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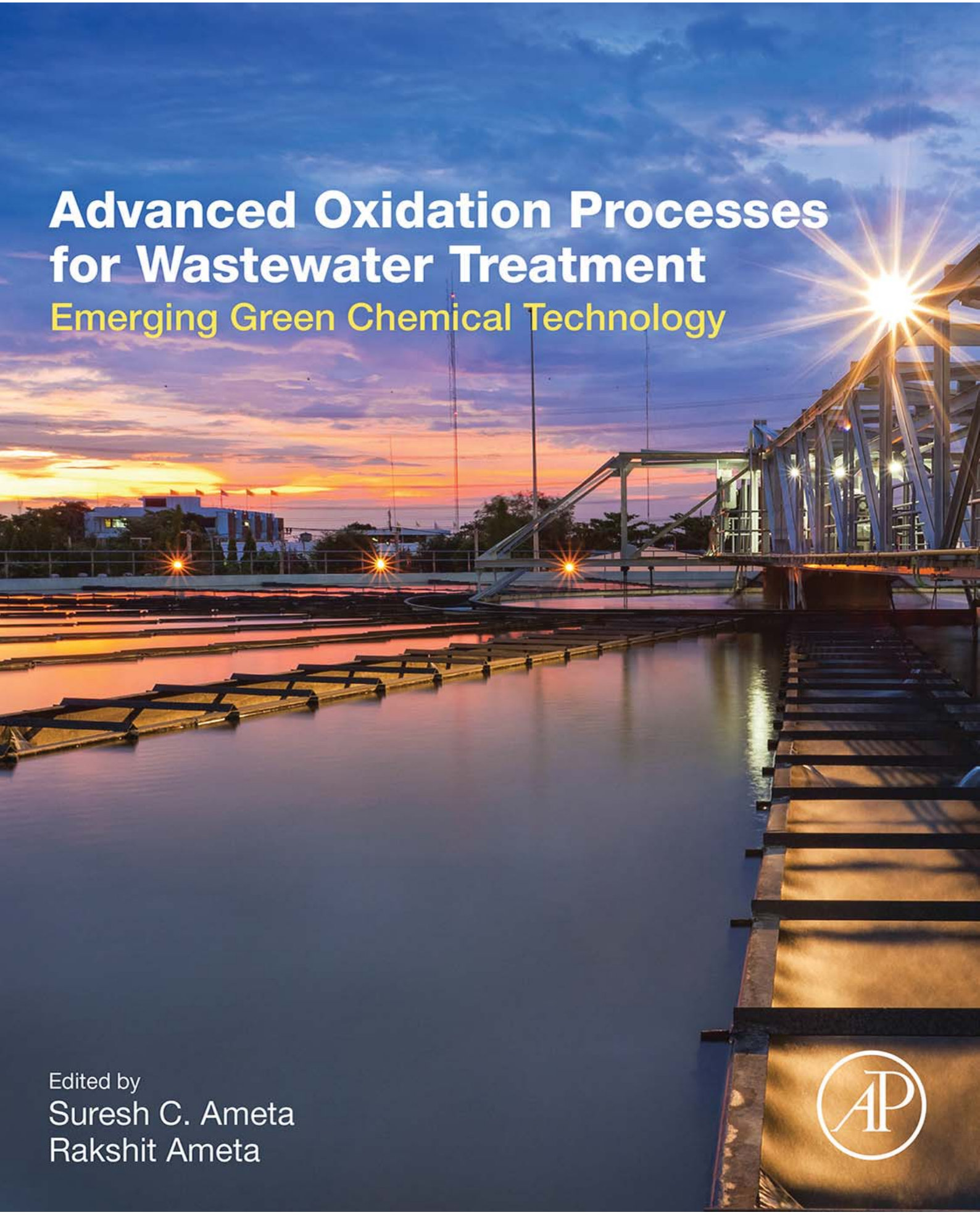

Edited by
Suresh C. Ameta
Rakshit Ameta

ADVANCED OXIDATION PROCESSES FOR WASTEWATER TREATMENT

Emerging Green Chemical Technology

Edited by

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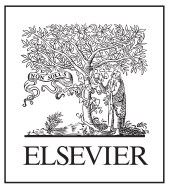
PAHER University, Udaipur, Rajasthan, India

Rakshit Ameta
J. R. N. Rajasthan Vidyapeeth (Deemed-to-be University), Udaipur, Rajasthan, India



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CHAPTER

3

Fenton and Photo-Fenton Processes

Rakshit Ameta[1], *Anil K. Chohadia*[2], *Abhilasha Jain*[3] *and Pinki B. Punjabi*[4]

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3.1 INTRODUCTION

Global economic growth is increasing exponentially in the first century of the new millennium, but at the same time, rapid urbanization and industrialization release enormous volumes of wastewater imposing various adverse effects on human health and grading the quality of the environment as a whole. It has been revealed that generation of wastewaters with complex and recalcitrant molecules is increasing day by day. The presence of these organic compounds in water poses a serious threat to public health since most of them are toxic, endocrine disrupting, mutagenic, or potentially carcinogenic to humans, animals. and aquatic life. There is a pressing demand for newer technologies for the complete mineralization of wastewaters.

Several conventional treatment methods are available such as biological, adsorption, chemical treatment, filtration, flocculation, activated charcoal and ion exchange resins for wastewater remediation. It has been frequently observed that pollutants not amenable to biological treatments may also be characterized by high chemical stability and/or by strong difficulty to be completely mineralized. In this context, oxidation processes are preferred to degrade such biorefractory substances present in wastewater. However, pollution load, process limitations, and operating conditions are the key factors to be considered during the selection of the most appropriate oxidation process for the degradation of a particular compound. Apart from high degradation efficiency, direct oxidation processes demand specified operating conditions to degrade the target compounds, which will increase the operation cost of the process.

Advanced Oxidation Processes for Wastewater Treatment
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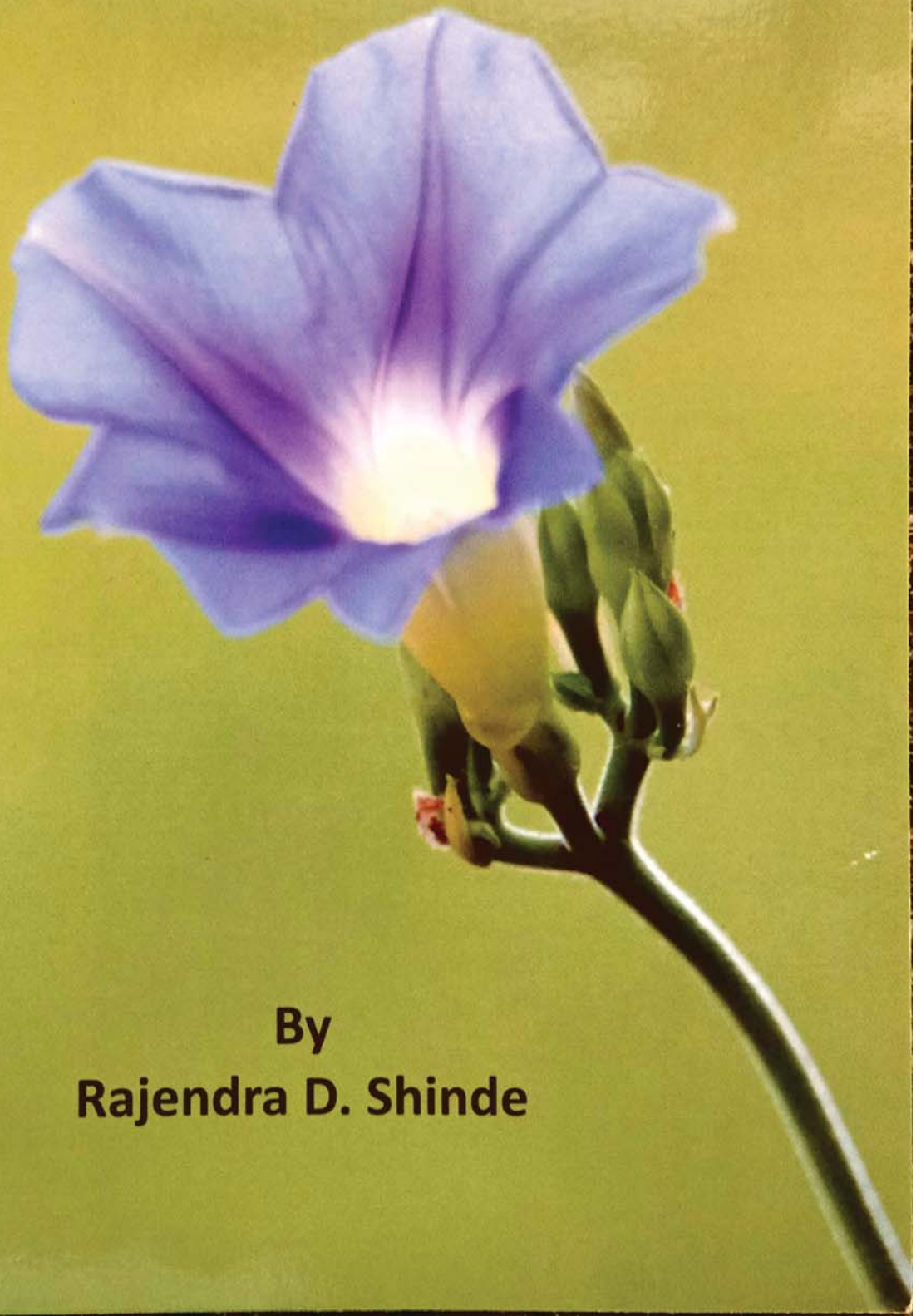
Floral Diversity of Nandur Madhameshwar Wildlife Sanctuary

