and why the *seledreamas*, or revelry, is silenced. In doing this, we would do well to veer way off the path of the tropes in Norman literature, where hall-scenes of heroic romances, while heavily informed by the Germanic imagery, acquire

cultural connotations not entirely Germanic, with the possible late exception of *Sir Gawain and the Green Knight* (late 14th Century AD).

Before we start expounding on the possible causes for the destruction and disruption of the mead-hall ideal as the Anglo-Saxons perceived it, we have to identify exactly what is being destroyed. It is, first and foremost, a place for enjoyment, but it is also a place for shelter- "wherein you sit at supper in winter, with your commanders and retainers, while the fire blazes in the midst, and the hall is warmed, but the wintry storms of rain or snow are razing abroad." (Bede). Bede's imagery is used to highlight both the brevity and preciousness of life, which is granted but once, life being the brief shelter for the soul, as the hall shelters the king, his commanders, and the retainers. In *Beowulf*, both before the attack of Grendel and after Beowulf's conquest of him and his mother, Heorot is shown as a place where both material (gold) and immaterial (fame) wealth can be earned- 'He béot ne áléh, béagas daėlde/Sync æt symle" [He did not boast in vain, and distributed rings, treasure at his feast]. The mead-hall has a deeper significance yet for the sailor in *The Wanderer*-

"Gemon hē selesecgas ond sincþege
hu hine on geoguðe his goldwine
wenede to wiste…
… ond on cnēo lecge
honda ond hēafod swā hē hwīlum ær
In geārdagum giefstōlas brēac"

[He remembers Hall-warriors and [the] treasure-giver, how his gold-giver endeavoured to entertain him in his youth….And on [his lord's] knee lays hand and head, as he before, in days of yore, enjoyed the gift-throne].

The loss experienced here, is more personal than the destruction of Heorot. The sailor has not only lost his occupation and the source of his mortal and immortal wealth, but he has also lost his lord and his companions. The breaking down of the *comitatus* bond between the erstwhile vassal and the new lord is pretty clear here, but the sailor's elegy also contains a feeling of familial loss and a disintegration of communal values. His departure from the mead-hall, then, makes his grief as great as it would be when separating from a loved one, and the memories, ghost-like, appear before his eyes to haunt him, a memory of a joyous time that will never return.

"… Sorg bið geniwað
Þonne māga gemynd mōd geondhweorfeð
grēteð glīwstafum georne geondscēawað
secga geseldan. Swimmað eft on weg.
Flēotendra ferð nō þær fela bringeð
cūðra cwidegiedda…"

[Sorrow is renewed, when the memory of kin is brought to mind. He greets them with joy, eagerly looking over his companions. They always swim away. The spirit of seabirds never brings there much in known speech.]

The disappearance of joy in the mead-hall, then, can also be associated with the loss of varying

values both familial and heroic. And the mead-hall ideal, when at the risk of being lost or disturbed, must take into account the causes for the disruption or failure of such values.

Before we start discussing the disappearance or disruption of the mead-hall ideal, we have to consider a few things. Firstly, we are basing the identification of causes on very few texts, as much of the Old English corpus does not survive. Secondly, and this is related to the first concern, the selection of said texts was not objective. The texts were selected and recorded by book-learned men, who were mostly from the clergy- King Ælfred was one of a kind in his ambition, and the hand of non-royal commanders and retainers is even less to be seen in the process of selection and editing of Anglo-Saxon texts. Therefore, the mead-hall debacle cannot be represented in the entirety of its facets which must have been present in the literature of that time.

An apparent cause is the growing religious and public intolerance for inebriation. The contempt is not necessarily for the mead-hall itself, but the overindulgence in wine. One of the *Exeter* (manuscript dated late 10th Century AD) riddles, to which the answer is "wine", says, "Hrægl is min hasofag, hyrste beorhte/reade scire on reafe/ic dysge dwelle, dole hwette/unrædsiþas"(Chiefly Christian Riddles 18, Baum 1963) [My garment is dark, with bright decoration red and shining on my dress, I mislead fools, and encourage the unwise towards stupidity.] Drinking itself is not discouraged, and a clear picture of the survival of the mead-hall can be seen in the sword/cross riddle- "ic seah in heall þær hæleð druncon/ on flet beran feower cynna" (Chiefly Cristian Riddles 13, Baum 1963) [I saw in the hall where heroes drank, a thing of four kinds being carried to the floor].

This intimates that the heroes' drinking in the hall has not quite gone out of fashion as of yet, but the scarcity of drunken exploits seen in a positive light in later Anglo-Saxon literature is very telling of the millennial attitude. The merry monks of Coldingham who had partied themselves to a death by fire (The Saint's Bridge Blog 2013) are a thing of the past; the Benedictine reforms are here to stay. This brings us to the next probable cause- the souring of relations between the church and a certain number of the nobility.

In late 10th Century AD, upon the death of Edgar, who was deeply sympathetic with the causes of Bishop Dunstan (the chief-most voice for Benedictine reforms in England), his son Edward is murdered as well, and, in his place, Æthelred, the favourite contender of the Wessex anti-Dunstan nobility is made king. This causes much conflict of interests between the Benedictine reformers and the ruling aristocracy. The revelry of nobility begins to be considered as immoral and even pagan to an extent, and especially so by the clergy. Such sentiments are best illustrated with quotations from a presumably late 10th-century poem, *Juliana.* In one of the instances, there, the Devil finds the revelry of the mead-hall a perfect opportunity to grab a man's soul: "þæt he in win-sele/þurh sweord-gripe sawle forletan/ of flæschoman" [that he in the mead-hall, through swordfight, releases his soul from his body]. The mead-hall is, then, no longer a joyous place, but the prowling ground of the Devil, who can snatch away souls at will. Later, Juliana's saintly death is succeeded by the dark and cold death of her pagan suitor and his friends, and this death is contrasted with their time spent in the mead-hall to highlight the futility of the latter:

"Ne þorftan þa þegnas in þam þyrstan ham,

Seo geneat-scolu in þam neolan scræfe
to þam frumgare feoh-gestealda
witedra wenan, þæt he in win-sele
Ofer beor-setle beagas þegon"

[In that dark home, in that dark place, the retainers did not need to look to their treasure-giver for reward, to expect gifts that he, in the mead-hall, across the beer-bench, may have given as rings.]

The life in the mead-hall, in comparison to the Christian sobriety and prudence of Juliana, is not only seen as barbaric, but as un-Christian. The description of the mead-hall in *Juliana*, one should keep in mind, does not resemble the Roman orgies (as it would be fitting for the time of the original story), but bases itself on the gift-giving revelry of the Anglo-Saxon mead-hall tradition, and very possibly implies a close connection to the contemporaneous political turmoil between the Church and the State, tacitly questioning the validity of the anti-Benedictines' access to power. As Hugh Magennis puts it in reference to this poem, "…the ungodliness of this life is suggested: the warriors are seekers of hell." (Magennis, 1996). Juliana's triumph over the pagans, when seen side-by-side with Judith's triumph over Holofernes, intimates a paradigm of new heroism, one that not only thinks mead-hall revelry to be unnecessary, but as something that leads to violence and hellish condemnation. This is around the time when violence in its negative connotations begins to register in the Germanic consciousness, and creates a new binary of violent and non-violent deeds, as opposed to the previous binary of heroic and non-heroic.

The mead-hall also gets disturbed by the frequent internal and external political struggles occurring in England. The Benedictine struggle does enough to divide the land into warring factions, and various tribes begin to see this instability as a golden opportunity to attack England, the Northmen being the fiercest amongst them, but the Picts and the Scots also want their due. The combined effect of these causes is a loss of old values, and the *comitatus* bond, as Wulfstan says in *Sermo Lupi Ad Anglos* (1014 AD approx.):

"Ful micel hlāfordswice eac bið on worolde þæt man his hlāford of līfe forrǣde, oððon of lande lifiende drīfe, and ægþer is geworden on þysan earde; Eadweard man forrǣde and syððan ācwealde and æfter þām forbærnde;"

[And the greatest betrayal to a lord is when one would deprive his lord of life, or drive him out of his land; and both have happened in this land; Edward was betrayed, and afterwards killed and then burned].

In this, the Vikings and the Dane-law also play a hand, as those servants who cross over to the Viking lands and gain freedom may kill their erstwhile lords without fear of monetary retribution, while, if the lord kills his former servant, he has to pay the full gild, as it would be ordained for someone of his status, to the kin of the slain man. In relation to this, the description of Grendel in *Beowulf* as *caines cynne* or Cain's kind is very significant; he may not be only a physical manifestation, but also a moral disruption. Being the successor of the first kin-slayer, Grendel wreaks havoc in a world where kin-slaying is the most shameful and un-heroic deed, along with the

betrayal of one's lord - possibly reminding them of the inner disintegration of values; that Unferth, guilty of the same crime as Cain's, remains in the hall of Heorot and within the rank of Hrothgar's vassals. Grendel's attack on Heorot, then, may point to a disintegration that has already begun; an unravelling, so to speak, of the old heroic values, and in that the destruction and slaughter done by Grendel may well be a metaphor for this unravelling. This point gains more currency if we consider that well after Beowulf's leaving, the kin-slaying continues, Wealhþēow's sons being slaughtered by their kinsman - this implies that the joy Beowulf had brought to Heorot was transitory and illusive.

Another, and final, issue that we should deal with in this context is the prediction of the apocalypse, which Wulfstan very nicely makes into a foreground for *Sermo Lupi Ad Anglos*, detailing the disintegration of the moral, ethical, and physical in the land as premonitions of the impending Apocalypse. In fact, he may not be the only one to connect the loss of the heroic value and the mead-hall ideal to the impending doom. The sailor in *The Wanderer* uses the instrument of fate- "onwendeð wyrda gesceaft weoruld under heofonum" [fate's decree turns this world under heaven]- and connects it to the physical destruction of the land- "eal þis eorþan gesteal idel weorþeð" [All this foundation of the earth becomes wasted]. A further connection, between the two, is made in relation to the values the sailor has abided by, and feels bereaved without: "Hwǣr cwōm maþþumgyfa?/ Hwǣr cwōm symbla gesetu? Hwǣr sindon seledrēamas?/Ēalā beohrt bune! Ēalā byrnwiga!/ Ēalā þēodnesþrym!" [Where is the giver of treasures? Where are the seats for the feast? Where is the revelry (lit.hall-cheer)? Alas bright cup! Alas mailed warrior! Alas the glory of the lord!]. Thus the sailor ties a very personal and moral apocalypse to a seemingly physical one, and the loss of heroic values may appear to him as the warning for the end that is to come; if we are in any doubt about his reference to the Apocalypse, we may refer to a few lines: 'Ȳþde swā þisne eardgeard ælda Scyppend" [The Creator of men destroys this city.] and "norþan onsendeð/hrēo hræglfare hæleþum on andan" [From North comes a mighty hailstorm, malicious to men]. If we take the latter to be a metaphor, it may easily be claimed that the poet is aware of both the impending doom and the Northmen's fury, and is very aware of what they mean for the ideal of the mead-hall.

Therefore, the mead-hall, for the most part in later Anglo-Saxon literature, is but a fragment of what it once used to be; fraught with the frowns of Church-fathers, the shifting political scene, and predictions of apocalypse, it survives more as a memory than any distinct place in time.

REFERENCES

1. Baum, P.F., 1963. Anglo-Saxon Riddles of the Exeter Book. Duke University Press. Wikisource.org. URL:https://en.wikisource.org/wiki/Anglo-Saxon_Riddles_of_the_Exeter_Book. Last visited on 11th January 2020.
2. Bede. Ecclesiastical History of the English Nation. Pyle, Alexander, (ed). Internet Medieval Sourcebook. Fordham University. URL:https://sourcebooks.fordham.edu/basis/bede-book2.asp. Last visited on 9th December 2019.

3. Celts to the Creche: Abbess Æbbe of Coldingham. The Saint's Bridge Blog. URL:https.//www.saintsbridge.wordpress.com/2013/12/16/celts-to-the-creche-aebbes-aebbe-of-coldingham. Last visited on 12th November 2015.
4. Gollancz, I., 1896. The Exeter Book: An Anthology of Anglo-Saxon Poetry. Early English Text Society, London. The Internet Archive.
   URL:https://ia800500.us.archive.org/10/items/exeterbookanthol00goll/exeterbookanthol00goll.pdf. Last visited on 15th January 2020.
5. Magennis, H., 1996. Images of Community in Old English Poetry. Cambridge Studies in Anglo-Saxon England, 18. Cambridge University Press, Cambridge.
6. Slade, Benjamin, trans. and ed. Beowulf. Heorot.dk. URL:www.heorot.dk/beowulf-rede-text.html. Last visited on 22nd January 2020.
7. The Wanderer. Old English Aerobics. URL:http://www.oldenglishaerobics.net/wanderer.php. Last visited on 8th February 2020.
8. Wulfstan's Sermo Lupi Ad Anglos. Old English Aerobics.
   URL:http://www.oldenglishaerobics.net/sermo.php. Last visited on 13th January 2020.