A Pictorial guide



By
Rajendra D. Shinde

Floral Diversity of Nandur Madhameshwar Wildlife Sanctuary
- A pictorial Guide

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Floral Diversity of Nandur Madhameshwar Wildlife Sanctuary

A Pictorial guide

By
Rajendra D. Shinde

PREFACE

The diverse flora of India has been documented mainly in formal "Floras" ranging from J.D.Hooker's Flora of British India (1875-1897) to district or even taluka-level floras. However, the rapidly growing interest amongst laypeople in the environment and in nature study in the last two to three decades has created a demand for literature which would help a layperson to identify and learn more about the flora of a region; Flowers of Sahyadri by Shrikant Ingalhalikar (2001) was a pioneering and very successful attempt to fill this lacuna for the much-visited mountains of the Sahyadris; Pradip Krishen's Trees of Delhi (2006) and his more recent, Jungle Trees of Central India - a Field Guide for Tree Spotters (2013) are other popular examples; incidentally both the above authors are non-botanists!

A visitor to a wildlife sanctuary is primarily interested in the fauna, in a wetland the primary interest is birds, yet in the intervals when the animals are not visible a secondary interest often arises in identifying the flora, especially flowers or plants with some peculiar morphology. This book is an attempt to help the visitor to Nandur Madhameshwar Wildlife Sanctuary identify and learn some uses of the plants most likely to be encountered and noticed by an amateur visiting the Sanctuary. We hope to stimulate an interest in the diversity and beauty of the flowering plants in a wetland and, thus, promote their appreciation and conservation.

Rajendra Dattatraya Shinde

ACKNOWLEDGEMENT

This book would not have been possible without the help of Late Dr. Marselin R. Almeida and Dr. (Ms.) Saramma Almeida who initiated the project and was involved in the project till its completion.

I thank the Maharashtra Forest Department for financing this book, especially Shri. M.K. Rao, Additional Principal Chief Conservator of Forests (Wildlife West), Borivali, Mumbai; Shri. N. R. Praveen, Conservator of Forests (Wildlife), Nashik, and Shri. Bharat Shinde, Assistant Conservator of Forest, Nandur Madhameshwar Wildlife Sanctuary, Nashik; it was Shri. B. Shinde who pushed me to write this book.

I am thankful to Dr. Rajdeo Singh who took the responsibility of taking photographs in the field as also in the compilation of the book & Ms. Candice Dcosta, who painstakingly edited the original manuscript of my thesis earlier.

I would like to acknowledge the help provided by Mr. V. K. Mohan, Retired IFS office, who was the DFO, Nashik during 1984-88, and Mr. Debi Goenka who accompanied us on field trips and taught me to identify a few common waders.

I am grateful to Dr. Agnelo Menezes, Principal, St. Xavier's College (Autonomous), Mumbai for constant support and encouragement, and to my colleagues in the Blatter Herbarium & Botany Department for helping me in sharing my responsibilities and giving me time to do this work.

And finally to my family who always support me in all my endeavors...

Rajendra Dattatraya Shinde
Mumbai
January 11, 2018.

Disclaimer

INTRODUCTION :

Nandur Madhameshwar Wildlife Sanctuary, also known as 'Mini-Bharatpur' of Maharashtra, is situated at 20°00.780' N and 74°10.4424' E in Niphad tehsil of Nashik district (Map 1). The primary routes to reach this area are from Nashik via, either Sayakheda (35 kms) or Sinnar (55 kms). Niphad railway station on the Central Railway is 12 kms from Nandur Madhameshwar and can be traversed by ST bus. A stone pick-up weir was constructed in 1907-13 across the river Godavari just below the confluence of Kadwa and Godavari rivers at Nandur Madhameshwar; the water level therefore is always fluctuating in Nandur Madhameshwar Lake. This reservoir is surrounded by grape vineyards and fields of sugarcane, onions, jowar, wheat. There are no forests in this area but it is rich in herbaceous flora and aquatic vegetation.

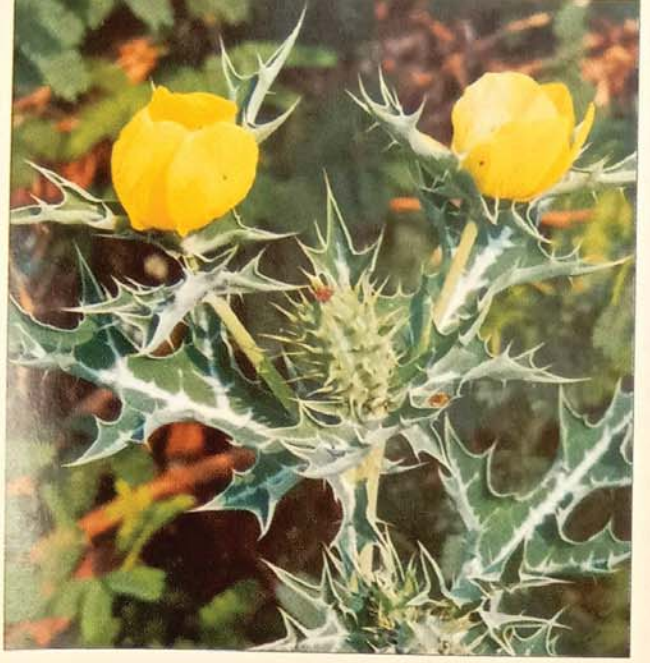
An irrigation reservoir which is known as 'Khangaon thadi' or Nandur Madhameshwar reservoir is situated near Khangaon thadi village, about 2 km away from Nandur Madhameshwar. Due to siltation, the reservoir is gradually becoming a shallow lake and it represents a sort of marshy ecosystem. It has three big islands in the middle and has an abundance of vegetation, fishes, mollusks and insects. Various species of *Cyperus, Typha, Amaranthus, Potamogeton, Ipomoea* and *Eichhornia* which are abundant on the islands provide excellent hiding and roosting places especially for different types of ducks. It is a paradise for many other birds; they feed upon plants and build their nests on them. Recent surveys have recorded 265 species of birds, 7 mammal species and 41 butterfly species in the area (Forest Dept., Nashik Div.). Due to constant efforts of local organizations, Bombay Natural History Society (BNHS), World Wide Fund for Nature-India (WWF-India) and the Forest Department, in 1978, this area was declared as a 'Protected Area' under the Wildlife (Protection) Act 1972 by the Maharashtra Government (Gaz. of Govt. of Maharashtra, 1978) and subsequently was declared as Nandur Madhameshwar Wildlife Sanctuary (Government of Maharashtra, Revenue and Forest Dept. Gazetteer, March 20, 1986, under the sub-sections (1) and (2) of Section 18 of the Wildlife (Protection) Act, 1972 (53 of 1972) (Appendix I page 29). The Nandur Madhameshwar Wildlife Sanctuary spans an area of 100.12 sq. km.

Two canals emanate from the Nandur Madhameshwar reservoir - the Godavari Left Bank Canal and the Godavari Right Bank Canal - with a total capacity of 7,763 m.c.ft. The reservoir irrigates a cultivable area of 88,000 Acres, which falls in Niphad and Yeola tehsils of Nashik district and Kopergaon tehsil of Ahmednagar district. The Godavari Right Bank Canal is approximately 111 km in length and irrigates a cultivable area of 1,36,380 Acres, falling in Niphad and Sinnar tehsils of Nashik district and Kopergaon and Shrirampur tehsils of Ahmednagar districts.

Historical importance:

In the middle of the riverbed in between Khangaon thadi and Nandur Madhameshwar village, standing on a small rocky islet, is a 250 years old temple of 'Madhyameshwara' from which the village has derived it's the second half of its name. The lamp pillar near the temple bears an inscription dated 1738 with the name of an ascetic.

Agricultural importance : Niphad tehsil has an area of 1,05,228 ha, of which 90,631 ha is

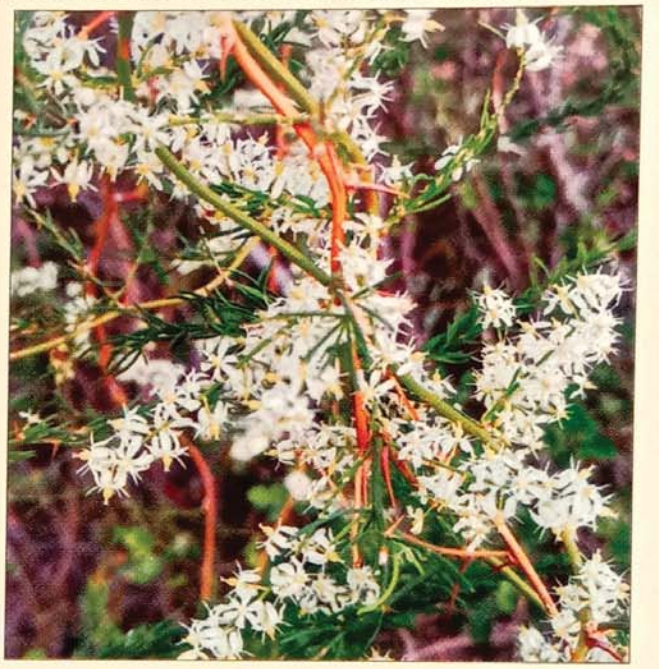


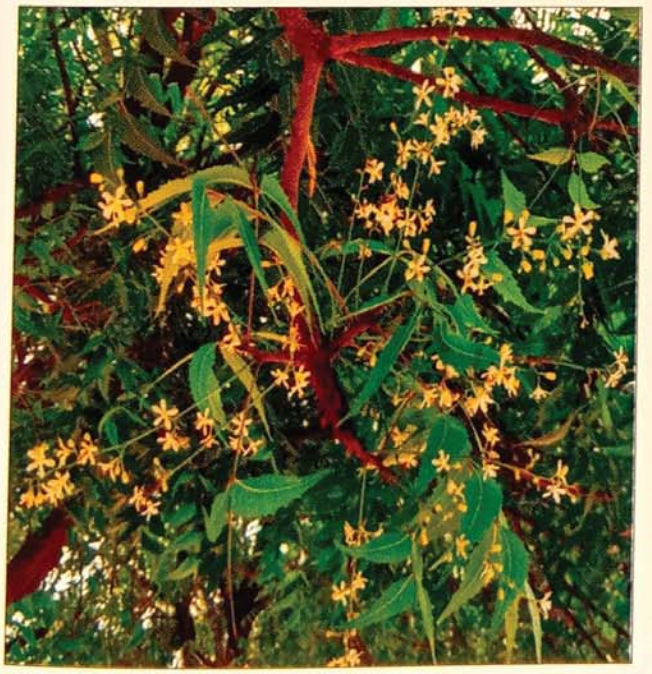
Argemone mexicana L.

Family : Papavaraceae
Common Name : Pivala-Dhotra
Habitat : Common weed in waste land and in cultivated fields
Location : Khangaon thadi, Manjargaon
Fl. & Fr. : Throughout the year
Description : Annual, erect, prickly herb. Leaves are radical or cauline, variegated white, spiny on margins and veins, sessile. Flowers are yellow, axillary, solitary.
Uses : Entire plant is anti-fungal and also possess anti-leprotic activity.

Asparagus racemosus Willd.

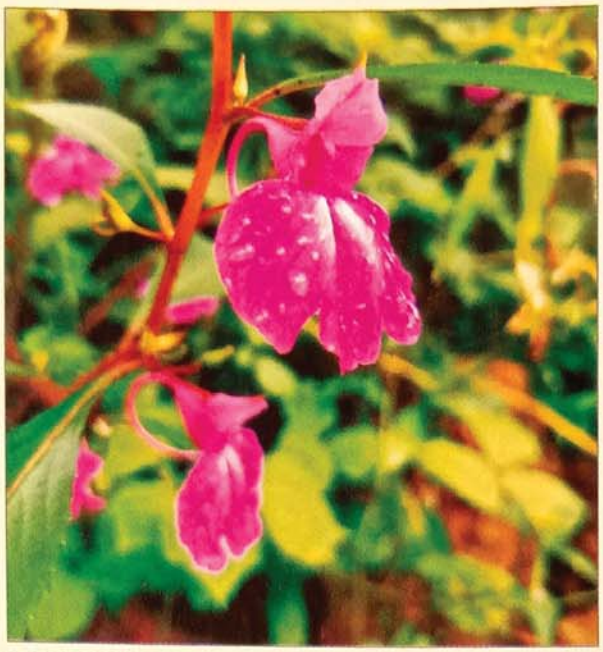
Family : Liliaceae
Common Name : Shatavari
Habitat : Common along the hedges
Location : Khangaon thadi
Fl. & Fr. : June to October
Description : Shrubs with tuberous fascicled roots. Cladodes slender, glabrous. Flowers white in raceme.
Uses : Bark of plant show antibacterial activity and roots are used as galactogogue.





Azadirachta indica (L.) A. Juss.

Family : Meliaceae
Common Name : Kadunimb
Habitat : Commonly cultivated along the canal and road sides.
Location : Khangaon thadi, Manjargaon
Fl. & Fr. : March to June
Description : Trees with leaves crowded near end of branches. Leaflets ovate-lanceolate. Flowers white, in axillary panicles.
Uses : Flowers and Leaves are antibacterial and used as an analgesic.

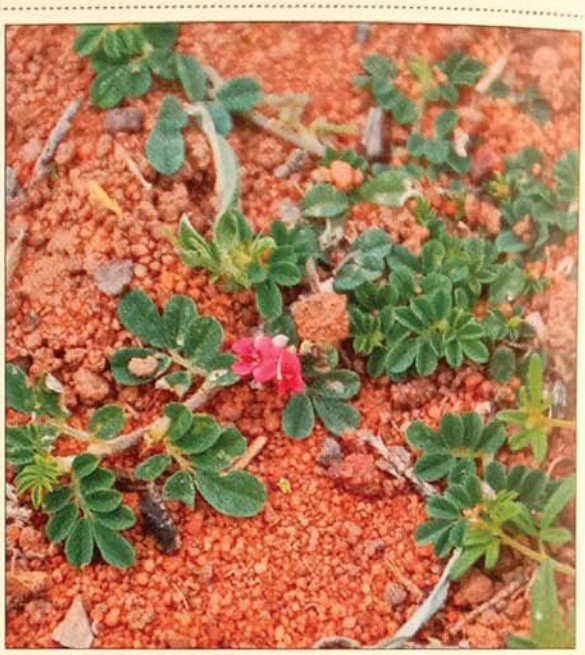


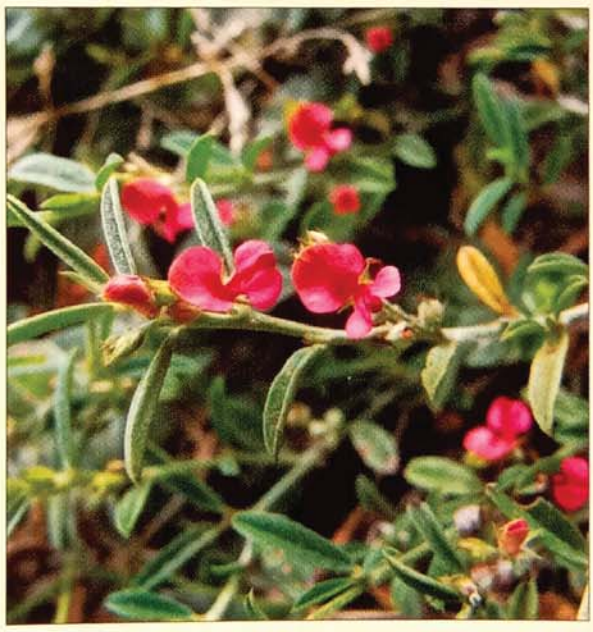
Impatiens balsamina L.

Family : Balsaminaceae
Common Name : Terda
Habitat : Rare in horticultural land.
Location : Khangaon thadi
Fl. & Fr. : July to August
Description : Annual herbs with alternate, elliptic, acute leaves. Flowers pink, axillary, fascicled; lateral sepals ovate with short spur.
Uses : Plant possess anti-fungal and anti-cancer activity.

Indigofera cordifolia Heyne ex Roth

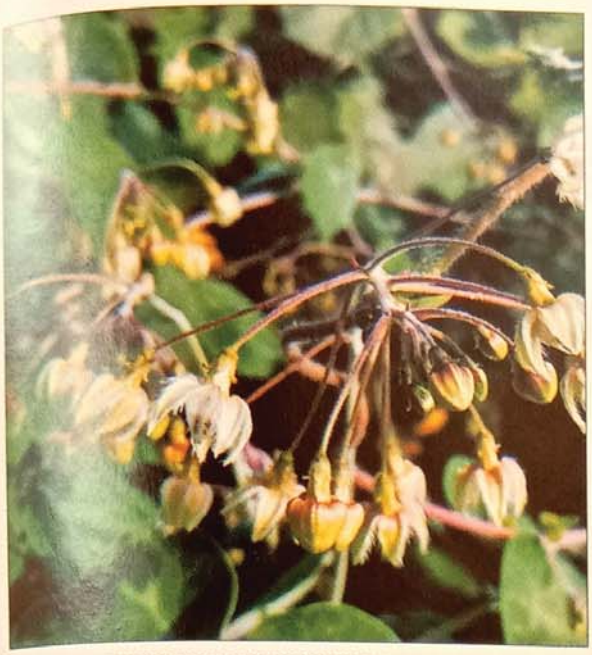
Family : Fabaceae
Common Name : Bechka
Habitat : Common along the river bed
Location : Khangaon thadi
Fl. & Fr. : Throughout the year
Description : Herbs, prostrate, pilose. Leaves are ovate, acute, cordate, pilose on both surfaces. Flowers are red, 4-6 in number, in condensed racemes, tomentose.
Uses : Seeds are aphrodisiac and used as bitter tonic.
Photo : Dr. Mayur Nandikar





Indigofera linifolia (L.f.) Retz.