Piali Mondal
Piali Mondal is an Assistant Professor in the Department of English at Jogamaya Devi College. She is currently pursuing her Ph.D on "Violence as Dialogue in Early Germanic Literature" in Department of English, Jadavpur University. Her areas of interest include Medieval European Literature, Queer Studies, Graphic Novels (Manga and Manhwa, in particular), and Food History.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 81-88

সমাজদর্পণে নারী

রজত কুমার নস্কর
সহকারী অধ্যাপক, সংস্কৃত বিভাগ, যোগমায়া দেবী কলেজ, কোলকাতা।
rajatkumarnaskar@gmail.com

প্রবন্ধসার (Abstract): বৈদিকসমাজ স্বচ্ছতা, সাম্য, সততা ও সারল্যের প্রতীক। সংহিতা, ব্রাহ্মণ, আরণ্যক ও উপনিষদে যে সমাজচিত্রের উল্লেখ পাই, তা এক উন্নত যুগেরই প্রতিচ্ছবি। ঋগ্বৈদিকযুগে পুরুষের ন্যায় নারীরাও স্বাধীনভাবে বেদপাঠ ও বেদচর্চা করতেন। অম্ভৃণীবাক্, লোপামুদ্রা, পৌলমী, রোমশা, ঘোষা, কাক্ষীবতী, অপালা প্রভৃতি মন্ত্রদ্রষ্ট্রী ও বেদজ্ঞ নারীর নাম উল্লেখযোগ্য। বৈদিক ক্রিয়াকর্ম ছিল যাগনির্ভর। অপত্নীক ব্যক্তির যজ্ঞে কোন অধিকার ছিল না। কারণ, প্রত্যেক প্রধানযাগে 'পত্নীসংযাজ' নামে এক যাগ অবশ্যকর্তব্য ছিল। এই যাগে যজমানপত্নীর অংশগ্রহণ আবশ্যিক ছিল। পুরুষের সম্পূর্ণতা বিবাহের দ্বারা, পত্নীলাভের মাধ্যমেই। মেয়েরা প্রাপ্তবয়স্ক হয়ে তবেই বিবাহে অগ্রসর হত ও পতিনির্বাচনে তাদের স্বাধীনতা ছিল। অর্থাৎ, বাল্যবিবাহ ছিল না। পাত্রপক্ষ কন্যাপণ দিয়ে বিবাহ করত। অবিবাহিতা কন্যার পিতৃসম্পত্তিতে সমানাধিকার ছিল। সতীদাহ বা সহমরণ সেযুগে ছিল না। পাণিনি তাঁর অষ্টাধ্যায়ীতে 'আচার্যা' ও 'উপাধ্যায়া' শব্দদ্বয়ের উল্লেখ করেছেন। অর্থাৎ, নারীরাও অধ্যাপনা করতেন। আবার, মিথিলারাজ জনকের রাজসভায় যাজ্ঞবল্ক্য ও গার্গীর মধ্যে শাস্ত্রবিষয়ক তর্কযুদ্ধের উল্লেখ পাওয়া যায়। এছাড়া, গান্ধর্ববিদ্যা ও যুদ্ধবিদ্যাতেও নারীজাতির দক্ষতার বর্ণনা আছে। বয়নশিল্প, সুগন্ধিদ্রব্যনির্মাণ প্রভৃতি কর্ম নারীদের জন্যই নির্দিষ্ট ছিল। তবে, বৈদিকযুগের শেষদিকে নারীদের ক্ষমতা ক্রমশঃ কমতে থাকে।

বৈদিক যাগকর্মবিধির জটিলতার কারণে তা থেকে নিষ্কৃতির উপায়স্বরূপ সমাজে ধর্মশাস্ত্রের তথা স্মৃতিশাস্ত্রের উদ্ভব হয়। মনুস্মৃতি সমাজের অনুশাসনরূপে পরিগণিত হয়। এই যুগে নারীক্ষমতা হ্রাস পেতে থাকে। যদিও, বেশ কিছু ক্ষেত্রে মনুর মুখে নারীর প্রশংসা পাওয়া যায়; তথাপি, অধিকাংশ ক্ষেত্রে তিনি নারী সম্পর্কে বিরূপ মনোভাব দেখিয়েছেন। নারীর স্বাধীনতা তিনি অস্বীকার করেছেন। বলেছেন, স্ত্রীজাতি হল সন্তানোৎপাদনের যন্ত্র। 'শৃগালযোনি' প্রভৃতি অপশব্দ তিনি নারীজাতির উদ্দেশেই ব্যবহার করেছেন।

কিন্তু, উনবিংশ শতাব্দীতে রাজা রামমোহন রায় ও ঈশ্বরচন্দ্র বিদ্যাসাগরের হাত ধরে ভারতে নবজাগরণের জোয়ার আসে। সতীদাহপ্রথা, বাল্যবিবাহ প্রভৃতি কুসংস্কারগুলি সমাজ থেকে দূরীভূত হয় এবং মেয়েদের শিক্ষার প্রসারে অসংখ্য বিদ্যালয় স্থাপিত হয়। বিধবাবিবাহ আইন প্রণীত হয়। এছাড়া, রামমোহন রায়-প্রতিষ্ঠিত ব্রাহ্মসমাজ, জোড়াসাঁকোর ঠাকুরবাড়ি সেসময় নারীশিক্ষার বিস্তারে উল্লেখযোগ্য ভূমিকা পালন করেছিল। বিংশ ও একবিংশ শতাব্দীতে নারীর অধিকার তথা স্বাধীনতা প্রতিষ্ঠার লক্ষ্যে ভারত সরকার একাধিক পদক্ষেপ গ্রহণ করে। এতৎসত্ত্বেও, ভারতের প্রত্যন্ত অঞ্চলগুলিতে, এমনকি, কখনও শহরাঞ্চলেও এখনও নারীনির্যাতনের হার যথেষ্টই।

বীজশব্দঃ বৈদিকযুগ, অধ্যগ্নি, স্ত্রীধন, অধ্যাবাহনিক, নারীস্বাধীনতা, অম্বাধেয়

১। ভূমিকা

ভারতবর্ষের তথা বিশ্বের অন্যতম প্রাচীন সাহিত্য হল বেদ তথা ঋগ্বেদ। যে সময় বিশ্বের অধিকাংশ স্থানে সভ্যতার আলো ফোটেনি, যে সময় মানুষ ঐক্যবদ্ধ হতে শিখলেও যাযাবরের ন্যায় জীবন অতিবাহিত করছে, ভারতবর্ষে তখন ঋগ্বেদ সাহিত্যের আকারে আত্মপ্রকাশ করে ফেলেছে। অর্থাৎ, সিংহভাগ বিশ্ব সমাজবদ্ধ হওয়ার পূর্বেই বেদের আবির্ভাব। তাই, ভারতবর্ষই প্রাচীন সভ্যতা-সংস্কৃতি-সমাজব্যবস্থার দৃষ্টান্ত, একথা আমরা নিঃসন্দেহে বলতে পারি, ঋগ্বেদকে মাথায় রেখে।

প্রাচীন ভারতবর্ষে বেদ ছিল ভারতমানসের আইন তথা সংবিধান। যদি সর্বপ্রাচীন ভারতকে জানতে হয়, যদি তৎকালীন মানবসভ্যতা, সমাজকাঠামো, সামাজিক রীতিনীতি তথা সার্বিক চিত্র সম্পর্কে অবগত হতে হয়, তবে, বেদ হল একমাত্র সহায়। অপৌরুষেয় বেদের ঋষিরা ক্রান্তদর্শী। তাঁদের অতীন্দ্রিয়তার বাঙ্ময় উপলব্ধি হল বেদ। বেদের কোন রচয়িতা নেই – 'ন কশ্চিদ্ বেদকর্তাস্তি (বন্দ্যোপাধ্যায় ২০০১)। বেদ হল সৃষ্টির পূর্ব থেকেই বিরাজমান এক বিশাল অখণ্ড জ্ঞানরাশি। প্রলয়ান্তে নতুন সৃষ্টির পর ক্রান্তদর্শী ঋষিগণ দিব্যদৃষ্টি দ্বারা সেই পরমজ্ঞানকে উপলব্ধি করেছেন মাত্র। তাঁদের উপলব্ধ সেই আতীন্দ্রিয় জ্ঞানভাণ্ডার তাঁরা যোগ্য অনুগামীদের নিকট ব্যক্ত করেছেন, তাঁদের মধ্যে সঞ্চারিত করেছেন। আবহমান কাল ধরে শ্রুতি আকারে তা ঋষিদের চর্চিত বিষয় ছিল। কালক্রমে তা লিখনের মাধ্যমে প্রকাশ পায়। কালের ব্যবধানে তার সঙ্গে আনুষঙ্গিক

আরও অনেক বিষয় যুক্ত হয়। এই প্রকাণ্ড কর্মরাশি বহুযুগ ধরে চলতে থাকলেও খ্রীষ্টপূর্বকালের অনেক আগেই তা সম্পূর্ণতা লাভ করে।

বেদে যাজ্ঞিক ক্রিয়াকর্মের পাশাপাশি চলেছে আধ্যাত্মিক সাধনাও। আবার, মানুষের ব্যবহারিক দৈনন্দিন জীবনযাত্রার চিত্রও পাই। এই সার্বিক বৈদিকসভ্যতায় মানুষের জীবনযাত্রা ছিল অনেক উচ্চমানের। বৈদিকযুগের অবসানের পর ধর্মশাস্ত্রযুগের আবির্ভাব হয়, যেখানে মানবজীবন নির্ধারিত হত নির্দিষ্ট মাপদণ্ডের দ্বারা। যাগযজ্ঞের জটিলতা অতিক্রম করে মানবসমাজ অবগাহন করল কর্তব্য ও নিয়মানুবর্তিতার দুস্তর সমুদ্রে। ধীরে ধীরে উদ্ভব হল জাতি-ধর্ম-বর্ণের তথা ভেদব্যবস্থার। সমাজপতিদের করালদংষ্ট্রা-মেঘে আচ্ছাদিত হল স্নিগ্ধ সমাজসূর্য। এভাবেই দীর্ঘকাল চলতে থাকার পর অবশেষে কালো মেঘের পতনে নতুন সূর্যের স্বচ্ছ আভা সমাজের দিগন্ত পর্যন্ত বিস্তৃত হল। বিশিষ্ট মনীষীদের কঠোর প্রতিরোধে মানবজীবন থেকে কুসংস্কারগুলি দূরীভূত হতে থাকল। কিন্তু, সম্পূর্ণ কলুষমুক্ত মনুষ্যসমাজ বোধ হয় অকল্পনীয়ই। প্রতিবন্ধকতা প্রশমনের প্রচেষ্টা তাই প্রতিনিয়তই মানুষকে করে যেতে হয়।

২। বৈদিক সভ্যতায় নারী

মন্ত্রদ্রষ্টা বৈদিক ঋষিদের অধিকাংশই পুরুষ। তবে, বেদের পুরুষ-ঋষিদের পাশাপাশি নারী-ঋষিদেরও নাম পাওয়া যায়। সে যুগে নারীরাও পুরুষদের সমান ক্ষমতা ভোগ করতেন। মধ্যপন্থা অবলম্বন করে বেদের সময়কাল ২০০০-১৫০০ খ্রীষ্টপূর্বাব্দ ধরলে এবং সংহিতা, ব্রাহ্মণ, আরণ্যক ও উপনিষদ্ – এই চার ভাগ পর্যালোচনা করলে বলা যায়, দু-একটি বিক্ষিপ্ত বিবরণ ছাড়া সমগ্র বৈদিকযুগে নারীক্ষমতা উৎকর্ষতার চরম শিখরে পৌঁছেছিল। বেদচর্চার জন্য পুরুষের ন্যায় নারীরও উপনয়ন সংস্কার হত এবং নারীরও বেদচর্চায় অধিকার ছিল। স্মৃতিকার যম বলেছেন –

"পুরাকল্পে কুমারীণাং মৌঞ্জীবন্ধনমিষ্যতে।
অধ্যাপনঞ্চ বেদানাং সাবিত্রীবচনং তথা।।"

পৃথিবীর অন্য কোন প্রাচীন গ্রন্থে নারীগ্রন্থকারের নাম পাওয়া না গেলেও ঋগ্বেদে সাতাশ জন নারী মন্ত্রদ্রষ্ট্রী ঋষির নাম পাওয়া যায়। তাঁদের মধ্যে অম্ভৃণীবাক্, লোপামুদ্রা, পৌলমী, বিশ্ববারা, কাক্ষীবতী, রোমশা, ঘোষা, শ্রদ্ধা, কামায়ণী, অপালা প্রভৃতি উল্লেখযোগ্য। তাঁরা ঋষি, কারণ, তাঁরা মন্ত্রসমূহের দর্শন করেছেন; তাঁরা ব্রহ্মবাদিনী, কারণ, তাঁদের দৃষ্ট মন্ত্ররাজিতে জগদুৎপত্তি ও বিনাশ বর্ণিত হয়েছে। তাঁরা তত্ত্বদ্রষ্ট্রী ও দিব্যভাবসম্পন্না বিদুষী নারী-ঋষি। যদিও, 'ঋষি' একটি পারিভাষিক শব্দ, অনেক মনুষ্যেতর প্রাণীও ঋষিরূপে পরিচিতি পেয়েছে।

বৈদিক যুগে মেয়েদের ধর্মাচরণ থেকে শুরু করে যৌনজীবন চর্চায় যে ধরনের স্বাধীনতা লক্ষ্য করা যায়, বেদোত্তর যুগে তা ক্রমশঃ দুর্লভ হয়ে ওঠে। পুরুষ যতদিন না বিবাহের মাধ্যমে পত্নীলাভ করে, ততদিন সে সম্পূর্ণ নয় – 'তাবৎ স অর্ধো ভবতি যাবদ্ জায়া ন বিন্দতি' (বন্দ্যোপাধ্যায় ২০০১)। অপত্নীক ব্যক্তির যজ্ঞে কোন অধিকার ছিল না – 'অযজ্ঞিয়ো বা এষ যোঽপত্নীকঃ' (বন্দ্যোপাধ্যায় ২০০১)। কারণ, প্রত্যেক প্রধান যাগে 'পত্নীসংযাজ' নামে এক যাগ অবশ্যকর্তব্য ছিল। এতে যজমানপত্নীর অংশগ্রহণ অপরিহার্য্য ছিল এবং তাঁকেও কিছু মন্ত্রপাঠ করতে হত এবং তবেই যজ্ঞ সম্পূর্ণ হত। ঋগ্বেদের কয়েকটি মন্ত্র তার প্রমাণ (বন্দ্যোপাধ্যায় ২০০১)। অর্থাৎ, যজ্ঞকর্মে নারী ও পুরুষের সমানাধিকার ছিল। শতপথব্রাহ্মণে পত্নীকে যজ্ঞের একটি অংশ বলা হয়েছে – 'অর্ধো হবা এষ যজ্ঞস্য যৎ পত্নী' (বন্দ্যোপাধ্যায় ২০০১)। অপত্নীকের হাত থেকে দেবতারা কোন উপহার নিতেন না – 'ন বৈ অপত্নীকস্য হস্তাৎ দেবা বলিং গৃহ্ণন্তি' (বন্দ্যোপাধ্যায় ২০০১)। বাল্যবিবাহ ছিল না, কন্যা প্রাপ্তবয়স্ক হয়ে বিবাহে অগ্রসর হত। সেযুগে কন্যারা পতিনির্বাচন করতে পারত। বিবাহের সময় পাত্রপক্ষ রীতিমত কন্যাপণ দিয়ে পত্নীবরণ করত (বন্দ্যোপাধ্যায় ২০০৩)। আবার, অবিবাহিত কন্যা পিতার গৃহেই অবস্থান করত এবং পিতৃসম্পত্তির সমান উত্তরাধিকারী হত (বন্দ্যোপাধ্যায় ২০০১)। বেদে সতীদাহ বা সহমরণের কোন উল্লেখ পাওয়া যায় (বন্দ্যোপাধ্যায় ২০০১)। বিধবা নারীর সমাজে অবস্থান স্বাভাবিক ছিল।