Family : Fabaceae
Common Name : Lal Godhadi
Habitat : Common along the river bed.
Location : Khangaon thadi, Manjargaon
Fl. & Fr. : July to December
Description : Herbs, prostrate, much branched, pubescent. Leaves simple, linear, acute, pubescent on both sides. Flowers bright red, in sessile or shortly peduncled axillary racemes.
Uses : Seed oil is anti-microbial and nutritive tonic.

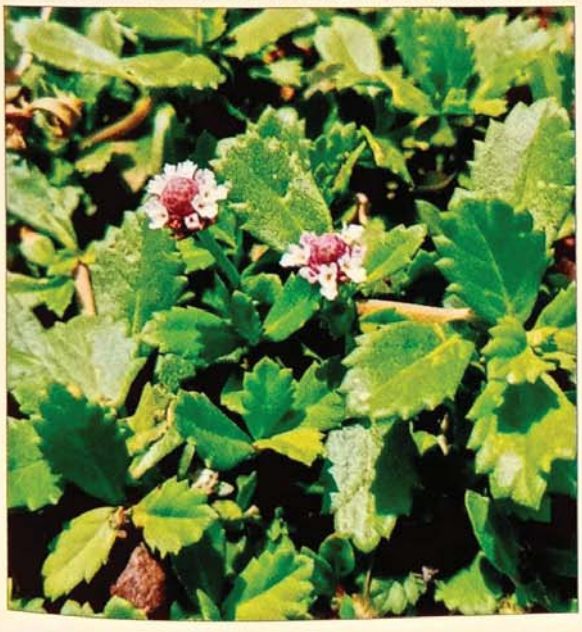


Pergularia daemia (Forssk.) Chiov

Family : Asclepidaceae
Common Name : Utarn
Habitat : Common along the hedges
Location : Khangaon thadi, Manjargaon, Tarul-Khedale
Fl. & Fr. : March to December
Description : Herbs, twining, with milky sap. Leaves suborbicular with cordate base. Flowers in cymes, pubescent.
Uses : Leaf juice is emetic and used against snake bite.

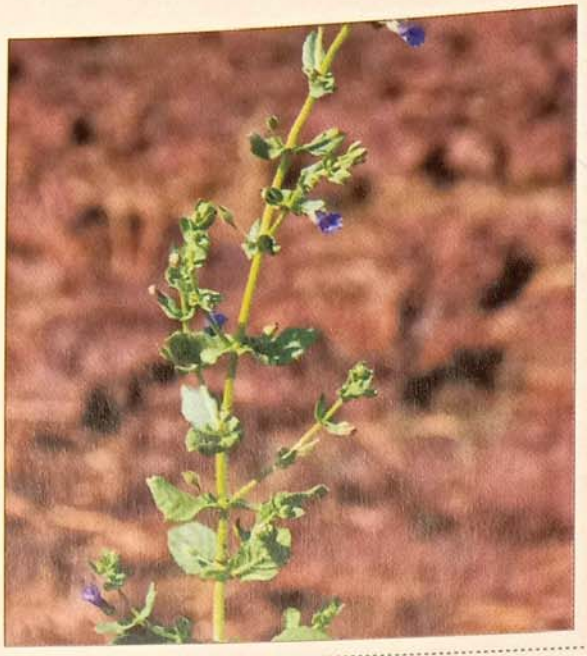
Persicaria glabra (Willd.) M. Gomez

Family : Polygonaceae
Common Name : Sheral
Habitat : Common along the river banks
Location : Madhameshwar, Manjargaon
Fl. & Fr. : October to March
Description : Herbs, stem thick, reddish after drying. Leaves lanceolate, acute or acuminate at apex, entire, glabrous. Flowers pink, in terminal racemes.
Uses : Leaves are used in colic pain and as febrifuge.



Phyla nodiflora (L.) Greene

Family : Verbenaceae
Common Name : Jalpimpli
Habitat : Common in dried cultivated lands
Location : Khangaon thadi
Fl. & Fr. : Throughout the year
Description : Herbs, prostrate, with woody root stocks, rooting at the nodes, pubescent. Leaves oblanceolate-obovate, subsessile to sessile. Flowers purple or white, solitary, axillary or in spikes.
Uses : Infusion of leaves and stalks are given to women after delivery and also plant is used for joint pain.

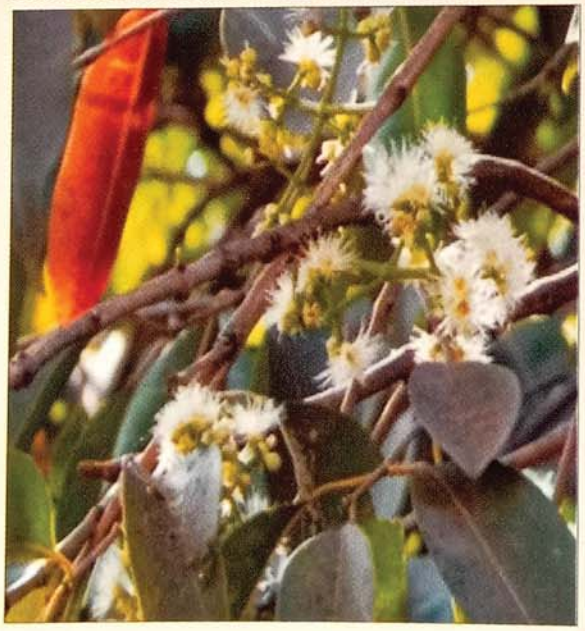


Stemodia viscosa Roxb.

Family : Scrophulariaceae
Common Name : Satmodi
Habitat : Common along the river banks and in moist places
Location : Khangaon thadi, Manjargaon, Madhameshwar
Fl. & Fr. : November to January
Description : Herbs, erect, aromatic; stem and branches are viscidly pubescent. Leaves sessile, oblong, acute, serrate, pubescent. Flowers purple, solitary, axillary or in terminal racemes.
Uses : Infusion of plant is used as demulcent.