পাণিনির গ্রন্থে 'আচার্য্যা' ও 'উপাধ্যায়া' শব্দের ব্যবহার থেকে প্রতীত হয় যে, নারীরা বেদ অধ্যাপনা করতেন। অধ্যাপিকাদের মধ্যে আপিশালা, ঔদমেধার নাম পাওয়া যায়। এছাড়া, সুলভা, বড়বা, প্রাথিতেয়ী প্রভৃতি বিদুষী নারীর নামও উল্লিখিত আছে। আবার, জ্ঞানঋদ্ধা বিদুষী গার্গীর নাম আছে, যিনি মিথিলারাজ জনকের রাজসভায় জ্ঞানীব্যক্তিদের সমাবেশে ব্রহ্মজ্ঞানী যাজ্ঞবল্ক্যের সঙ্গে তর্কযুদ্ধে অবতীর্ণ হয়েছিলেন (বন্দ্যোপাধ্যায় ২০০১)। সেখানে যাজ্ঞবল্ক্যের নিকট বিশিষ্ট বিদ্বানগণ তর্কযুদ্ধে পরাস্ত হলেও গার্গী অপরাজিতই থাকেন। বৃহদারণ্যকোপনিষদে যাজ্ঞবল্ক্যের পত্নী মৈত্রেয়ী ব্রহ্মবিদ্যার অনুশীলনের কাছে সংসারজীবনকে তুচ্ছজ্ঞান করেছেন।

বিদ্যাচর্চার তথা শাস্ত্রচর্চার পাশাপাশি গান্ধর্ববিদ্যা ও যুদ্ধবিদ্যাতেও নারীজাতির দক্ষতার উল্লেখ আছে। নৃত্য, কণ্ঠসংগীত, যন্ত্রসংগীত মুখ্যতঃ স্ত্রীকর্ম হিসাবেই বিবেচিত হত। তাই বলা হয়েছে – 'নৃত্যং গীতং স্ত্রীণাং কর্ম'। শতপথব্রাহ্মণে বলা হয়েছে, যজ্ঞের সময় যজমানপত্নী বীণা বাজিয়ে গান করতেন (বন্দ্যোপাধ্যায় ২০০১)। নারীদের যুদ্ধ করার বর্ণনাও পাওয়া যায়। বিশ্পলা, শশীয়সী, মুদ্গলিনী, বধ্রিমতী প্রমুখ বীরাঙ্গনার নাম এক্ষেত্রে উল্লেখযোগ্য। ঋগ্বেদে বলা আছে, রাজা খেলের স্ত্রী বিশ্পলা যুদ্ধের সময় একটি পা হারান এবং সেজন্য তাঁর লোহার কৃত্রিম পা প্রতিস্থাপন হয় (বন্দ্যোপাধ্যায় ২০০১)। মুদ্গলিনী শত্রুপক্ষের সঙ্গে রথে চড়ে যুদ্ধ করেছিলেন – এরূপ জানা যায়। আবার, বয়নকর্ম, বস্ত্রালংকরণ, তুলো থেকে সুতো তৈরী, সুগন্ধিদ্রব্যনির্মাণ ইত্যাদি কর্মও স্ত্রীলোকেরই নির্দিষ্ট ছিল – 'তদ্ বা এতৎ স্ত্রীণাং কর্ম যৎ ঊর্ণা সূত্রং কর্ম' (বন্দ্যোপাধ্যায় ২০০১)। শুক্লযজুর্বেদের ৩০তম অধ্যায় থেকে জানা যায়, তৎকালীন ভারতে প্রায় ৭০ প্রকার বৃত্তি প্রচলিত ছিল, যার মধ্যে ৮ প্রকার বিদ্যা কেবল নারীদের জন্যই নির্দিষ্ট ছিল (বন্দ্যোপাধ্যায় ২০০১)।

কিন্তু, বৈদিকযুগের প্রথমদিকে নারীরা পুরুষদের সমান ক্ষমতা ভোগ করলেও শেষদিকে নারীদের ক্ষমতা কমতে শুরু করে। মূলতঃ, ঋগ্বেদের শেষদিক থেকে সমাজ ক্রমশঃ পুরুষতান্ত্রিক হয়ে পড়ায় এবং যাগযজ্ঞের জটিলতার কারণে তার স্থানে বিভিন্ন আচার-অনুশাসন সামাজিকতার অঙ্গ হয়ে পড়ায় এবং অনার্যসংস্কৃতির সংমিশ্রণের কারণে স্ত্রীস্বাধীনতা ও স্ত্রীজাতির মর্যাদা ক্রমশঃ লঘু হতে থাকে। ঋগ্বেদেই বলা হয়েছে, স্ত্রীলোকের প্রণয় স্থায়ী হয় না, স্ত্রীলোকের হৃদয় বৃকের হৃদয়ের ন্যায় –

"ন বৈ স্ত্রৈণানি সখ্যানি সন্তি
সালাবৃকাণাং হৃদয়াণ্যেতা।" (বন্দ্যোপাধ্যায় ২০০৩)

আবার বলা হয়েছে, স্ত্রীলোকের বুদ্ধি নিম্নমানের (বন্দ্যোপাধ্যায় ২০০৩)। মৈত্রায়ণীসংহিতায় নারীকে মিথ্যাচারিণী, দুর্ভাগ্যস্বরূপিণী বলা হয়েছে (বন্দ্যোপাধ্যায় ২০০৩)। শতপথব্রাহ্মণে নারী, শূদ্র ও কুকুরকে একই শ্রেণীর বলা হয়েছে (বন্দ্যোপাধ্যায় ২০০৩)।

৩। মনুসংহিতায় নারী

বৈদিক যুগের শেষদিকে যখন অগ্নিহোত্রাদি কর্মকাণ্ড ক্রমশঃ অবলুপ্তির পথে, তখন, সামাজিক ভারসাম্য বজায় রাখার জন্য সূত্রসাহিত্যের আবির্ভাব ঘটল। সূত্রসাহিত্য কথার অর্থ হল, সূত্রাকারে রচিত গ্রন্থসমূহ। তারই একটি গুরুত্বপূর্ণ শাখা হল ধর্মসূত্র। পরবর্তীকালে এই ধর্মসূত্রকে অবলম্বন করে ধর্মশাস্ত্রের উদ্ভব হয় ছন্দোবদ্ধ পদ্যের আকারে। ধর্মশাস্ত্রের পর্যায়শব্দ হল স্মৃতিশাস্ত্র। শ্রুতি কথার অর্থ যেমন বেদ, ধর্মশাস্ত্র বলতে তেমন স্মৃতিশাস্ত্রকেই বোঝায়। মনুস্মৃতিতে বলা হয়েছে – 'শ্রুতিস্তু বেদো বিজ্ঞেয়ো ধর্মশাস্ত্রং তু বৈ স্মৃতিঃ' (বন্দ্যোপাধ্যায় ২০১৬)। যে শাস্ত্রে বেদবিহিত ধর্মের স্মরণ আছে, তাকে স্মৃতিশাস্ত্র বলে – 'স্মর্যতে বেদধর্মোঽনেনেতি স্মৃতিঃ' (মুখোপাধ্যায় ২০০৪)।

মহর্ষি যাজ্ঞবল্ক্যের বর্ণনায় মোট যে কুড়িজন স্মৃতিকারের নাম পাওয়া যায়, তাঁদের মধ্যে মনুই প্রথম। মনু-নির্দিষ্ট *মনুসংহিতা* বা *মনুস্মৃতি*ই আবিষ্কৃত স্মৃতিগ্রন্থগুলির মধ্যে প্রাচীনতম। সামাজিক রীতিনীতি থেকে শুরু করে মনুষ্যের দৈনন্দিন কর্তব্যসমূহের নির্দেশ আছে এই গ্রন্থে। এককথায়, ভারতীয় সমাজব্যবস্থার নিয়ামক ও সমাজদর্পণ হল এই গ্রন্থ। *মনুস্মৃতি*র মাধ্যমেই বৈদিক সমাজ ক্রমশঃ ধর্মশাস্ত্র তথা স্মৃতিশাস্ত্রের সমাজে পরিণত হয়। গবেষকদের সিদ্ধান্ত অনুযায়ী, খ্রীষ্টপূর্ব দ্বিতীয় শতক থেকে খ্রীষ্টীয় দ্বিতীয় শতকের মধ্যবর্তী কোন এক সময়ে এটি রচিত হয়। বৈদিক সমাজের শেষলগ্নে নারীর যে অপক্ষমতায়ন শুরু হয়েছিল, মনুর বিধান ঠিক সেইখান থেকেই শুরু। তবে, কোথাও কোথাও নারীজাতি সম্পর্কে তিনি উচ্চধারণাও পোষণ করেছেন। তাঁর মতে, যে বংশে নারীজাতি পূজিত হন, দেবতারা সেই বংশের প্রতি সন্তুষ্ট হন; দেবতারা সন্তুষ্ট হলে কাঙ্ক্ষিত ফললাভ হয়। কিন্তু, যেখানে স্ত্রীজাতির অসম্মান হয়, সেখানে দেবতাদের উদ্দেশ্যে বিহিত যাগক্রিয়াদি নিষ্ফল হয়-

"যত্র নার্যস্তু পূজ্যন্তে রমন্তে তত্র দেবতাঃ।
যত্রৈতাস্তু ন পূজ্যন্তে সর্বাস্তত্রাফলাঃ ক্রিয়াঃ।।" (বন্দ্যোপাধ্যায় ২০১৬)

যে পরিবারের স্ত্রীজাতি শোকসন্তপ্ত থাকে, সেই পরিবারের ধ্বংস অনিবার্য। কিন্তু, যেখানে এর বিপরীত চিত্র দৃষ্ট হয়, সেখানে সুখসমৃদ্ধি বিরাজ করে –

"শোচন্তি জাময়ো তত্র বিনশ্যত্যাশু তৎকুলম্।
ন শোচন্তি তু যত্রৈতা বর্ধতে তদ্ধি সর্বদা।।" (বন্দ্যোপাধ্যায় ২০১৬)

অর্থাৎ, মনুর বক্তব্য হল, পরিবারের উন্নতি ও তার উত্তরোত্তর শ্রীবৃদ্ধি চাইলে, পরিবারের কন্যাসন্তান, পত্নী ও পুত্রবধূর প্রতি সম্মানপ্রদর্শন ও তুষ্টিবিধান অবশ্যকর্তব্য। সংসারপালনের ক্ষেত্রে মনু নারীকেই প্রধান সহায়রূপে দেখেছেন। সন্তান উৎপাদন ও তার প্রতিপালন, ধর্মীয় ক্রিয়ানুষ্ঠান, পতি ও পিতৃপুরুষের স্বর্গলাভ, অতিথি-সৎকার প্রভৃতি সাংসারিকতার সুষ্ঠু সাধনের জন্য তিনি স্ত্রীলোকের ভূমিকাকেই প্রধানরূপে দেখেছেন –

"উৎপাদনমপত্যস্য জাতস্য পরিপালনম্।
প্রত্যহং লোকযাত্রায়াঃ প্রত্যক্ষং স্ত্রীনিবন্ধনম্।।
অপত্যং ধর্মকার্যাণি শুশ্রূষা রতিরুত্তমা।
দারাধীনস্তথা স্বর্গঃ পিতৃণামাত্মনশ্চ হ।।" (বন্দ্যোপাধ্যায় ২০১৬)

তাই, স্ত্রীজাতিই হলেন গৃহের অলংকারস্বরূপা। যেহেতু, তাঁদের গর্ভজাত সন্তান তথা পুত্র দ্বারা বংশরক্ষা সম্ভব হয়, তাই, তাঁরা সকলের পূজনীয়া। সেজন্য গৃহের শ্রী ও স্ত্রীর মধ্যে কোন পার্থক্য নেই –

"প্রজনার্থং মহাভাগাঃ পূজার্হা গৃহদীপ্তয়ঃ।
স্ত্রিয়ঃ শ্রিয়শ্চ গেহেষু ন বিশেষোঽস্তি কশ্চন।" (বন্দ্যোপাধ্যায় ২০১৬)

তাই, পুরুষজাতির উচিত স্ত্রীজাতিকে রক্ষা করা, তাকে উপযুক্ত মর্যাদা দেওয়া। পিতার উচিত সৎপাত্রে সম্প্রদান না করতে পারা পর্যন্ত কন্যাকে রক্ষা করা; পতির উচিত স্ত্রীকে যথাযোগ্য সম্মান সহ নিরাপত্তা দেওয়া; আর, পুত্রের কর্তব্য হল, বার্ধক্য অবস্থায় তার বৃদ্ধ মাতাকে রক্ষা করা –

"পিতা রক্ষতি কৌমারে ভর্তা রক্ষতি যৌবনে।
রক্ষন্তি স্থবিরে পুত্রা ন স্ত্রী স্বাতন্ত্র্যমর্হতি।।" (বন্দ্যোপাধ্যায় ২০১৬)

কিন্তু, 'ন স্ত্রী স্বাতন্ত্র্যমর্হতি' – বাক্যাংশের দ্বারা স্পষ্ট প্রতীত হয় যে, মনু নারীর স্বাধীনতা দিতে চাননি। বিবাহ সম্পর্কে তাঁর অভিমত হল, পিতা কন্যাকে উপযুক্ত পাত্রের হাতেই সমর্পণ করবেন। যদি যোগ্য পাত্রের সন্ধান না পাওয়া যায়, তাহলে, কন্যা সারাজীবন পিতার গৃহেই অবস্থান করবে; কিন্তু, কোন মতেই তাকে অযোগ্য পাত্রে সমর্পণ করা যাবে না-

"উৎকৃষ্টায়াভিরূপায় বরায় সদৃশায় চ।
অপ্রাপ্তামপি তাং তস্মৈ কন্যাং দদ্যাদ্ যথাবিধি।
কামমামরণাত্তিষ্ঠেদ্ গৃহে কন্যর্তুমত্যপি।
ন চৈবৈনাং প্রযচ্ছেত্তু গুণহীনায় কর্হিচিৎ।।" (বন্দ্যোপাধ্যায় ২০১৬)

আবার, পিতার অসামর্থ্যে বা অনাগ্রহে কন্যা নিজেই পতিনির্বাচন করতে পারবে – মনুর এরূপ বিধানও আছে –

"ত্রীণি বর্ষাণ্যুদীক্ষেত কুমার্যৃতুমতী সতী।
ঊর্দ্ধন্তু কালাদেতস্মাদ্বিন্দেত সদৃশং পতিম্।।
অদীয়মানা ভর্তারমধিগচ্ছেদ্ যদি স্বয়ম্।
নৈনঃ কিঞ্চিদবাপ্নোতি ন চ যং সাধিগচ্ছতি।।
অলংকারং নাদদীত পিত্র্যং কন্যা স্বয়ংবরা।
মাতৃকং ভ্রাতৃদত্তং বা স্তেনঃ স্যাদ্ যদি তং হরেৎ।।" (বন্দ্যোপাধ্যায় ২০১৬)

বিবাহের বয়স-বিধান দিতে গিয়ে *মনুসংহিতায়* বলা হয়েছে, ত্রিশবৎসর বয়স্ক পুরুষের সঙ্গে দ্বাদশবর্ষীয়ার, চব্বিশ বৎসর বয়সী পুরুষের সঙ্গে অষ্টমবর্ষীয়ার বিবাহ সম্পন্ন হবে। যদিও, *মনুসংহিতার* টীকাকার কুল্লূকভট্টের মতে, এক্ষেত্রে মনুর উদ্দেশ্য হল, পত্নীর বয়স হবে পতির বয়সের তিনভাগের একভাগ। আবার, *মনুস্মৃতির* সর্বপ্রাচীন টীকাকার মেধাতিথির মতে, বিবাহ্যা কন্যার বয়স বিবাহ্য পুরুষের চেয়ে কম হবে – এটাই মনুর অভিপ্রায়। বিবাহকালে নবোঢ়াকে নানারকম ধনসম্পদ দান করা হত, এগুলিকে স্ত্রীধন বলে। *মনুস্মৃতিতে* ছয় প্রকার স্ত্রীধনের উল্লেখ পাওয়া যায়। তন্মধ্যে বিবাহের সময় সদ্যস্ত্রী যে স্ত্রীধন পায়, তাকে বলে অধ্যগ্নি। স্বামীগৃহে প্রবেশের পর প্রাপ্তধনকে বলে অধ্যাবাহনিক। বিবাহের পর পিতা ও পিতৃকুল, মাতা ও মাতৃকুল, স্বামী ও স্বামীর আত্মীয়স্বজনেরা যে ধন দান করেন, তার নাম অন্বাধেয়। স্বামীর জীবিতাবস্থায় যদি স্ত্রীর মৃত্যু হয়, তাহলে এই অন্বাধেয় ধনের অধিকার পায় তাঁর সন্তানেরা। স্ত্রীলোক যদি নিঃসন্তান অবস্থায় মারা যান, তাহলে ব্রাহ্ম, দৈব, আর্ষ, গান্ধর্ব ও প্রাজাপত্য বিবাহের ক্ষেত্রে স্ত্রীধনের পুরোটাই পান স্বামী। কিন্তু, আসুর, রাক্ষস ও পৈশাচ বিবাহের দ্বারা লব্ধ স্ত্রীধন নিঃসন্তান নারীর মৃত্যুর পর তাঁর পিতা-মাতা পান।

"অধ্যগ্ন্যধ্যাবাহনিকং দত্তঞ্চ প্রীতিকর্মণি।
ভ্রাতৃমাতৃপিতৃপ্রাপ্তং ষড়্বিধং স্ত্রীধনং স্মৃতম্।।

অম্বাধেয়ঞ্চ যদ্দত্তং পত্যা প্রীতেন চৈব যৎ।
পত্যৌ জীবতি বৃত্তায়াঃ প্রজায়াস্তদ্ধনং ভবেৎ।।
ব্রাহ্মদৈবার্ষগান্ধর্বপ্রাজাপত্যেষু যদ্বসু।
অপ্রজায়ামতীতায়াং ভর্তুরেব তদিষ্যতে।।
যৎ তস্যাঃ স্যাদ্ধনং দত্তং বিবাহেষ্বসুরাদিষু।
অপ্রজায়ামতীতায়াং মাতাপিত্রোস্তদিষ্যতে।।" (বন্দ্যোপাধ্যায় ২০১৬)

তবে, শ্রদ্ধার তুলনায় নারী সম্পর্কে মনুর বিরূপ মনোভাব কিঞ্চিৎ বেশিই দৃষ্ট হয়। নারীজাতির স্বাধীনতালাভের কোন যোগ্যতা নেই বলে তাঁর অভিমত। দিন ও রাতের কোন সময়েই যাতে স্ত্রীলোক স্বাধীনভাবে বিচরণ না করে সেই বিষয়ে পিতা, স্বামী, পুত্র প্রভৃতি পুরুষদের লক্ষ্য রাখার নির্দেশ দিয়েছেন তিনি। কোন ধর্মীয় অনুষ্ঠানে তাদের অর্থব্যয় নিষিদ্ধ! এমনকি গীতবাদ্য থেকে তাদেরকে নিবৃত্ত করার বিধানও দিয়েছেন তিনি –

"অস্বতন্ত্রাঃ স্ত্রিয়ঃ কার্যাঃ পুরুষৈঃ স্বৈর্দিবানিশম্।
বিষয়েষু চ সজ্জন্তঃ সংস্থাপ্যাত্মনো বশে।।"(বন্দ্যোপাধ্যায় ২০১৬)

মনুনির্দিষ্ট সমাজ পুরুষতান্ত্রিক। সেখানে পুরুষেরই প্রাধান্য, নারী তার বশবর্তিনী। একদিকে পুরুষের জন্য বহুবিবাহের বিধান দিয়েছেন, অপরদিকে স্ত্রীজাতিকে সন্তান উৎপাদনের যন্ত্ররূপে চিহ্নিত করেছেন। নারীর সৃষ্টি গর্ভধারণের জন্যই – 'প্রজনার্থং স্ত্রিয়ঃ সৃষ্টাঃ সন্তানার্থঞ্চ মানবাঃ' (বন্দ্যোপাধ্যায় ২০১৬)।

স্বামী যদি জুয়াখেলা প্রভৃতিতে আসক্ত হয়, যদি অন্যের স্ত্রীর প্রতি অনুরক্ত হয় এবং একেবারেই নির্গুণ হয়, তথাপি, সাধ্বী স্ত্রী সেসব উপেক্ষা করেও স্বামীকে দেবতার ন্যায় সেবা করবে –

"বিশীলঃ কামবৃত্তো বা গুণৈর্বা পরিবর্জিতঃ।
উপচর্যঃ স্ত্রিয়া সাধ্ব্যা সততং দেববৎ পতিঃ।।" (বন্দ্যোপাধ্যায় ২০১৬)।

পত্নীর মৃত্যুর পর পতির পুনর্বিবাহের নিদান থাকলেও পতির মৃত্যুর পর পত্নী পরপুরুষের নামোচ্চারণ পর্যন্ত করতে পারবে না এবং সেই বিধবা স্ত্রীকে স্বল্পাহারের দ্বারা জীবনক্ষয় করার বিধান দেওয়া হয়েছে –

"কামং তু ক্ষপয়েদ্দেহং পুষ্পমূলফলৈঃ শুভৈঃ।
ন তু নামাপি গৃহ্ণীয়াৎ পত্যৌ প্রেতে পরস্য তু।।" (বন্দ্যোপাধ্যায় ২০১৬)।

পতির মৃত্যুর পর বিধবাকে ব্রহ্মচর্য পালনের কথা বলেছেন। সাধ্বী স্ত্রীর দ্বিতীয় বিবাহ নিষিদ্ধ। যে স্ত্রী সন্তানের লোভে অপর পুরুষের কথা ভাবে ও তার সংসর্গ লাভ করে, সেই স্ত্রী সমাজে নিন্দাভাজন হয় ও স্বর্গলাভ থেকে বঞ্চিত হয়।

"অপত্যলোভাদ্ যা তু স্ত্রী ভর্তারমতিবর্ততে।
সেহ নিন্দামবাপ্নোতি পতিলোকাচ্চ হীয়তে।।" (বন্দ্যোপাধ্যায় ২০১৬)।

পরপুরুষের সঙ্গে সংসর্গকারী স্ত্রীলোক মৃত্যুর পর শৃগালযোনিতে জন্মগ্রহণ করে এবং কুষ্ঠ প্রভৃতি পাপরোগের দ্বারা আক্রান্ত হয় –

"ব্যভিচারাত্তু ভর্তুঃ স্ত্রী লোকে প্রাপ্নোতি নিন্দ্যতাম্।
শৃগালযোনিং প্রাপ্নোতি পাপরোগৈশ্চ পীড্যতে।।"(বন্দ্যোপাধ্যায় ২০১৬)

৪। নারীচেতনা: ঊনবিংশ শতকে

অর্থাৎ, মনুযুগে নারীর ক্ষমতা ও অধিকার বৈদিক যুগের তুলনায় বহুলাংশে হ্রাস পেয়েছে। তারপর, সময় যত এগিয়েছে, সামাজিক অনুশাসন তত তীব্র হয়েছে। সামাজিক রীতিনীতি পুরুষনির্ভর হয়ে পড়ায় নারীর উপর বর্ষিত হয়েছে বিবিধ নিষেধাজ্ঞা। মধ্যযুগেও তার ধারাবাহিকতা বজায় ছিল।

তারপর, ঊনবিংশ শতাব্দীর শুরুর দিকে নবজাগরণের তরঙ্গে ভারতবর্ষের সামাজিক পরিকাঠামোয় আমূল পরিবর্তন আসে। মূলতঃ বঙ্গদেশ থেকেই এই সামাজিক সংস্কার শুরু হয়, যা পরবর্তীকালে গোটা ভারবতর্ষে ছড়িয়ে পড়ে।

১৮২৯ খ্রিষ্টাব্দে রাজা রামমোহন রায়ের একক প্রচেষ্টায় গভর্নর জেনারেল উইলিয়ম বেন্টিঙ্কের কার্যকালে সতীদাহ প্রথার বিলোপ নিশ্চিত হয়। এরপর, ঈশ্বরচন্দ্র বিদ্যাসাগরের আবির্ভাবে বাংলা তথা সারা ভারতবর্ষে নবজাগরণের উদয় হয়। বিদ্যাসাগর ছিলেন ঊনবিংশ শতকের বাংলার নবজাগরণের পুরোধা ও নারীশিক্ষার পথিকৃৎ। নারীজাতির দুর্দশার অবসানের জন্য নারীশিক্ষাই যে প্রথম পদক্ষেপ, তা তিনি উপলব্ধি করলেন। পাশাপাশি, সামাজিক কুসংস্কারগুলির বিরুদ্ধে তীব্রভাবে প্রতিবাদ করলেন। ১৮৫৬ সালে কার্যত তাঁরই ব্যক্তিগত উদ্যোগে ও ঐকান্তিক প্রচেষ্টায় বিধবা বিবাহ আইন বলবৎ হয়। এর ফলে, বিধবাদের অসহনীয় দুঃখ ও তাঁদের প্রতি সামাজিক বঞ্চনা ও ধিক্কারের পুরোপুরি অবসান ঘটে। বিদ্যাসাগর শুধু আইন পাশ করিয়েই ক্ষান্ত থাকেননি, তাঁর একমাত্র পুত্র নারায়ণচন্দ্র বন্দ্যোপাধ্যায়ের বিবাহও দেন এক বিধবার সঙ্গে। তাঁর মনে হয়েছিল যে, নারীশিক্ষা ছাড়া সমাজের সার্বিক বিকাশ অসম্ভব। তাই, মেয়েদের জন্য জন এলিয়ট ড্রিঙ্কওয়াটার বিটনের সহযোগে কলকাতায় হিন্দু বালিকা বিদ্যালয় স্থাপন করলেন। এর মাধ্যমে প্রতিষ্ঠিত হল ভারতের সর্বপ্রথম বালিকা বিদ্যালয়টি। বর্তমানে এটি বেথুন স্কুল নামে পরিচিত। ১৮৫৭ সালে বর্ধমানে আরও একটি বালিকা বিদ্যালয় তৈরী করেন। বঙ্গদেশে সর্বত্র নারীশিক্ষার বিস্তারের জন্য ১৮৫৮ সালে নদীয়া, বর্ধমান, হুগলী ও মেদিনীপুর জেলায় তিনি মোট ৩৫টি বালিকা বিদ্যালয় তৈরী করেন। ১৮৬৪ খ্রিষ্টাব্দে বঙ্গদেশে বালিকা বিদ্যালয়ের সংখ্যা গিয়ে দাঁড়ায় ২৮৮ তে। ১৮৯০ সালে নিজের মায়ের স্মৃতির উদ্দেশ্যে তিনি তাঁর জন্মস্থান মেদিনীপুরের বীরসিংহ গ্রামের ভগবতী বিদ্যালয় প্রতিষ্ঠা করেন। মেয়েদের বাল্যবিবাহ রদ করার জন্য ও পুরুষের বহুবিবাহ বন্ধ করার জন্য তিনি আজীবন অক্লান্ত পরিশ্রম করেছেন। এছাড়া, শ্রী মদনমোহন তর্কালংকার, দক্ষিণারঞ্জন মুখোপাধ্যায় প্রমুখের নামও স্ত্রীশিক্ষা বিস্তারের ক্ষেত্রে উল্লেখনীয়।

বঙ্গদেশের পাশাপাশি প্রায় একই সময়ে মহারাষ্ট্রেও নারীচেতনা ও নারীমুক্তি কর্মধারা জাগ্রত হয়েছিল। মহাত্মা জ্যোতিরাও (জ্যোতিবা) ফুলে ও তৎ-পত্নী সাবিত্রীবাঈ ফুলের নাম এক্ষেত্রে অগ্রগণ্য। তৎকালীন ভারতীয় জনজীবনে প্রচলিত বর্ণবৈষম্য, জাতিবৈষম্য সহ নানা প্রতিকূল পরিস্থিতির মধ্য দিয়ে ও সামাজিক গোঁড়ামো ভেদ করে ফুলে-দম্পতীর মাথা তুলে দাঁড়ানো আজ এক দৃষ্টান্ত। সাবিত্রীবাঈ ফুলে সতীদাহ ও বাল্যবিবাহ প্রথার বিরুদ্ধে প্রচারের পাশাপাশি বিধবা ও অসহায় নারীদের জন্য সহায়তা কেন্দ্র স্থাপন করেছিলেন। মেয়েদের শিক্ষার জন্য স্বামীর সহায়তায় তিনি ১৮টি বিদ্যালয় চালু করেছিলেন। শেষে প্লেগরোগীদের সেবায় অক্লান্ত পরিশ্রমে প্লেগেই আক্রান্ত হয়ে তিনি মৃত্যুবরণ করেন।