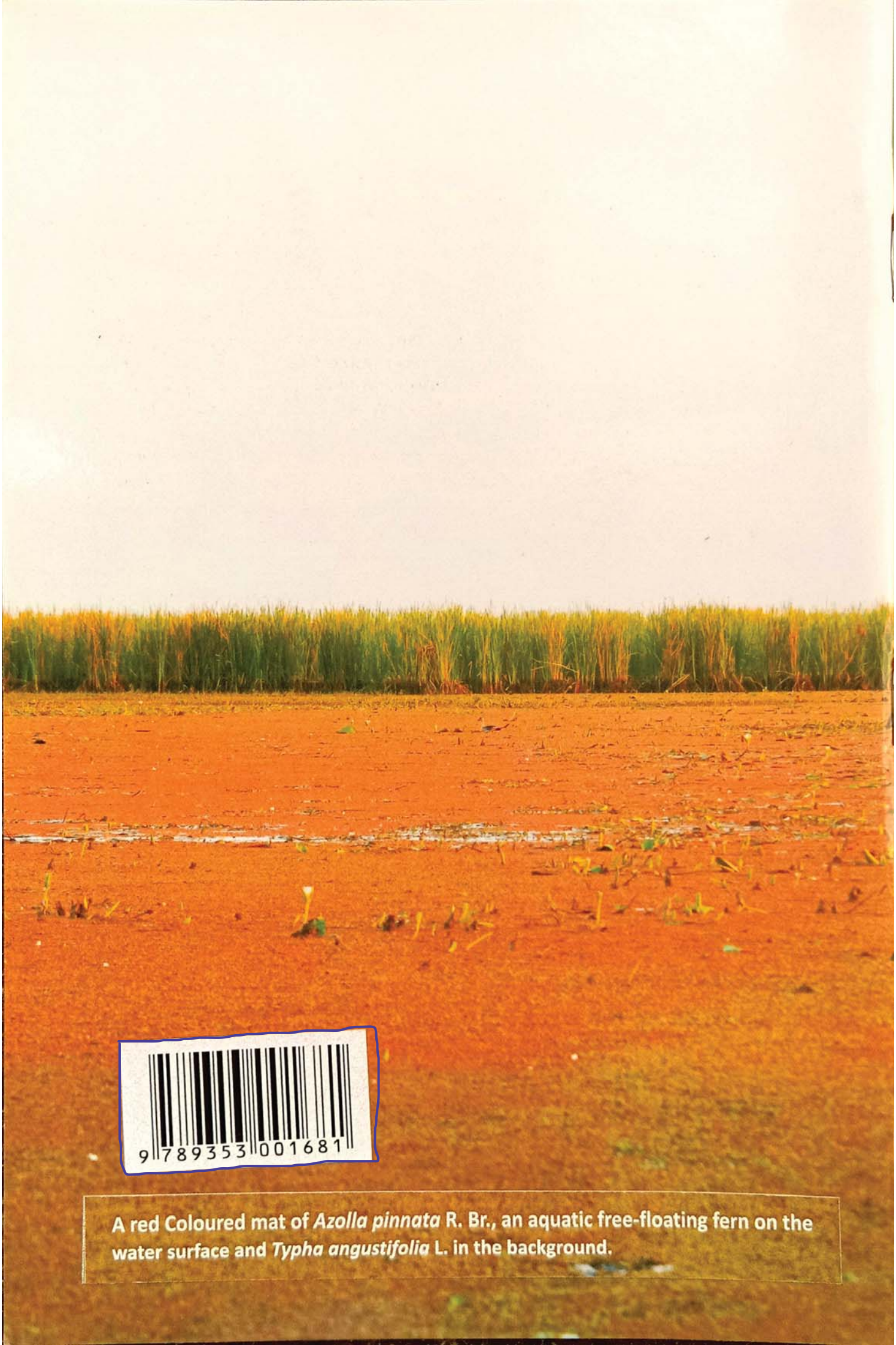
Striga angustifolia (D. Don) Saldanha

Family : Scrophulariaceae
Habitat : Rare in grasslands
Location : Madhameshwar
Fl. & Fr. : July to October
Description : Much branched stout herb. Leaves linear, sessile, scabrous. Flowers sessile or shortly pedicellate, in long, erect spikes or racemes.
Uses : Plant is used in diabetes



Syzygium cumini (L.) Skeels

Family : Myrtaceae
Common Name : Jambhul
Habitat : Common; cultivated in the farms and gardens for its edible fruits
Location : Khangaon thadi
Fl. & Fr. : March to May
Description : Trees, Leaves lanceolate, elliptic-oblong or broadly ovate-elliptic. Flowers dirty white, in panicled cymes.
Uses : Fruit is used in diarrhoea and dysentery.



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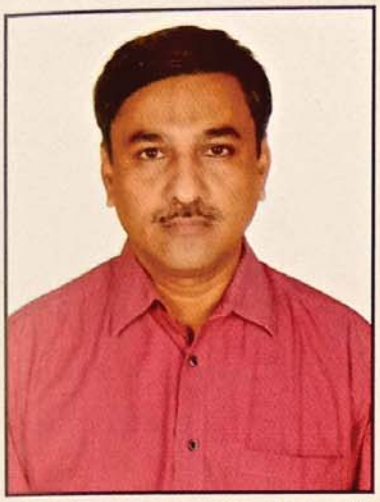
A red Coloured mat of *Azolla pinnata* R. Br., an aquatic free-floating fern on the water surface and *Typha angustifolia* L. in the background.



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Dr Rajendra D. Shinde is the Head, Department of Botany & the Director, Blatter Herbarium at St. Xavier's College (Autonomous), Mumbai.

He is the member of the "Plant Biodiversity Expert Committee", Maharashtra State Biodiversity Board since 2017. He has served the St. Xavier's College in the capacity of Vice-Principal from 2010 to 2017. He is Elected Fellow of the Indian Association Angiosperm Taxonomy, Life Member of Society of Ethnobotany, Association of Plant Taxonomy, Indian Botanical Society, Bombay Natural History Society, Alumni of the Fulbright-Nehru Programme (2012), Rotary Foundation-Rotary International: GSE programme (2000), Nominated Member of Tree Authority - Thane Municipal Corporation (2014-2017). Angiosperm Taxonomist by specialization, he has been teaching Botany at St. Xavier's College, Mumbai since 1991. He has also served as a Curator of the Blatter Herbarium from 1983 to 1991. During the year 2003-2004, Dr Shinde had an opportunity to serve as a senior lecturer at the Faculty of Natural Sciences, University of Guyana, Georgetown, Guyana (South America). Systematic and ecological studies on the Nandur Madhmeshwar, Nashik District, Maharashtra (1988), Arboreal Flora of Greater Bombay (1993), Tree Census of Greater Bombay (1998), Tree Census of Thane Municipal Corporation (2002), Digitized Inventory of Medicinal Plants Resources of Maharashtra (2009-2013) are some of the major projects completed by him along with five minor research projects from various funding agencies.

Besides several research papers in reputed and peer-reviewed journals, he has authored a book entitled "Ethno medicinal plants of Raigad District, Maharashtra (2016). He is a well-known research guide in the field of Angiosperm Taxonomy and Ethnobotany and got 4 PhD awarded under his guidance so far.

During his Master's study at St. Xavier's College, along with Late Dr. M.R. Almeida, he had visited Nandur Madhameshwar during 1984-1988 regularly to study the flora of the area. He updated this work in the year 2012-2015. He has reported 536 plant species from the Nandur Madhameshwar Wildlife Sanctuary during this study. This book is the outcome of this study.

A Study of Retention and Motivational Practices in Banks with Special Reference to Mumbai City

Editors

Dr. Suvaiba I. Shirshikar

Dr. Megha Somani

Himalaya Publishing House

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A Study of Retention and Motivational Practices in Banks with Special Reference to Mumbai City

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पाठ्य-पुस्तक

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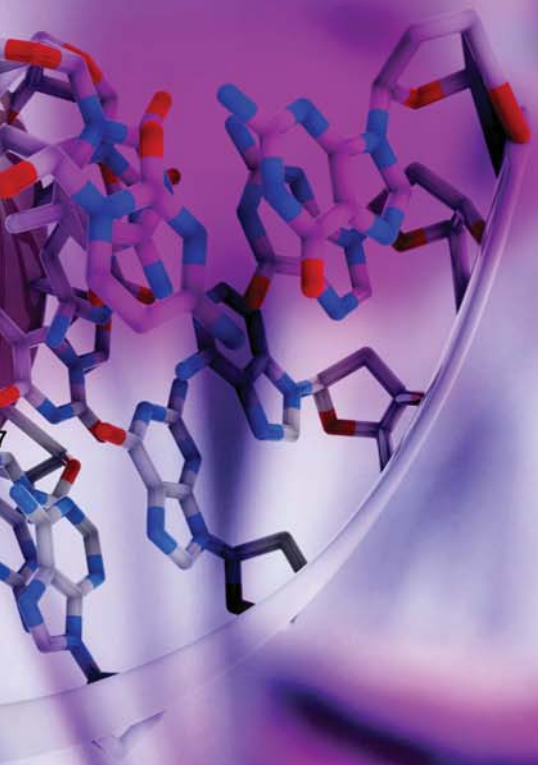

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CONTENTS

FOREWORD

The sixth volume of Topics in Anti-Cancer Research presents some exciting contributions in frontier areas of anti-cancer research. These include the role of microtubules for the treatment of various cancers, novel chemoimmunotherapy drug combinations & methods in clinical studies/trial and current studies in targeting polyunsaturated fatty acids (PUFAs) in the treatment of colorectal cancer. Natural and synthetic chalcones and their derivatives that have shown potent anticancer activity against a number of cancer cell lines and murine tumor models are discussed. The discovery of selective small-molecule hLDH-A inhibitors and LDH-based approaches in the progress of anticancer therapy are also presented. Recent advances in microRNA-based cancer therapeutics for the treatment of cancer are presented. The role of inflammation in chemotherapy-induced neuromuscular effects and the side effects and recent relevant patents for beneficial approaches to improve heart failure cases due to inflammation, mitochondria and energy metabolism in cancer cachexia are also covered. It is hoped that the present volume will be found useful by a large number of scientists working in this field.

The editors are thankful to the authors for their excellent contributions and to the reviewers for their in -depth comprehensive comments for the improvement of chapters. We are also grateful to Mr. Mahmood Alam, Mrs. Rafia Rehan and other colleagues for their support and assistance in the finalization of this volume.

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INTRODUCTION

Topics in Anti-Cancer Research covers important advances on both experimental (preclinical) and clinical cancer research in drug development. The book series offers readers an insight into current and future therapeutic approaches for the prevention of different types of cancers, synthesizing new anti-cancer agents, new patented compounds, targets and agents for cancer therapy as well as recent molecular and gene therapy research.

The comprehensive range of themes covered in each volume will be beneficial to clinicians, immunologists, and R&D experts looking for new anti-cancer targets and patents for the treatment of neoplasms, as well as varied approaches for cancer therapy.