রাজা রামমোহন রায়-প্রতিষ্ঠিত ব্রাহ্মসমাজের নামও এবিষয়ে উল্লেখযোগ্য। কলকাতার জোড়াসাঁকোর ঠাকুরবাড়িও নারীশিক্ষার প্রসারে অগ্রণী ভূমিকা পালন করেছিল। প্রিন্স দ্বারকানাথ ঠাকুর ও তৎপুত্র মহর্ষি দেবেন্দ্রনাথ ঠাকুর তৎকালীন কুসংস্কারাচ্ছন্ন সমাজের বিরুদ্ধে দৃষ্টান্ত স্থাপন করেছিলেন ঠাকুরবাড়ির সমস্ত মহিলা-সদস্যদেরকে পড়াশোনা শিখিয়ে। ঠাকুরবাড়ির কোন মহিলাই অশিক্ষিত ছিলেন না এবং সময়ের সঙ্গে সঙ্গে তাঁদেরকে বিভিন্ন কবিতা-আবৃত্তি, নাটকাদিতে অংশগ্রহণ করানো হত। বিদেশিনীরাও আসতেন তাঁদেরকে বিভিন্ন ভাষা প্রভৃতি শেখাতে।

ঊনবিংশ শতাব্দীর দ্বিতীয়ার্ধে বিভিন্ন পত্র-পত্রিকাতেও নারীশিক্ষার প্রয়োজনীয়তা অত্যন্ত গুরুত্বের সহিত ধারাবাহিকভাবে প্রকাশিত হতে থাকল। এবিষয়ে, বামাবোধিনী, অবলা-বান্ধব, হেমলতা, বিনোদিনী, বালিকা, বঙ্গমহিলা, বঙ্গবালা, সাবিত্রী প্রভৃতি পত্রিকার নাম করা যায়। ১৮৭০ সালে প্রকাশিত হয় মহিলাদ্বারা পরিচালিত প্রথম পত্রিকা বঙ্গ-মহিলা, যার সম্পাদক ছিলেন মোক্ষদায়িনী মুখোপাধ্যায়। এরপর একের পর এক মহিলা-পরিচালিত পত্রিকা প্রকাশিত হতে থাকে। সেগুলির কয়েকটি নিম্নোদ্ধৃত হল –

পত্রিকা	**সম্পাদক**	**প্রকাশকাল**	**প্রকাশকাল/পর্যায়**
হেমলতা -	হেমলতা দেবী	১৮৭৩	-
অনাথিনী -	থাকমণি দেবী	১৮৭৫	মাসিক
হিন্দুললনা-		১৮৭৮	পাক্ষিক
পরিচারিকা-	মোহিনী দেবী	১৮৭৮	মাসিক
খ্রীষ্টীয়মহিলা -	কুমারী কামিনী শীল	১৮৮১	মাসিক

বঙ্গবাসিনী-		১৮৮৩	সাপ্তাহিক
সোহাগিনী -	কৃষ্ণরঞ্জিনী বসু ও শ্যামাঙ্গিনী দেবী	১৮৮৪	মাসিক
ভারতী -	স্বর্ণকুমারী দেবী	১৮৮৪	মাসিক
বালক-	জ্ঞানদানন্দিনী দেবী	১৮৮৫	মাসিক
বিরহিণী -	শৈলবালা দেবী	১৮৮৮	মাসিক
ভারতভাগিনী-	হর দেবী	১৮৮৯	মাসিক
পুণ্য -	জ্ঞানসুন্দরী দেবী	১৮৯৭	মাসিক
অন্তঃপুর -	বনলতা দেবী	১৮৯৮	মাসিক

বিংশ শতকেও মহিলাদের উত্তরণের প্রচেষ্টায় বিভিন্ন পত্রিকা প্রকাশিত হতে থাকে। যেমন জাহ্নবী (১৯০৪ খ্রীষ্টাব্দ), ভারত-মহিলা (১৯০৫ খ্রীষ্টাব্দ), সুপ্রভাত (১৯০৭ খ্রীষ্টাব্দ), গৃহলক্ষ্মী (১৯০৭ খ্রীষ্টাব্দ), ভারতলক্ষ্মী (১৯১০ খ্রীষ্টাব্দ), শ্রেয়সী (১৯২২ খ্রীষ্টাব্দ), বঙ্গনারী (১৯২৩ খ্রীষ্টাব্দ), পরিচারিকা (১৯২৩ খ্রীষ্টাব্দ), শ্রমিক (১৯২৪ খ্রীষ্টাব্দ), বঙ্গলক্ষ্মী (১৯২৫ খ্রীষ্টাব্দ), মাতৃমন্দির (১৯২৫ খ্রীষ্টাব্দ), জয়শ্রী (১৯৩১ খ্রীষ্টাব্দ), সেবিকা (১৯০২ খ্রীষ্টাব্দ) প্রভৃতি।

৫। নারীস্বাধীনতা: বিংশ শতকে ও একবিংশ শতকের প্রারম্ভে

উনবিংশ শতক হল নারীমুক্তি আন্দোলনের, আর, বিংশ শতক হল নারী স্বাধীনতার। বিবিধ ক্ষেত্রে পুরুষের সমান ক্ষমতাভোগ, নির্বাচনী ভোটাধিকার, পণপ্রথার নিষিদ্ধি, রাজনৈতিক ও সামাজিক কর্মকাণ্ডে অবাধ বিচরণ – নারীস্বাধীনতার এই বিষয়গুলিই মূলতঃ প্রাধান্য পেয়েছে বিংশ শতাব্দীতে। রোকেয়া সাখাওয়াত হোসেন তাঁর সাহিত্যকীর্তি এবং বিভিন্ন সামাজিক ও সাংস্কৃতিক কর্মকাণ্ডের মাধ্যমে নারীজাতির শিক্ষাবিস্তার ও আত্মমর্যাদাবোধ জাগ্রত করেছেন। আবার, নারীবাদী নজরুল তাঁর 'নারী' কবিতায় লিখলেন –

'বিশ্বের যা কিছু মহান সৃষ্টি কল্যাণকর,
অর্ধেক তার করিয়াছে নারী, অর্ধেক তার নর।'

রবীন্দ্রনাথের 'স্ত্রীর পত্র', 'সমাপ্তি', 'শাস্তি', 'শেষের কবিতা', 'রক্তকরবী' সহ আরও অনেক সাহিত্য সৃষ্টির নেপথ্যে রয়েছে নারীমর্যাদা ও নারীস্বাধীনতা।

বিংশ শতকে নারীর অধিকার ও নারী স্বাধীনতার লক্ষ্যে একের পর এক পদক্ষেপ গৃহীত হয়েছে। ১৯২৯ সালে বাল্যবিবাহ নিয়ন্ত্রণ আইন (Child Marriage Restraint Act) পাস হয়। ১৯৪৭ সালে ভারতের ইংরেজমুক্তি ও ১৯৫০ সালে সংবিধান কার্যকর হওয়ার পরই মূলতঃ যুগান্তকারী পদক্ষেপগুলি গৃহীত হয়। ভারতের সংবিধানে শিক্ষা, মৌলিক অধিকার, লিঙ্গসাম্য প্রভৃতি ক্ষেত্রগুলিতে নারীর মর্যাদারক্ষায় রাষ্ট্রকে পদক্ষেপ নিতে বলা হয়েছে। পঞ্চম পঞ্চবার্ষিকী পরিকল্পনা(১৯৭৮খ্রী.- ১৯৭৮ খ্রী.)র অধিকাংশটাই নারীর অধিকারের কথা বলে। সমাজ থেকে পণপ্রথা নিষিদ্ধ করার লক্ষ্যে ১৯৬১ সালে তৈরী হয় পণপ্রথা নিষিদ্ধিকরণ আইন (The Dowry Prohibition Act)। যদিও, এই আইনে অনেক অসঙ্গতি ও ফাঁকফোকরের কারণে এর উদ্দেশ্য ব্যাহত হতে থাকলে ভারত সরকার ১৯৮৬ সালে এই আইন সংশোধন করে নতুন রূপ দেয়। ১৯৭৮ সালে বাল্যবিবাহ রোধ আইনের বেশ কিছু ধারা সংশোধিত হয় এবং অপরাধীর শাস্তির ব্যবস্থা করা হয়। ১৯৯০ সালে জাতীয় মহিলা কমিশন তৈরী হয় সংসদীয় আইনের মাধ্যমে। সংবিধানের ৭৩ ও ৭৮ সংশোধনীর মাধ্যমে পঞ্চায়েত, পৌরসভা ও স্থানীয় প্রশাসনে মেয়েদের জন্য আসন সংরক্ষণের ব্যবস্থা করা হয়। ২০০১ সালটিকে ভারত সরকার 'নারীর ক্ষমতায়ন বর্ষ' রূপে ঘোষণা করে। ২০১০ সালে ভারতের সংসদে মহিলা সংরক্ষণ বিল পাস হয়, যার মাধ্যমে ভারতের সংসদ ও বিধানসভাগুলিতে মহিলাদের জন্য ৩৩% আসন সংরক্ষণের কথা বলা হয়। ২০১৩ সালে কর্মক্ষেত্রে নারীদের যৌন হয়রানি রোধে (Sexual Harassment of Women at Work Place Act) আইন বলবৎ হয়। ২০১৭ সালে ভারতীয় সর্বোচ্চ ন্যায়ালয় মুসলিমদের তাৎক্ষণিক তিন তালাক অসংবিধানিক ঘোষণা করে ও ভারত সরকারকে এই বিষয়ে আইন তৈরী করার নির্দেশ দেয়। ফলস্বরূপ, ২০১৯ সালে আইন তৈরীর মাধ্যমে তাৎক্ষণিক তিন তালাক প্রথাকে ভারত সরকার ফৌজদারী অপরাধ হিসাবে গণ্য করে অবৈধ ঘোষণা করে।

৬। উপসংহার

এতৎসত্ত্বেও, ভারতীয় সমাজজীবনের চিত্র পুরোপুরি বদলায়নি। আইন, সংবিধান, নীতি, পরিকল্পনা প্রভৃতিতে যে লক্ষ্যের কথা বলা হয়েছে, ভারতীয় নিত্যজীবনে তার রূপায়ণ কোথাও আংশিক, কোথাও বা যৎসামান্য। এখনও প্রত্যন্ত গ্রামগুলিতে আর্থিক কাঠামো ও সামাজিক বিন্যাস দুর্বল হওয়ায় এবং জাতিগত ও লিঙ্গগত বৈষম্য থাকায় মহিলারা নিত্যই নিপীড়িত হয়। থমসন রয়টার্সের একটি রিপোর্ট অনুযায়ী, মহিলাদের জন্য ভারত চতুর্থ বিপজ্জনক দেশ। জি-২০ দেশগুলির মধ্যে ভারতবর্ষ নারীদের জন্য সবচেয়ে অস্বাস্থ্যকর দেশ হিসাবে উল্লিখিত। আজও দেশের অনেক স্থানে কন্যাসন্তান অবাঞ্ছিত। শিশুকন্যা যাতে বাবা-মায়ের দুশ্চিন্তার কারণ হয়ে না দাঁড়ায়, সেজন্য ২০১৪ সালে ভারত সরকার 'সুকন্যা সমৃদ্ধি যোজনা' চালু করে। কিন্তু, আমরা ভারতবাসীরা মানসিকতার উন্নতিতে বিশ্বের বহু দেশের তুলনায় এখনও বহু যোজন পিছিয়ে।

কৃতজ্ঞচিত্তে

আমি আন্তরিক কৃতজ্ঞতা জানাচ্ছি সেই অজ্ঞাত পর্যালোচককে, যিনি আমার এই ক্ষুদ্র প্রচেষ্টাটির প্রতি সদর্থক ও নির্বাধ অভিমত জ্ঞাপন করেছেন। ধন্যবাদ জানাই যোগমায়া দেবী মহাবিদ্যালয়ের গবেষণা-আয়োগের সদস্যবর্গকে, যাঁদের নিয়ত পরিশ্রম ব্যতীত এই আন্তর্বিষয়ক পুস্তকটির প্রকাশ অসম্ভব হত। এতদ্ব্যতীত, এই প্রতিষ্ঠানের দুই সহকারী অধ্যাপক ডঃ ভাস্কর ঘোষ ও ডঃ প্রসেনজিৎ ঘোষ এবং রবীন্দ্রভারতী বিশ্ববিদ্যালয়ের তরুণ গবেষক শ্রীমান রাজকুমার মিদ্যা আমার বিশেষ ধন্যবাদার্হ, তাঁদের অবিমুখ পরামর্শ দানের জন্য।

গ্রন্থপঞ্জী

১। দাস, দেবকুমার, ১৪১২। সংস্কৃতসাহিত্যালোকঃ, সংস্কৃত পুস্তক ভাণ্ডার, কলিকাতা।

২। বন্দ্যোপাধ্যায়, উদয়চন্দ্র, ২০০১। বেদ-সংকলন, দ্বিতীয় সংস্করণ, সংস্কৃত বুক ডিপো, কলিকাতা।

৩। বন্দ্যোপাধ্যায়, ধীরেন্দ্রনাথ, ২০০০। সংস্কৃত সাহিত্যের ইতিহাস, দ্বিতীয় সংস্করণ, পশ্চিমবঙ্গ রাজ্য পুস্তক পর্ষৎ, কলিকাতা।

৪। বন্দ্যোপাধ্যায়, মানবেন্দু, ২০১৬। মনুসংহিতা, তৃতীয় সংস্করণ, সংস্কৃত পুস্তক ভাণ্ডার, কলিকাতা।

৫। বন্দ্যোপাধ্যায়, শান্তি, ২০০৩। বৈদিক সাহিত্যের রূপরেখা, তৃতীয় সংস্করণ, সংস্কৃত পুস্তক ভাণ্ডার, কলিকাতা।

৬। বসু, যোগীরাজ, ১৯৭৫। বেদের পরিচয়, ফার্মা কে.এল্.মুখোপাধ্যায়, কলিকাতা।

৭। ভট্টাচার্য, সুকুমারী, বাং, ১৩৯৪। প্রাচীন ভারত: সমাজ ও সাহিত্য, আনন্দ পাবলিশার্স, কলিকাতা।

৮। মুখোপাধ্যায়,তপতী, ২০০৪। ধর্ম, অর্থ ও নীতি: প্রাচীন ভারতীয় শাস্ত্রসমীক্ষা, চ্যাটার্জী পাবলিশার্স, কোলকাতা।

৯। Mondal, S., 2015. The Portrayal of Women's Images in Bengali News Papers, Magazines and Advertisements.

Rajat Kumar Naskar
Rajat Kumar Naskar is an Assistant Professor in the Department of Sanskrit at Jogamaya Devi College, Kolkata. He is pursuing doctoral research at Rabindra Bharati University, Kolkata, on a manuscript of a Sanskrit drama.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 89-93

The Introduction of Artificial Intelligence in ESL Teaching: Possibilities and Limitations

Rituparna Mukherjee
Department of Communicative English, Jogamaya Devi College
ritumukherjee10@gmail.com

Abstract: Artificial Intelligence is a domain of computer science that has gradually become an invaluable part of twenty-first century life and is used almost universally to navigate various commercial and non-commercial platforms. It is little wonder therefore that this technology has forayed into the domain of teaching, especially in English Language teaching. This paper tries to locate the areas in which the use of artificial intelligence can aid the teachers based on their dissemination of classroom lectures as well as administrative duties, alongside noting the nature of infrastructural preparedness the use of AI would entail. This paper also uses a survey of a random sample of 200 students in Kolkata to ascertain their present classroom ecology and their expectations from the use of AI in classrooms.

Keywords: Artificial Intelligence, ESL classroom, educational governance, English language teaching

Artificial Intelligence, ever since its inception at the 1956 Dartmouth Conference has been making steady strides in changing the landscape of our socio-economic world, the way we interact with others presently and the manner in which we operate even the most basic financial transactions at this date. The boom of the cyberspace and social media has suddenly brought into our world an abundance of personal, professional and financial data, and artificial intelligence as a concept mines this data in order to systematize and simplify our lives. Defined, artificial intelligence is an algorithm that programmes machines to emulate and project human behaviour and do tasks that require human intelligence: "…activities that we associate with human thinking, activities such as decision-making, problem-solving, learning…" (Bellman 1978, cited in the UNESCO working papers on education policy, 2019). Presently its ubiquity is evident in the use of navigation systems, voice recognition software, natural language processing, machine learning system, text to speech synthesis, computer games, and speech and handwriting recognition software. This essay outlines and identifies the areas of education in which artificial intelligence can be used successfully to ensure easy accessibility to the learners and a wide range of educational choices, with special reference to teaching English as a Second Language. This essay also aims to describe the potential benefits of incorporating artificial intelligence in the educational system, discuss the challenges and implications of introducing this system in the Indian context and argue the state of preparedness of our current educational system through a survey statistical data, conducted among 200 students in Kolkata.

It is the common perception that India needs to step up to the world's educational level, both in terms of academic infrastructure and academic content. The 'one model fits all' strategy has to make way eventually for a more individualized, specialized educational paradigm that is tailored to the students' needs. In this context, artificial intelligence can play a key role in enhancing the

current educational architecture in a two-pronged manner. Firstly, we can utilize AI's proclivity for excelling at tasks of a repetitive and predictable nature productively in reducing the encumbrances of educational governance and management. The most favoured instances would include administrative tasks such as admission procedures, wherein administrators can use AI monitored systems to categorize students based on merit, automatizing paperwork, reducing workload on teachers, and teaching assistants. Another beneficial manner in which AI can help educators is by assisting in grading papers that have an objective based pattern. Educators can apply AI in curriculum development based on collected students' personality data and their individual learning styles. The same core curriculum can then be adapted in various specialized areas, with inputs from AI-monitored ongoing student assessments that can accurately gauge student skill acquisition over time (Karsenti 2019). They can employ AI to monitor and categorize student feedback, and other administrative activities such as ordering and budgeting for educational materials and equipment, expense management and facilities management. The National Testing Agency is also planning to utilize AI software powered assessments to conduct examinations like JEE, UGC NET to ensure fairness, test reliability and validity and prevent leakage of papers, as well as to enable timely correction of papers and declaration of results. The fruitfulness of such AI manipulation is that it gives the teachers greater freedom and time to engage in research and professional development, as well as encourage personal interaction with students.

The goal of all education, especially higher education is to ensure learner autonomy. Schools and colleges can apply artificial intelligence in a variety of innovative ways to ensure quality education. Governments and higher education institutions are reconstructing the present educational system to broaden its reach to a greater number of takers. Institutions can employ AI with cloud computing software very successfully in developing enhanced distance learning programmes. They can design intelligent tutoring platforms and online applications to cater to teachers and students who can access educational materials from even remote places. The Indian Government schemes such as SYAWAM (Study Webs of Active Learning for Young Aspiring Minds), that aim to make education available to all are a case in point. 62% of the students surveyed in Kolkata have claimed that they are self-reliant learners, and the introduction of tutoring applications has not only empowered the students to think on their feet but also to lessen their core reliance on classroom methodology. Around 68% of the students surveyed opt for online learning resources as one of their self- learning strategies. In cue with this trend, publishing houses are developing on-demand digital content and this is changing the manner in which the present education system is operating. It is quite a possibility that education will soon become partially paperless if not entirely. Teachers, on the other hand, can take the help of AI powered software to understand the students with differing levels of ability and aptitude and offer appropriate remedial exercises. The trend towards AI hyper-personalization is gradually becoming apparent, as more and more educators in developed countries such as Australia (Popenici & Kerr 2017) are using AI systems to personalize learning for their students. Teachers are using AI systems to assist the students with learning, answering tasks or reinforce conceptual knowledge with additional materials. In some countries such as China, AI powered systems are helping in tackling the increasing teacher-student ratio, combating inadequate number of teachers by catering to the students' lack of basic knowledge, encouraging self-monitored learning routines and modules in students (Zhu 2017).

Teachers can use artificial intelligence constructively in learning scenarios where there is a dynamic exchange of language involved. Language learning classrooms, especially English language learning requires structured and varied language inputs and many language specialists argue to the benefits of employing AI in an English Language classroom. It is a tool for optimal use of language in a classroom (Li 2017), and 74% of the students surveyed have preferred a learning environment that includes a teacher and some form of ICT methodology, stating that learning with a teacher can be a more shared, personal and often emotional experience, while a machine enables audio-visual data, which is not only interesting but also aids retention and better comprehension. Keerthiwansha, 2018, explores the practicality of incorporating voice-driven AI software such as Amazon Alexa in an elementary English classroom. His findings indicate that the students were more responsive, highly engaging, prone to self-correction, and having greater participation than an entirely teacher-governed classroom. Yang, 2007, gives an example of an AI programme, Lucy, in integrating oral practice and written exercises for elementary learners who find it difficult and often inhibiting to open up to teachers. Lucy is an AI software with a virtual face and audio output that works on the principle of text and audio communication, ensuring a two-way communication in real time. It has an in-built electronic dictionary that the learners can access in order to develop vocabulary and phrases. However, AI lacks the sophistication of understanding complex human language mechanisms like humour, pun, irony and sarcasm, and therefore cannot be used to understand and further materials in subjective human learning. This is where the human factor becomes so important. Dodigovic, 2007, highlights a more refined approach to AI utilization in the computer programme, Intelligent Tutor. This programme is designed to diagnose and correct some typical errors produced by adult learners of English as a Second Language. The system helps to diagnose errors based on frequency, gravity of the error and its communicational significance in terms of communication breakdown. This kind of AI interface is extremely beneficial for an ESL teacher in being able to create a learner-error corpus and create suitable customized remedial and practice exercises for learner improvement. This will especially aid the development of common Indian ESL errors like SVO construction, use of tenses and aspects, appropriate inflectional and derivational suffix use. AI in this context will help teachers design specific lesson plans and provide rule-based clarifications. However, as 75% of the students surveyed attest their faith in teacher over machine in error correction, the final remediation must come from the teachers. Zhu, 2017, argues that proper introduction of AI in the ESL paradigm on a regular basis will comprise four kinds of users, namely, system administrators that are staff ensuring the smooth management and wellbeing of the softwares and hardwares in question; field experts who are English language educators with long-standing experience entrusted to develop, modify and manage content as per need; English teachers who will implement the system to organize, analyze and diagnose student weakness and needs; and finally the students who will be the takers of this system.

However, changing the generic architecture of the educational system to an AI-driven one is not without its challenges. The UNESCO Education Policy 2030 Report (2019) identifies four main considerations: ensuring inclusive, fair, and equitable use of AI in education; leveraging AI properly to enhance the teaching and learning experience; promoting adequate skills essential to implement AI in a large-scale manner, and finally, safeguarding ethical use, privacy and transparency of the data that is mined for the purpose. It has become increasingly important for governments to encourage and mobilize research in AI-driven educational programmes if our

country is to follow the global trend in education. Also, AI-monitored systems have the clear capability of overtaking and replacing a significant number of staff employed in the education administration. It is therefore extremely essential to train personnel in more contributory, creative and entrepreneurial roles (Popenici and Kerr 2017). France, South Korea and China are already creating programmes and comprehensive plans to deploy vocational training and development in this sector, as per the UNESCO report. Most importantly, the students and teachers, who are the primary recipients of this development, need to be trained in order to operate in this new learning environment. Teachers must learn new digital skills in order to survive in this data driven environment as well as to foster better learning and a greater exchange of equitable learning materials. The government has to sanction the requisite vast sums of funds for sustainable teacher education and development. The government has to devise suitable public policies that will work at the national and international level to ensure data accountability, basic infrastructure development and to ensure private and qualitatively superior learning environment, formulate quality and inclusive data systems and improve the state's capabilities of data storage, mining and management. The authorities will also need to ensure and address ethical concerns of data use in the dissemination in an educational paradigm.

To sum up, it is imperative that we remember that education is a human-driven effort and that the human is the centre and key to education. AI solutions take into account tasks that are automated and therefore simplified. AI systems in the educational context can only be operational in so far as it enables and empowers the educators to extend their capabilities and excel at their jobs by not being bogged down by tenuous administrative duties. Artificial intelligence in the educational sector can act as superlative teaching assistants in the detection of patterns, errors in use, providing practice, remedy and lively interactive classroom exchanges for optimization of learning. AI can never replace the expertise of a teacher's knowledge, nor do his/her personal touch. What it can do is to make teaching and learning more simplified, accessible, accurate, comprehensive, enjoyable and individual.

REFERENCES

1. Dodigovic, M., 2007. Artificial intelligence and second language learning: an efficient approach to error remediation. Language Awareness, 16.2, 99-113.
2. Jia, J., 2009. An AI framework to teach English as a foreign language: CSIEC. AI Magazine, 59-71, Summer 2009.
3. Karsenti, T., 2019. Artificial intelligence in education: the urgent need to prepare teachers for tomorrow's schools. Formation et Profession, 27.1, 105-111.
4. Keerthiwansha, N.W, August 2018. Artificial intelligence in education in English as a second language classroom in Sri Lanka. International Journal of Conceptions on Computing and Information Technology, 6.1, 31-36.
5. Kose, U. and Arslan, A., 2015. E-learning experience with artificial intelligence supported software: an international application on English language courses. GLOKALde, 1.1, 61-75, July 2015.

6. Li, X., 2017. The construction of intelligent English teaching-model based on artificial intelligence. *iJET*, 12.12, 35-44.
7. Livingstone, K.A, 2012. Artificial intelligence and error correction in second and foreign language pedagogy. Lincom Europa Publications.
8. Popenici, S. and Kerr, S., 2017. Exploring the impact of artificial intelligence on teaching and learning in higher education." Research and Practice in Technology Enhanced Learning. Springer Open, 12.22, 1-13.
9. Subrahmanyan, V.V and Swathi, K, 11-12 August, 2018. Artificial intelligence and its implications in education." Conference Paper. Presented in International Conference on Improved Access to Distance Higher Education Focus on Undeserved Communities and Uncovered Regions. Kakatiya University, Warrangal, Telengana, India.
10. Yang, S., 2007. Artificial intelligence for integrating English oral practice and writing skills. Sino-US English Teaching, 4.4, pp 1-6, April 2007.
11. Wang, R., 2019. "Research on Artificial Intelligence Promoting English Learning Change." *Advances in Social Science, Education and Humanities Research*, 325, 392-395.
12. Zhu, D., 2017. Analysis of the application of artificial intelligence in college English teaching. Advances in Intelligent Systems Research, 134, 235-237.

Rituparna Mukherjee
Rituparna Mukherjee is a Faculty of Communicative English at Jogamaya Devi College. She is currently pursuing Doctoral degree at IIIT Bhubaneswar. She specializes in African and American literature and Post-colonial and Feminist theories. She works, as a freelance ELT consultant for ELT publications, is a trained rater and language tester and a guest faculty, School of Languages and Linguistics, Jadavpur University.

⌘ Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I,
Jogamaya Devi College Interdisciplinary Volume 1, Issue 1 (2020), pp. 94-101

Changing Trend in Modern Sanskrit Drama: The Bengal Scenario

Sushree Chakraborty
Department of Sanskrit, Jogamaya Devi College
sushree.chakraborty78@gmail.com

Abstract: Sanskrit language is widely known for both its antiquity and its continuity through various phases of Indian civilization. The literature deals mainly with the universality and spirituality innate in mankind. Sanskrit literary works of early and medieval periods were tradition-bound, and changes against the scriptural directives were not allowed. However, twentieth century onwards the Sanskrit literary artists of Bengal were observed maintaining the continuity of Indian tradition and at the same time introducing modern elements and modern techniques, creating a nice blend of tradition and modernity.

Keywords: Dramaturgy, Modern, Sanskrit

1. Introduction

Sanskrit, the classical language of excellence and the language of ancient Indian stock of knowledge is widely known for both its antiquity and its continuity through various phases of Indian civilization. This language has been the greatest medium for the expression and propagation of wisdom and culture in India. Sanskrit literature of early and medieval periods deals mainly with the universality and spirituality innate in mankind. Literary works of these eras were tradition-bound and changes against the scriptural directives were not allowed in most cases. However, twentieth century witnessed the initiation and development of a transitional trend in Sanskrit creative literary genre. The literary artists of Sanskrit were observed maintaining the continuity of Indian tradition and at the same time introducing modern elements and modern techniques, creating thereby a nice admixture of tradition and modernity. This blending eventually became the predominant characteristic of modern Sanskrit literature. Modern Sanskrit dramas also naturally imbibed the new flavor to represent the modernity of thought and expression. The present article is an attempt to cast a cursory glance on the different features of the doctrines followed in traditional as well as modern Sanskrit dramaturgy and to discuss the probable causes behind the transforming trend.