The topics covered in the sixth volume of this series include:

- The role of microtubules for the cure of various untreated cancers
- Novel chemoimmunotherapeutic drug combinations & methods in clinical studies/trials
- Targeting polyunsaturated fatty acids (PUFAs) in the treatment of colorectal cancer
- Anti-cancer activity of natural and synthetic chalcones and their derivatives
- Recent advances in microRNA-based cancer therapeutics
- Treatment of heart failure due to inflammation, mitochondria and energy metabolism in cancer cachexia
- Regulation/inhibition of human lactate dehydrogenase A for discovering anti-cancer drugs

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CHAPTER 1

Targeting Polyunsaturated Fatty Acid Metabolism in Colorectal Cancer Therapy: A Review of Recent Patents

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Abstract: In the recent years, fatty acids (FAs) have been acknowledged not only as building materials for lipid membranes and carbon source for β-oxidation, but also as important signaling molecules. In this field, polyunsaturated fatty acids (PUFAs) have received special attention as modulators of inflammation. The enzymes that process PUFAs into bioactive metabolites (cyclooxygenases, lipoxygenases) have already been targeted by pharmaceutical agents. Given the fact that intense synthesis of FAs is a metabolic hallmark of cancer, it is expected that FAs play an important role in cancer development, progression and invasion, and could be targeted by modern therapies. In this chapter, we will discuss the possible use of FAs and drugs affecting their metabolism against colorectal cancer (CRC), which is strongly associated with environmental factors such as high-fat, high caloric diet and obesity. We will cover the role of n-3 PUFAs as dietary supplements in primary prevention of CRC based on the results obtained from clinical trials, and elaborate on the latest patents designed to improve the bioavailability of PUFAs concentrates as nutritional treatments for patients with CRC. We will also discuss the enzymes processing PUFAs and their role in tumorigenesis with focus on their potential as markers for "molecular staging" (fatty acid synthases and elongases) and targets in therapy (cyclooxygenase 2 and lipoxygenase 5). Finally, we will examine new drug formulations (e.g. liposomes) and their utility in CRC therapy. The chapter is based on the review of literature (PubMed Database) and patent documents.

Keywords: Adjuvant therapy, chemotherapy, colorectal cancer, cyclooxygenase, dietary supplementation, docosahexaenoic acid, eicosapentaenoic acid, fatty acids, gastrointestinal cancer, inflammation, lipoxygenase, liposomes, nutritional treatment, polyunsaturated fatty acids, prevention, patents.

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1. INTRODUCTION

Colorectal cancer (CRC) is the second most common cancer in women and third in men, responsible for 600,000 deaths annually worldwide [1 - 3]. It is the fourth cause of oncological deaths, which creates a substantial global burden [4]. Up to 50% of CRC risk is lifestyle-related - most prominent risk factors include obesity, sedentary behavior, alcohol consumption, tobacco smoking, high-meat / high-calorie intake, as well as fat-rich and fiber-deficient diet [5]. All of these disturb the metabolic balance and add to CRC development. A cause-effect relation has been proven for alcohol (which promotes folate deficiency and thus leads to DNA instability and carcinogenesis) and tobacco smoking (which spreads carcinogens from cigarettes to colorectal mucosa, stimulating carcinogenesis) [5]. In turn, dietary habits and sedentary lifestyle not only cause obesity but also lead to the development of metabolic syndrome highlighted by a range of abnormalities encompassing impaired glucose tolerance, elevated blood pressure and dyslipidemia. These metabolic disorders tip the cytokine balance toward chronic low-grade inflammation and further disturb the levels of adipokines e.g. adiponectin and leptin, and insulin growth factors which all affect cellular proliferation, adhesion and migration [6 - 8]. Moreover, unbalanced diet can directly promote carcinogenesis by modifying the intestinal microbiome and making alterations in the complexity of the colorectal mucosa - for details see [6].

Alterations in lifestyle patterns through higher intake of fish and fish oils, dietary fiber, vitamin D and calcium, regular use of aspirin and habitual physical exercise modulate the course of CRC, especially at the initial stage of its development, and improve the quality of life of patients [5]. The protective role of fish and fish oils is mainly attributed to the high content of polyunsaturated fatty acids (PUFAs). The fact that aspirin also acts on the metabolism of PUFAs further suggests that these fatty acids may play a significant role in CRC development and possible prevention.

PUFAs are organic acids comprising of a carbohydrate chain with more than one double (C=C) bond in their structure. Long-chain PUFAs are divided into n-6 PUFAs (first double bond at C6, counting from the methyl C) and n-3 PUFAs (first unsaturated bond at C3). The main representatives of these groups are linoleic acid (LA, 18:2) for n-6 PUFAs and α-linolenic acid (ALA, 18:3) for n-3 PUFAs, together called essential fatty acids (FAs). The term "essential" emphasizes their importance in maintaining the optimal health of humans and other animals, as they cannot be synthesized de novo but have to be supplemented in the diet. These FAs provide the carbon chain necessary for the synthesis of longer FAs: n-6 arachidonic acid (AA, 20:4), and n-3 eicosapentaenoic acid (EPA, 19:5) and docosahexaenoic acid (DHA, 22:6) in the reactions catalyzed by

elongases and desaturases. In humans, the efficacy of transforming ALA to longer n-3 PUFAs is low and personally variable [9] and thus its derivatives should also be supplemented in diet. Animal-derived products (meat, eggs, dairy) are the most common source of LA and its derivative AA, whereas fish, particularly salmon, provides mainly n-3 PUFAs.

This chapter will briefly describe the fundamental knowledge of PUFAs and their metabolism. A detailed section is devoted to reports from the *in vitro* and *in vivo* studies investigating links between PUFAs and CRC. The main body covers various ways in which PUFAs could be utilized to prevent or treat cancer, especially CRC, based on the already established patents and promising reports from the literature.

The review is based on literature search conducted in the following databases: PubMed (for original papers and reviews), ClinicalTrials.gov, EU Clinical Trials Register and UMIM (for clinical trials), and WIPO (for pertaining to patents). The keywords used to search for patents included: adjuvant therapy, chemotherapy, colorectal cancer, dietary supplementation, docosahexaenoic acid, eicosapentaenoic acid, endocannabinoids, fish oil, liposomes, polyunsaturated fatty acids and resolvins. The literature was searched in relation to relevant patents. Non-English articles were not included in the review. All patents and clinical trials mentioned in this paper are summarized in Tables **1** and **2**, respectively.

2. PUFAS AND THEIR METABOLITES

PUFAs are important elements of cellular lipid membranes released into circulation by phospholipase A2. By undergoing various enzymatic and non-enzymatic pathways, PUFAs are converted into biologically active lipid metabolites and mediators (Fig. **1**). The most prominent enzymes participating in the formation of bioactive metabolites of n-3 and n-6 PUFAs include:

- Cyclooxygenases (COXs) that produce prostaglandins (PGs), thromboxanes (TXs) and prostacyclins;
- Lipoxygenases (LOXs) which process AA into lipoxins (LXs) and leukotrienes (LTx), and n-3 PUFA into protectins, marensins and resolvins;
- Cytochrome 450 (Cyp 450) which converts PUFAs into hydroxyeicosatetraenoic acids (HETEs).

CHAPTER 2

Microtubules as Anti-Cancer Drug Targets

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Abstract: In developmental biology, all cellular events are suitably synchronized to ensure proper growth and development of any multicellular organism. A healthy adult tissue is often characterized by stem cells that can undergo orchestrated cell division and differentiation. Disruption of these events often leads to cancer resulting from the accretion or accumulation of the genetic and epigenetic changes that occur at the somatic as well as the germ line levels. In the recent years, significant progress has been made in the early detection, treatment and prevention of cancer. Targeted cancer therapies include the use of apoptosis inducing drugs and drugs that target microtubules among others. Over the past few years, drugs that inhibit microtubule dynamics have been successfully used as anticancer drugs. They can either be microtubule stabilizers (Vincristine, Vinblastine, Colchicine etc.) or microtubule destabilizers (Paclitaxel, Docetaxel, Epithilones, Taccalonolides etc.). Recently, new classes of compounds have been identified that interfere with cell growth and proliferation as a consequence of binding to tubulin αβ- dimers. Natural compounds like Curcumin have shown to inhibit tubulin activity. Whereas some antimitotic agents like Aurora A/B, Pentoxifylline, benzimidazole derivatives, combrestatin, polymeric nanoparticles etc. have been reported to show significant effect in the treating several types of cancer which were previously deemed untreatable. The following chapter acknowledges the presence of these anti-tumor compounds and how they target microtubules and further aid in the treatment of various cancers afflicting human beings.

Keywords: Antimitotic agents, Aurora A, Apoptosis, Cancer, Combretastatin analogs, Colchicine, Curcumin, Docetaxel, Epothilones, Microtubules, Microtubule polymerizers, Microtubule depolymerizers, Paclitaxel, Pentoxifylline, Taccalonolides, Taxanes, Tubulin, Vinca alkaloids, Vinblastine, Indexing words: Microtubules, Anti-cancer drug targets, Microtubule stabilizers, Taxanes, Epothilones, Taccalonolides, Microtubule destabilizers, Vinca alkaloids, Colchicine, Halichondrin B, Dolostatin 10, Aurora A, Curcumin, Pentoxifylline, Combretastatin, Benzimidazole derivatives, Casein K2 peptide inhibitor, Nanoparticles.

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Atta-ur-Rahman and Khurshid Zaman (Eds.)

1. INTRODUCTION

1.1. Cancer

Cancer is the second leading cause of death in the world with the first position being conferred to cardiovascular diseases. The word cancer finds its origin from the Greek word *Karkinos* which was the term used by the Greek physician, Hippocrates (460-370 B.C) to describe carcinoma tumours. Within the developing embryo, events such as stem cell divisions, their fate determination, proliferation of cells and their migration followed by apoptosis need to be orchestrated. In an adult, the constant turnover of cells as well as their optimal functioning is ensured by the division and differentiation of the stem cells that are present in small numbers in the healthy tissues [1]. Cancer is thought to be the disruption of this critical organisation resulting from the accretion or accumulation of the genetic and epigenetic changes that occur at the somatic as well as the germ line levels [2]. This causes uncontrolled proliferation of normal cells and subsequently leads to the formation of cancerous cells which proceed to grow, proliferate and re-divide giving rise to abnormal cells instead of undergoing apoptosis. These cells have several features in common with stem cells. The observation of these similarities led to the advent of two alternative hypotheses, one stating that the stem cells might themselves be the targets of the mutations that transform them while the other suggesting that the dedifferentiation of those cells that are transformed and terminally differentiated gives rise to cancer stem cells (CSCs), thereby manifesting the disease [3] Cells of different types of cancer migrate via the blood circulation or lymph vessels to the other regions of the body and begin to grow in that target region. This phenomenon is termed as “metastasis”. These cells are incapable of DNA repair and hence can be considered malignant (cancerous). However, some tumors do not possess the capacity to grow and migrate to the other parts of the body and are, therefore, categorized as benign (non-cancerous) [4].

Cancer is a multistage disease however; work carried out on cancer recognizes a link between chronic inflammation and cancer with Virchow (1863) hypothesising that cancer originates at the sites of chronic inflammation [4]. More advanced studies on cancer suggest that the inflammatory cells are actually involved in the promotion of cancer progression [5]. Most of the malignancies have been observed to be initiated by chronic inflammation or tissue injury, which can be associated to known parasitic, viral or bacterial infections [6].

Worldwide estimates about 15% of the malignancies (1.2 million/year) attributed to chronic infections instances of which include liver cancer caused due to Hepatitis B and C infection, cervical cancer caused due to human papilloma virus

and gastric cancer resulting from *Helicobacter pylori (H. pylori)* infection. Individuals susceptible to an increased risk of cancer exhibit increased polymorphisms in the genes encoding pro-inflammatory cytokines. Population-based studies have established that when tissues are chronically inflamed, the susceptibility to cancer increases and also the risk of many cancers reduces significantly as a consequence of long- term use of NSAIDs, thereby demonstrating the vital role of inflammation in the pathogenesis of cancer [7].

1.2. Hallmarks of Cancer

Advances in cancer research has gained new insights and it is thought to be a disease that involves dynamic changes in the genome; the basis of which has been built on the discovery of mutations that lead to the production of oncogenes and tumour suppressor genes. ***Oncogenes*** are the genes which have gained dominance over the function. They drive the normal cells towards unrestrained growth and develop into cancer cells. Proto-oncogenes are the normal genes of the cell that regulate the frequency of cell division as well as the extent of its differentiation. Oncogenes arise when mutations occur in the proto-oncogenes. ***Tumor suppressor genes*** are the normal genes that are involved in regulating cell division, DNA repair and signalling of apoptosis. Tumor suppressor genes experience recessive loss of function. Any dysfunction in a tumor suppressor gene results in an uncontrollable growth of cells thereby causing cancer [8].

Cancer cells possess impaired regulatory circuits that are responsible for normal cell proliferation and maintenance of homeostasis. More than 100 distinct types of cancer exist with many subtypes of tumors being found within specific organs. The vast catalog of cancer genotypes is thought to be manifested due to six of the crucial alterations in the physiology of cells which eventually lead to a malignant growth. The six alterations seen are as follows:

1. Loss of sensitivity to growth-inhibitory signals: Tissue homeostasis is maintained when cells respond to anti-proliferative signals during G1 phase. However cancerous cells become insensitive to such signals due to the disruption of retinoblastoma proteins which helps in filtering anti proliferative signals.
2. Evasion from apoptosis: Cancerous cells grow in number not only because they become proliferative but also because they tend to evade cell death mechanisms.
3. Self- sufficiency in growth signals: Once a normal cell gets transformed into a cancerous cell, their dependency on exogenous stimulatory growth factor is scaled down. This is due to the fact that the oncogenes tend to mimic the growth signals in one form or the other.

CHAPTER 3

Effects of Inflammation, Mitochondria and Energy Metabolism in the Heart due to Cancer

Thomas G. Ikonomidis[1], Timothy C. Tan[1,2] and **Patsie Polly[1,*]**

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Abstract: Cancer cachexia is a paraneoplastic syndrome characterised by significant skeletal muscle wasting and cardiac atrophy. It occurs in 50% of patients with cancer and approximately 20% of cancer deaths are attributed to cachexia. Heart failure due to cancer cachexia is suggested to contribute to the high mortality rate and currently there is limited therapeutic intervention. The relationship between inflammation and energy metabolism as well as mitochondrial dysfunction in the heart in the context of cancer cachexia will be discussed. This chapter provides an understanding of potential, novel molecular mechanisms that could be of interest when considering therapeutic interventions for heart failure due to cancer cachexia. In summary, several interrelated molecular effects should be considered in cancer-induced cachexia in cardiomyocytes. TNF-α induced mitochondrial dysfunction may be important for the generation of ROS. IL-6 may induce an autophagic/mitophagic response as a result of downregulation of mitochondrial STAT3 due to mTOR suppression. An imbalance in mitochondrial dynamics may contribute to insulin-resistance and atrophy. Decreased expression of ANT1 may contribute to MPTP dysfunction and an altered energetic profile from adult to fetal metabolism. The effects of ANT1 expression in cardiac muscle during cancer cachexia is worth investigating in mouse models as discussed with reference to an ANT1 patent in this chapter. Furthermore, patents that are relevant for therapeutic strategies to ameliorate heart failure in cancer cachexia have also been discussed. Patents addressing interventions that could be applied to cancer cachexia-induced cardiac atrophy include: sodium selenite treatment, inhibitory agents of NADPH oxidase such as phycobilin, an AMPK inhibitor, modulation of mitochondrial biogenesis and modulation of mTOR. Understanding the underlying molecular mechanisms of mitochondrial dysfunction in cardiomyocytes during cancer cachexia-induced cardiac atrophy may reveal novel molecular targets for therapeutic intervention.

Keywords: Cancer, cancer cachexia, cardiac atrophy, cardiomyocyte, energy metabolism, heart failure, inflammation, inflammatory cytokines, mitochondria,

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Atta-ur-Rahman and Khurshid Zaman (Eds.)

mitochondrial dynamics, mitochondrial dysfunction, mitophagy, muscle wasting.

1. INTRODUCTION

Cancer cachexia is a multifaceted paraneoplastic syndrome occurring in approximately 50% of patients with cancer [1, 2]. It is a significant contributor to cancer morbidity and mortality, with approximately 20% of cancer deaths due to this syndrome [1, 2]. The disease is defined as progressive skeletal muscle wasting with anorexia, increased catabolic drive and functional impairment that is not effectively reversed with nutritional supplementation [3]. Heart failure and cardiac atrophy have also been reported in cancer cachexia [4]. Recent investigations suggest that cardiac atrophy may contribute to the high mortality rates in patients with cancer induced cachexia [5, 6]. The pathogenic mechanisms of cancer cachexia-induced cardiac failure are not well established.

Current research on cancer cachexia in cardiac tissue has relied on the development of animal and cell culture models due to the reduced availability and accessibility of human clinical samples [4]. Given the significant metabolic derangement in patients with cancer-induced cachexia, mitochondrial dysfunction may play a role in the pathogenesis of cancer cachexia-induced heart failure [7 - 9]. This chapter will focus on how known pathological mechanisms and previously identified key molecules relate to mitochondrial dysfunction in the heart in the context of cancer cachexia.