2. Traditional guidelines of Sanskrit dramaturgy

Sanskrit poetry has been classified broadly under two categories, namely – 'Śravyakāvya' and 'Dṛśyakāvya' – 'dṛśyaśravyatvabhedena punaḥ kāvyaṃ dvidhā matam' (Mukhopadhyay 1979). Śravyakāvya is a composition, metrical or non-metrical, that appeals only to the sense-organ of hearing (śravaṇendriya). Dṛśyakāvya stands for a poetic composition where the aesthetic feeling arises through the act of witnessing a drama with the help of the visual sense-organ (darśanendriya), though hearing organ also plays a vital role in the act of appreciation of the sentiments. 'Rūpaka', another designation of Dṛśyakāvya, is a pointer to the aspect of a drama wherein the actor, surrendering his original personal identity, morphs into the role of a certain character, (eg, Rāma,

Yudiṣṭhira,etc) – 'Rūpāropāttu rūpakam' (Mukhopadhyay 1979). However, the term 'Rūpaka' is also used to denote one (Major Dramas) of the two divisions of 'Dṛśyakāvya', the other being 'Uparūpaka' (Minor Dramas).

It goes without saying that the entire sphere of classical Sanskrit drama was designed and guided by the precepts of dramaturgy, basically propounded by the sage Bharata in his canonical book Nāṭyaśāstra. The directives regarding the science of dramaturgy were very minute in details regarding the sentiments, the plot, the stages of action, the characterization, the speech – to be precise, everything. Thus, even reluctantly we must admit that the liberty of the dramatists of Sanskrit classical drama has been restricted to some extent. The primary success of Dṛśyakāvya lies in creating 'Rasa'–'na hi rasādṛte kaścidarthaḥ pravartate' (Nagar 2004) – by rousing dormant emotions ('sthāyibhāva') through the aesthetic visual representation. Therefore, the aspiring dramatists should follow the rules and regulations of the dramaturgical theories in such a way that the soul of the composition, i.e. the Rasa, is developed with adherence to those.

The success of a drama depends upon several other factors too. The plot is considered to be one of the most important constituents of a drama since the success of a dramatist to a great extent depends upon the plot he weaves with his creative genius. Bharata has termed plot as 'Itivṛtta'. The preceptors of dramaturgy are of the opinion that the plot is always two-fold, viz. Ādhikārika and Prāsaṅgika (Nagar 2004). Ādhikārika is the main fact as it deals with the accomplishment of the desired goal of the protagonist of the drama and Prāsaṅgika is the secondary one that just accelerates and feeds this accomplishment. Action or 'Kārya' is an essential part of the story. There are five stages ('Avasthā's) in the development of the action (Kārya). They are called 'Ārambha' (introduction), 'Prayatna' (effort), 'Prāptisaṁbhava' (possibility of attainment), 'Niyatāpti' (certainty of attainment), and 'Phalayoga' (attainment of the result) (Nagar 2004). Besides the five stages of action there are five elements or 'Arthaprakṛti's into which the plot is divided. They are 'Bīja' (seed), 'Bindu' (the prominent point), 'Patākā' (incidental accounts), 'Prakarī' (the short incident) and 'Kārya' (epilogue) (Nagar 2004). Just like a human body has parts like the face, limbs, etc., the plot also has parts named 'Saṃdhi's. The above mentioned five Avasthās together with five Arthaprakṛtis respectively form the five Saṃdhis e.g. 'Mukha', 'Pratimukha', 'Garbha', 'Vimarśa' and 'Nirvahaṇa' (Nagar 2004). These Saṃdhis, like the joints of our body, serve in uniting the various parts of the plot into a single whole. The characterization is another important factor regarding which the dramatist must be very keen. Each and every character must have its own individuality and their actions must be in accordance with the dramatic situation. Language is another important factor which demands careful attention of the dramatist. Sanskrit dramaturgy prescribes employment of different languages and dialects for different characters, intending to depict the actual scenario of the society. Intelligibility, so that it can be within the reach of one and all; and suggestiveness, so that the erudite community finds it suitable to their intellectual class—both these qualities should be the predominant traits of the language for a drama to be successful –

> "tasmād gambhīrārthāḥ śabdā ye lokavedasaṃsiddhāḥ |
> sarvajanena grāhyās te yojyā nāṭake vidhivat ||" (Nagar 2004)

In a nutshell, these were the directives prescribed in ancient texts of Sanskrit dramaturgy. Let us now discuss about the transformations and renovations introduced in modern Sanskrit dramatics.

3. Transformations introduced in modern Sanskrit dramaturgy

The scholars are of different opinions regarding the onset of Modernism in Sanskrit literature. According to Ramji Upadhyay, the era of modern Sanskrit literature started 17th century onwards, after the demise of Panditaraja Jagannatha. Professor Rajendra Mishra opines that modernity of Sanskrit literature came into existence in 1784 CE (Das 2013). He even classified this modern era into three periods—the period of renaissance (1784-1884 CE), the period of establishment (1884-1940 CE) and the period of thriving (1940 CE-till date) (Tripathi 1999). Professor Chandrakishor Goswami divides the era of modern Sanskrit into two divisions-- pre-independence and post-independence (Jha 2003). Keeping a keen eye on the changing trend, the eminent critics of Sanskrit literature have pointed out some characteristic features of modern Sanskrit literature. According to Professor Nirmala Upadhyaya, depiction of patriotism, national integrity, contemporary events, amorous humor etc. constitute the primary thematic feature of modern Sanskrit literature. Dr. Radhaballav Tripathi opines that topics like social reforms, lives of great personalities, Gandhism etc. are the new themes adopted. Eulogy and translations of the legendary works from world literature are also becoming popular among the new-age writers.

Anyway, as the title suggests, my discourse will be focusing on the Bengal scenario only. The new forms and features, styles and experiments introduced in modern Sanskrit drama by the dramatists of modern Bengal can be observed mainly in four facets of Sanskrit dramaturgy-- content, techniques, language and music. Let us discuss about these aspects in detail.

The older dramas are mostly seen to be mythological and spiritual in character, mainly having content about legends from the Rāmāyaṇa, Mahābhārata and some other well-known mythological episodes. However, in the modern centuries, the dramatists from Bengal have penned their compositions in various categories such as biographies, translations, imaginative compositions, current affairs, etc. along with the traditional themes. Due to this deviation from the orthodox point of view, we have been gifted with dramas on contemporary themes as diverse as the topics of the second World War to the Naxalite movement or from the present condition of Sanskrit to the problem of refugee influx.

Some techniques essential in traditional Sanskrit dramaturgy started to be considered as superfluous in modern Sanskrit dramas. The essential gorgeous forms of the stages are transformed into simplified forms by the progressive outlook of the modern playwrights. Like Western dramas, the acts are now divided into scenes. Even when the drama is divided into acts, the dictum regarding the number of acts required in a drama, has been seen flouted. According to the Nāṭyaśāstra, the number should vary from five to ten— ‘pañcākṣarā daśaparā hyaṅkāḥ syurnāṭake prakaraṇe ca’ (Nagar 2004). However, we come across a good number of one-act plays, eg. ‘Athakim’ of Dr. Siddheswar Chattopadhyay and ‘Veṣṭanavyāyogaḥ’ of Dr. Birendra Kumar Bhattacharyya as well as drama consisting of even fifteen acts, eg. ‘Bhāskarodayam’ of Prof. Jatindra Bimal Chaudhuri. Usage of ‘Nāndī’ and ‘Bhratavākya’ became discarded in some plays. ‘Nanāvitāḍanam’ of Dr. Siddheswar Chattopadhyay, ‘Jananī’ of Gauri Dharmapal etc. are examples of dramas without the application of ‘Nāndī’. In ‘Śārdūlaśatakam’ of Dr. Birendra Kumar Bhattacharyya, the ‘Bhratavākyam’ was sung as a chorus presented by all the artists. The play ‘Atha kim’ composed by

Dr. Siddheswar Chattopadhyay deserves a special mention in the context of transformation of dramatic techniques of modern Sanskrit drama. This play exhibits a great influence of the drama 'Waiting for Godot' composed by Samuel Beckett. Chattopadhyay used Bengali letters symbolically to denote different classes of the society. Conventional dramatic techniques like 'Saṃdhi', 'Arthaprakṛti', 'Arthopakṣepaka' etc. have not been applied in this play.

Music has always been considered an integral part of Sanskrit drama. Tradition directs that a dramatist should be very careful about the application of music because it plays a vital role in the presentation of the drama in the correct perspective. Some experiments and innovations are found in this aspect too. In the dramas composed by Mm. Kalipada Tarkacharya, Pt. Vishweswar Vidyabhusan, Dr. Jatindra Bimal Chaudhuri, Dr. Roma Chaudhuri and Dr. Birendra Kumar Bhattacharyya, the application of music is praiseworthy. Bhattacharyya's play titled 'Śrīgītagaurāṅgam' deserves special mention in this context. He himself defined this composition as a lyrico-drama. In this play, six Rāgas and seventy-five Rāgiṇīs are employed with great skill. The songs in older plays are being inserted with specific mention to Tālas and Rāgas (Chattopadhyay 1992).

The modern Sanskrit dramatists of Bengal took a drastic turn against the scriptural prescription regarding the language of Sanskrit drama. They rejected the old practice of using Prākṛta dialogues for females and people belonging to the lower strata of the society and used Sanskrit instead. Sometimes, a tendency is visible in modern dramas to replace Prākṛta with Hindi or with some vernacular languages e.g. Bengali, Kashmiri, Rajasthani, etc. (Chattopadhyay 1992). The propensity for Bengali usages of the Bengali dramatists is easily traceable in some plays. Words like 'suvidhā', 'lucikā', 'jhanjhāṭa', 'paṭkā', 'gulti' etc. may be cited as examples. Some Bengali words have been sanskritized. The influence of Bengali proverbs is easy to find. Some English words, eg. tea-leaf, coffee-powder are sanskritized too, as 'cā-patram' and 'kaphi-cūrṇam'. Words like kerosene, stove, batting, cooker, etc. are also freely applied.

4. Reasons behind the changing trend

After the gradual decline of the Delhi Mughal empire, Bengal underwent the reign of the quasi-independent Nawabs, and finally the British took control of the Bengal region from the late 18th century CE. The plunder of Plassey in 1757 CE made direct significant contributions to the industrial revolution in Britain with the capital amassed from Bengal, resulting in a great increase of the British wealth as well as leading to the deindustrialization in Bengal. The socio-economic and political structure of Bengal was transformed by the advent of the British Raj, and this left inevitable impact on the education system also.

In the pre-British period, a typical system of education prevailed in Bengal which may be considered as the indigenous system of education. The popular education prevalent in India during this period was based on ideas and principles enriched in Hinduism, Islam and Buddhism. Education was centered around the house of a teacher, variously known as Tol, Chatuspathy, Maktub, Imambara, and Madrasa. The curriculum of the education system was associated with customs, languages, social values and various thoughts of people concerned. Grammar, Philosophy,

Vedic literature, scriptures, Purāṇas, poetry etc. were the branches that scholars used to cultivate. Bengal was considered and revered as the apex of education in all of India.

However, when the East India Company started gaining power, degradation in the field of education was marked. In the beginning, the Company was indifferent to the education of the countrymen. They found it futile to enlighten the people of Bengal about the European culture. The probable grudge triggered by interfering in the traditional education system was also apprehended. But some different reasons demanded the introduction of western education among the people of Bengal a few years later. In the first place, many English-knowing men were needed to work as clerks, translators and copyists in the various institutions of the government of the Company. For practical reason, it was not wise for the Company to bring sufficient number of people from England offering an excessive pay. Secondly, a class of people showed interest towards European education or the opportunity of earning livelihood, service and trade. A good number of intellectual people, also, realized the utility of learning Western knowledge and science and showed interest in learning English. The European missionaries also played a significant role in spreading the Western education amongst the people. As a result of all these factors, European education progressed at a rapid speed in Bengal.

Because of giving too much importance to English language, culture of the vernacular languages was hugely neglected. And this situation caused the most severe and irreversible damage to the cultivation of traditional scriptures and literature penned in Sanskrit. The new education system was confined to the elite and urban aristocrats only and did not serve the people of rural Bengal. Gradually, it created a class distinction in the field of education causing obstacles in the unity of the people of Bengal. The Sanskrit scholars began to be considered as persons of merit but of no practical utility, and they gradually became outcastes from the elite world. As an aftermath, the culture of various branches of Sanskrit literature was obstructed to a fatal extent and so was the fate of Sanskrit dramas. Sanskrit drifted farther away from applied and therefore daily life and its study was considered outdated. Still, we are fortunate to have a good number of devoted and dedicated scholars of Sanskrit, who by their unrelenting efforts kept the flame of Sanskrit burning, and gifted Sanskrit literature with abundant literary works of great merit. As appreciation and acceptance are the ‘sine qua non’ of every composition, in order to serve the changed taste of the readers and therefore to make their compositions befitting to the age, the Sanskrit scholars of Bengal experimented, modified and at times flouted the conventional dictums of Sanskrit dramaturgy.

5. Some exemplary Sanskrit dramas authored in modern Bengal

Let us discuss a few specimens of dramatic compositions emanating from the pens of the scholars belonging to Bengal. These dramas have not only maintained the continuity of Indian traditions of dramaturgy but have also reflected the present-day socio-cultural situation proving their relevance to the contemporary society.

Mm. Kalipada Tarkacharya, one of the most eminent scholars of Bengal, has five dramas to his credit – ‘Naladamayantīyam’, ‘Māṇavakagauravam’, ‘Sindhunidhanam’, ‘Syamantakoddhāravyāgohaḥ’ and ‘Praśāntaratnākaram’ (Chattopadhyay 1992). The dramas of

Tarkacharya mostly belong to the old tradition. He chose his themes from the Rāmāyaṇa, Mahābhārata, Purāṇas and quasi-historical episodes. He followed the technique and style of old dramatists while developing the plot, presenting the different stages of action and projecting the social and spiritual values but these dramas show the influence exerted on them by the technique of contemporary Bengali folk drama known as Yātrā.

Pt. Panchanan Tarkaratna composed two dramas- 'Amaramaṅgalam' and 'Kalaṅkamocanam' (Chattopadhyay 1992). Both the dramas hold ample traces of the impact created on the mind of the dramatist by the novels of Bankim Chandra Chattopadhyay and Ramesh Chandra Dutta, and the influence of the national freedom movement of our country. These dramas praise the age-old eternal values, and at the same time impress upon the connoisseurs the necessity of protecting the sovereignty of the motherland with great care.

Mm. Haridas Siddhantavagish gifted Sanskrit literature with four dramas— 'Mivārapratāpam', 'Vaṅgīyapratāpam', 'Śivājīcaritam' and 'Virājasarojinī' (Chattopadhyay 1992). Siddhantavagish was greatly influenced by the heroic deeds of the historical characters. In his dramas, he described the fundamentalism and the maladministration of the Muslim rulers along with the degenerated state of society during that reign with meticulous care. The impact created on the mind of the playwright by the independence movement is revealed everywhere. The influence of the novel 'Ānandamaṭh' by Bankim Chandra Chattopadhyay is also evident. The poet voiced the glory of independence of our motherland more than the glory of a particular society and the administration of a particular community.

Pt. Vishweswar Vidyabhusan, one of the diligent dramatists of Bengal, composed a good number of Sanskrit dramas, namely—'Bhāratamelanam', 'Cāṇakyavijayam', 'Vālmīkisaṃvardhanam', 'Uttarakurukṣetram' and 'Prabuddhahimācalam' (Chattopadhyay 1992). His works are noted for employment of simple Sanskrit and enchanting meters and for the introduction of the technique of incorporating songs, frequently adopted by the folk-art form named Yātrā in Bengal. One of the salient features of Vidyabhusan's dramas is the complete absence of Prākṛta in them. Keeping in mind the socio-cultural condition of the contemporary age, he used Sanskrit as the language of all his characters including the females making a marked difference from the traditional rules of dramaturgy.

Dr. Jatindra Bimal Chaudhuri, one of the most industrious playwrights of Bengal bestowed Sanskrit literature with a great number of compositions. Dr. Chaudhuri set themes of many of his dramas from the Gauḍīya Vaiṣṇava movement; 'Bhaktiviṣṇupriyam', 'Mahāprabhu-haridāsam' etc. are some examples (Chattopadhyay 1992). The tremendous influence of the poet Jayadeva, composer of 'Gītagovindam', is clear from the technique of the songs incorporated in these dramas. Dr. Chaudhuri was greatly influenced by the life and deeds of the sagacious descendants of Bengal. He paid his homage to those great personalities in his dramas, namely, 'Bhāskarodayam', 'Muktisāradam', 'Bhāratavivekam' and 'Subhāṣa-subhāṣam' (Chattopadhyay 1992). The dramas of Dr. Chaudhuri reject the old practice of using Prākṛta dialogues for females and people belonging to the lower strata of the society and use Sanskrit instead. The spouse of Dr. Chaudhuri, Mrs. Roma Chaudhuri, is equally famous in the field of Sanskrit literature. She selected the themes from the

Rāmakṛṣṇa-Vivekānanda movement as well as from the life histories of great personalities like Mahāprabhu Caitanya, Mahatma Gandhi, Sister Nivedita and so on. 'Yugajīvanam', 'Abhedānandam', 'Caitanya-caitanyam', 'Bhāratatātam', 'Niveditā-nivedanam' etc. are some of her compositions worth-mentioning (Chattopadhyay 1992). The dramas composed by the Chaudhuri couple follow some of the old techniques and trends but nevertheless, they keep the language as close as possible to the Bengali language and incorporate certain techniques of folk-art form prevalent in Bengal to serve the purpose of making these dramas enjoyable to the mass.

Pt. Sreejib Nyayatirtha was the top-notch of the Sanskrit literary circle of his contemporary era. This genius chose themes from the vast canvas of both the ancient and the modern history. The range of the themes adopted by him varies from the Purāṇas to the life history of Shankaracharya to the horror of second world war and even to the partition of Bengal. 'Svātantryasandhikṣaṇam', 'Rāgavirāgam','Puruṣa-puṅgavam', 'Nāganistāram', 'Mahākavi-kālidāsam', 'Kṣutkṣemīyam', 'Cauracāturīyam', 'Cipiṭakacarvaṇam' etc. earned great admiration among the connoisseurs of Sanskrit literature (Chattopadhyay 1992). The farcical works of Nyayatirtha deserve special mention. These plays represent a completely different type of dramatic art which casts a sarcastic fling at the deficiencies of man and the weaknesses of the society prevalent in his time. These plays also reflect the selfishness and foolishness of the modern human society marked in absolute contra-distinction to the harmony and tolerance of the ancient society.

Dr. Siddheswar Chattopadhyay composed his dramatic creations on the model of the farcical plays of Pt Nyayatirtha. Dr. Chattopadhyay has contributed to Sanskrit literature with four plays— 'Athakim', 'Dharitrīpatinirvācanam', 'Svargīyahasanam' and 'Nanāvitādanam' (Chattopadhyay 1992). In the first three plays he chose themes from the national and international political scenes, and mercilessly ridiculed the degeneration of the entire political system. In the last one he depicted the plight of Sanskrit in present days. The selection of themes of Dr. Chattopadhyay is more modern and the satire is more pointed, as a result of which his dramas are considered to be the best specimens of farcical plays composed in the recent years.

Equally interesting are the dramas composed by Dr. Birendra Kumar Bhattacharyya. Not only did he choose his themes from the life history of Kālidāsa, Gautama Buddha and Mahāprabhu Caitanya, but also tried his hand skillfully on the modern topics such as gherao, refugee problems, Naxalite movement and the workers of STC. Besides the deficiencies and weaknesses of the society, Bhattacharyya was also well aware of the fact that majority of the troubles start because of the unsympathetic attitude of the persons at the helm of affairs in all the sectors of education and employment. 'Kavikālidāsam', 'Siddhārthacaritam', 'Śrīgītagaurāṅgam', 'Veṣṭanavyāyogaḥ', 'Śārdūlaśatakam' etc. are some of his noteworthy compositions (Chattopadhyay 1992).

The tendency to collect scenes from contemporary, social and political scenes is found in the drama of Professor Amiya Nath Chakravorty, who has to his credit several dramas, namely, 'Meghanādavadham', 'Sambhavāmiyugeyuge' and 'Dharmarājyam'(Chattopadhyay 1992). Professor Chakravorty depicted the social and political episodes in the framework of the narratives taken from the Rāmāyaṇa, Mahābhārata and Śrīmadbhagavadgīta. In these works, the religious angle is pronounced in a completely different note (Chattopadhyay 1992).

6. Conclusion

The analysis of modern Sanskrit dramas penned by the authors belonging to Bengal from the last century till date shows a tendency for selecting themes from contemporary political, social, industrial and academic scenes. The portrayal of ethical values by creating dramatic versions of the stories contained in early Sanskrit literature and teachings of great personalities like Gautama Buddha, Mahāprabhu Caitanya, Sriramakrishna Paramahamsa etc. is noted as another salient feature of these writings. Above all, a penchant for composing dramas abiding by the traditional rules but at the same time by introducing certain new techniques to serve the taste of the modern literary circle befitting the developments occurring in the contemporary literature across our country, attributing to the juxtaposition of tradition and modernity, can be pointed as the most commendable tendency of the modern Sanskrit literature in Bengal.

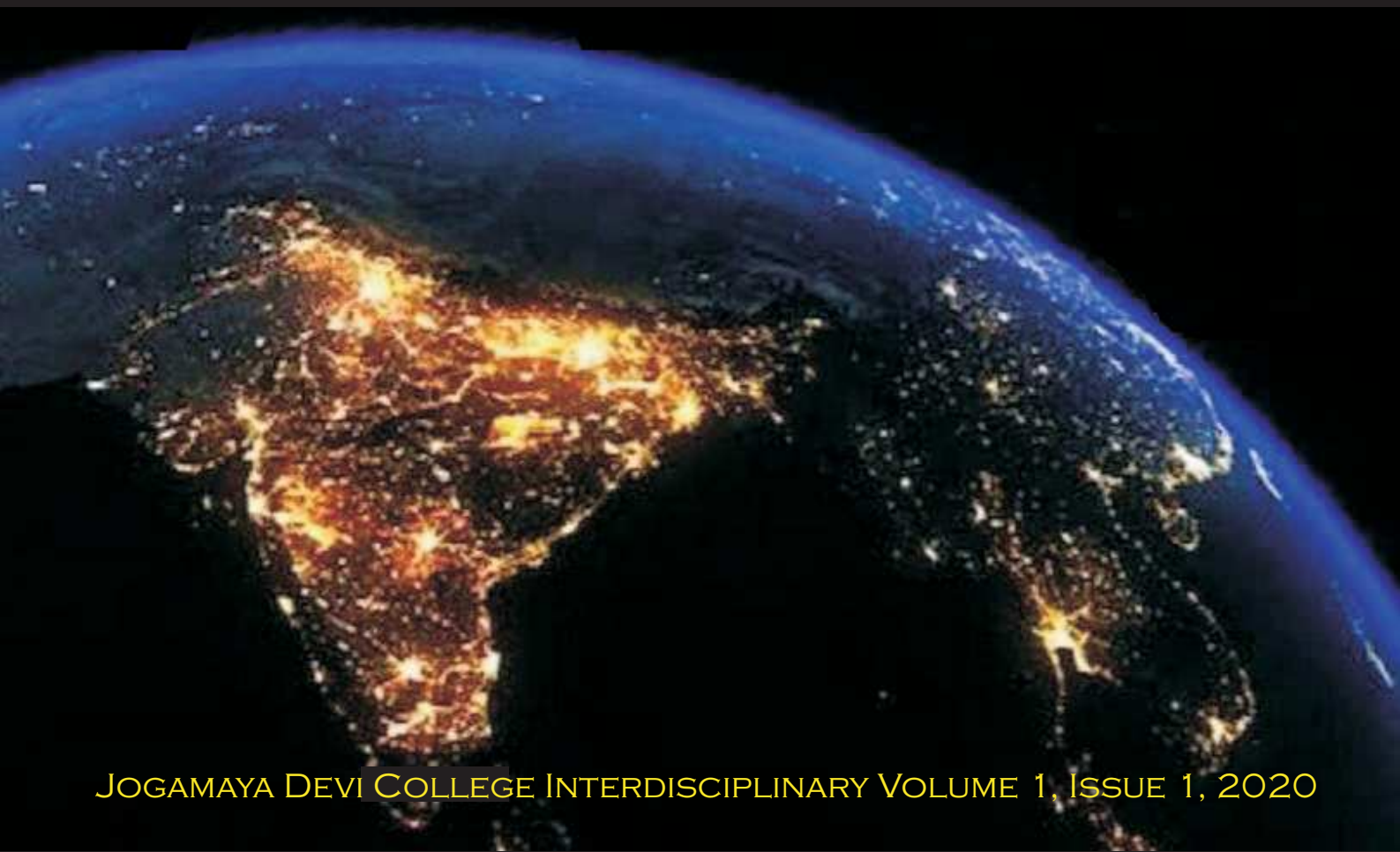
REFERENCES

1. Acharya, S.N., Das, D.K.(ed.), 2005. Dasharupakam. Sadesh, Kolkata.
2. Bandyopadhyay, S.C.,1963. Saṃskṛta Sāhitye Bāṅgālīra Abadāna. Sanskrit Pustak Bhandar, Kolkata.
3. Chattopadhyay, R., 1992. Modern Sanskrit dramas of Bengal (20th Century A.D.). Sanskrit Pustak Bhandar, Kolkata.
4. Das, N., 2013. Saṃskṛtasāhityepaścimbaṅgasyāvadānam. Kathabharati, Kolkata.
5. De, S.K.,1960. Bengal's Contribution to Sanskrit Literature & Studies in Bengal Vaisnavism (Reprint). Firma K.L.Mukhopadhyay, Kolkata.
6. Dutta Shastri, K.K., 1974. Bengal's Contribution to Sanskrit Literature. Sanskrit College, Kolkata.
7. Jha, V.N., 2003. Sanskrit Writings in Independent India. Sahitya Akademi, New Delhi.
8. Mukhopadhyay, A., 1979. Saṃskṛta Kāvyacarcāya Bāṅgalī: sekāla o ekāla. Sanskrit Pustak Bhandar, Kolkata.
9. Mukhopadhyay, B.K., 1979. Sāhityadarpaṇaḥ of Viśvanātha Kavirāja. Sanskrit Pustak Bhandar, Kolkata.
10. Nagar, R.S., 2004. Nāṭyaśāstra of Bharatamuni. Parimal Publications, New Delhi.
11. Sen, S., 2019. Bhāratavarṣe Ādunikasaṃskṛtasāhityam; Vihaṅgamadṛṣṭya Pariśīlanam. Sanskrit Pustak Bhandar, Kolkata.
12. Sharma, M.,2011. Ādunik Saṃskṛta Kāvya Kī Paramparā. Rashtriya Sanskrit Sansthan, New Delhi.
13. Tripathi, R.B., 1999. Saṃskṛtasāhitya:Visvī Śatābdī. Rashtriya Sanskrit Sansthan, New Delhi.

Dr. Sushree Chakraborty
Dr. Sushree Chakraborty is an Assistant Professor of Sanskrit at Jogamaya Devi College. She was awarded with Ph.D degree on Sanskrit Dramaturgy from Jadavpur University in 2013. Her research interests include Modern Sanskrit Literature and Buddhist Literature.

Changing Trends in Human Thoughts and Perspectives: Science, Humanities and Culture, Part I

This volume, entitled "Changing Trends in Human Thought and Perspective: Science, Humanities and Culture, Part I", is an agglomeration of peer-reviewed articles authored by college and university teachers and researchers from various disciplines, who have explained in a lucid and easily understandable manner the gradual evolution of human knowledge and understanding in different areas of natural sciences, social sciences, humanities, and culture. Each article, reviewed by eminent academicians, presents a comprehensive description of the history of progressive development of a particular concept or idea during a period of time. This interdisciplinary discourse aims to enable the students from different branches of learning to enrich their own knowledge bases, and may also help the researchers and academicians to enhance their own works with the ideas from other disciplines.



Jogamaya Devi College Interdisciplinary Volume 1, Issue 1, 2020