2. INFLAMMATORY CYTOKINES AND MITOCHONDRIAL DYSFUNCTION IN CARDIAC TISSUE

2.1. Tumour Necrosis Factor-α

Elevated inflammatory cytokines may facilitate heart failure in cancer cachexia by affecting cardiomyocyte mitochondrial function. Tumour Necrosis Factor (TNF)-α induced mitochondrial dysfunction in cardiomyocytes involves the generation of increased reactive oxygen species (ROS) [10, 11]. ROS may either induce, or result from, mitochondrial dysfunction. Therefore, investigating the source of ROS in cardiomyocytes may determine if mitochondrial dysfunction is a primary or secondary process in the pathogenesis of cancer cachexia in the heart. The main mitochondrial source of ROS in the heart is the electron transport chain (ETC), whilst non-mitochondrial sources in the heart include NADPH oxidases (Nox) and uncoupled nitric oxide synthases (NOS) [12]. TNF-α administered to a rat cardiomyocyte cell culture model demonstrated that the ETC was the major source of ROS [10]. Furthermore, in a ventricular pacing-induced canine model of

Congestive Heart Failure (CHF), TNF-α inhibition partially and completely restored cardiomyocyte mitochondrial complex III and ATP synthase activities respectively and ameliorated oxidative stress (Table **1**) [13]. Thus, demonstrating that ETC is a source of ROS. In another ventricular pacing-induced canine model of CHF, blocking the function of complex I in the ETC in cardiomyocytes increased ROS production 2.8-fold. Interestingly, complex I enzymatic activity was decreased in the context of heart failure, possibly contributing to uncoupling and ROS production in mitochondria [14]. Further evidence of an ETC source has also been observed in a fibrosarcoma cell culture model, where TNF-α primarily produced ROS at the ubiquinone site [15]. These studies suggest a potential role for TNF-α- induced alterations in mitochondrial function in cardiomyocytes. Future therapeutic strategies, such as sodium selenite treatment, could target mitochondrial dysfunction to ameliorate cancer cachexia-induced cardiac atrophy [16].

Table 1. Summary of the Effects of Inflammatory Cytokines on Mitochondria in the Heart.

Cytokine	Model	Effect of the Cytokine Studied	Mechanism or Signalling Pathway	Reference
TNF-α	Canine model of pacing-induced CHF	Mitochondrial production of ROS	Complex III and ATP synthase dysfunction	Moe *et al*., 2004 [13]
	Adult human cardiomyocyte cell culture	Activation of NF-kβ	NADPH oxidase production of ROS	Moe *et al*., 2014 [17]
	Adult male Sprague-Dawley rats	Decreased ANT protein levels Altered membrane permeability transition pore opening in mitochondria	Increased ROS Unknown - hypothesised to be due to down regulation of ANT1	Mariappan *et al*., 2007 [19]
	Neonatal Wilstar rat ventricular cell culture	ROS mediated mitochondrial DNA damage	Sphingomyelin-ceramide pathway	Suematsu *et al*., 2003 [10]
IL-6	Simulated ischemia/reperfusion in neonatal Sprague-Dawley rat ventricular cell culture	Increase inner mitochondrial membrane polarisation and increase mitochondrial Ca^{2+} loading	PI3-kinase/Akt pathway	Smart *et al*., 2006 [32]

In addition to the ETC, there are other non-mitochondrial sources of ROS in the heart including Nox and NOS [12]. There is emerging evidence for TNF-α-induced ROS generation from NADPH oxidase in cardiomyocytes [17] and TNF-

CHAPTER 4

Chalcone and Their Derivatives as Anticancer Agents

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Abstract: Cancer has eventually stepped into the molecular insights focussing on the development of new generation of anticancer drugs especially of natural origin and its analogues with less or no toxicity issues and targeting specific molecular signalling pathways. In various therapeutic areas, numerous natural products and their derivatives have been effectively used to treat many human diseases or disorders. Chalcones, as metabolic precursors of some flavonoids and isoflavonoids have a structure of open chain flavonoids (1,3-diaryl-2-propen-1-ones) present in fruits and vegetables, possessing a broad range of biological activities including cancer chemotherapeutic and chemopreventive property. The anticancer properties of chalcones have been improved by substituting aryl rings (e.g. methoxy substitution on both aryl rings A and B) and introducing heterocyclic moieties. Hybridization with other pharmacologically important moieties (benzodiazepines, benzothiazoles, imidazolones etc.) by taking the help of SAR (structure-activity relationship) studies with much ease in preparation and oral administration ultimately has made chalcone a safe therapeutic agent. Some clinical trials revealed that these compounds did not cause toxicity and are present in plasma at optimum concentrations. Nowaday's several chalcones are also used in cosmetic formulations and in food additives which could further be utilized for its chemopreventive potential. This book chapter briefly summarizes the demanding efforts made in the development of novel anticancer chalcones recorded in recent literatures with focussed cancer targets as well as presents an outline of the patents published in recent decades.

Keywords: Angiogenesis, antiproliferative, apoptosis, cancer, cell cycle arrest, cell line, chalcone, chalcone derivatives, chemoprevention, cytotoxicity, heterocyclic chalcone derivatives, IC_{50}, metastasis, NFκB, p53, p21, p23, TRIAL, tumor.

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1. INTRODUCTION

Chalcones are phytomolecules belonging to the largest group of secondary metabolites of plant system with chemical structure of 1, 3-diphenyl-2-prope-e-1-ones, in which the two aromatic rings are linked by three carbon α, β-unsaturated carbonyl system (Fig. **1**). The name was derived from "*chalcos*" meaning bronze due to its variant colour and it was given by Kostanecki and Tambor [1]. These compounds have a conjugated system where *p*-electron systems are delocalized with conjugated double bonds on both the benzene rings [2]. Chalcones due to their Michael acceptor features and small structure, easily bind with different cellular metabolites resulting in profound molecular and cellular effect ultimately exhibiting a broad range of biological activities [3]. Chalcones in general have lower redox potential due to enone (alkene-ketone) system and therefore, it prefers more electron transfer reactions. They are assumed to be intermediate metabolites in the synthesis of flavonoids and isoflavonoids that serve mainly for the defense system in the plants and thus protecting them from ROS (Reactive Oxygen Species) and consequently minimizing molecular and environmental injury. Functionally, it serves to regulate cholesterol levels, maintaining blood glucose levels, decrease the blood pressure, remove joint and muscle pain, help in sleep, improves immune system, liver and kidney functions, and enhance vision, skin beauty, hair growth and memory [4].

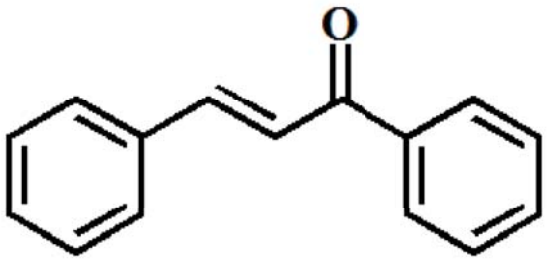

Fig. (1). Basic chalcone structure.

2. CONJUGATES AND DERIVATIVES OF CHALCONES

Chalcone has been widely used in organic synthesis to establish highly enantio-selective Michael adducts. The asymmetric catalytic conjugate adding a stabilized carbanion nucleophile to α, β-unsaturated carbonyl compounds shows one of the most essential carbon-carbon bond forming reactions in organic chemistry because the adducts are interesting intermediates for further optimization, such as amino-carbonyls, pyrrolidines and amino-alkanes. Many chalcone derivatives have also been prepared due to their convenient synthesis [3].

Madhavi *et al*. (2017) studied the synthesis of chalcones incorporating quinazoline derivatives as anticancer agents [5].

Bhale *et al*., (2017) worked on the synthesis of protracted conjugated indolyl chalcones as the strong antioxidant, anti-inflammatory and anti-breast cancer agents [6]. Cai *et al*. (2017) studied the analogues of xanthones-chalcones and bis-chalcones as α-glucosidase inhibitors and anti-diabetes candidates [7]. Hawash and collaborators worked on the synthesis and bioactivity of novel pyrazolic chalcone derivatives as novel hepatocellular carcinoma therapeutics [8]. Ramaiah *et al*., (2011) studied Chalcone-imidazolone conjugates and they found that these synthesized conjugates trigger DNA damage in the cells and show apoptosis [9]. Kamal *et al*., (2015) studied about phenstatin/isocombretastatin-chalcone conjugates as effective tubulin polymerization inhibitors and mitochondrial apoptotic inducers [10]. Similarly, Khan (2009) published a patent on certain novel chalcones derivatives (in particular boronic chalcone derivatives) wherein he claimed that they possess anti-proliferative activity against cancer cells at micro molar concentrations. The invention provides the design and synthesis of novel boronic chalcone derivatives, and pharmaceutical compositions of chalcones derivatives. The invention also reveals the high activity and less toxicity of numerous compounds against breast cancer cell lines compared to normal MCF12A cells [11].

In glioblastoma cell lines, Indole chalcone has been recognized as a possible anticancer agent as it decreases the multiplication of cells under *in vitro* conditions. It was revealed that the indole chalcone battle for the binding site with colchicine and induces the inhibition of tubulin polymerization. Moreover, it distorted microtubule formation and triggered G2/M phase arrest and apoptosis. The molecule also worked as the dual inhibitor of Pgp and BCRP in glioblastoma cell line [12]. Chalcones are reported for both cancer chemotherapeutic action as well as for its chemopreventive mechanism as it possesses ability to inhibit carcinogenesis due to various modes like by increasing reduced glutathione levels and maintaining the optimum redox level [13].

TRAIL (Tumor necrosis factor related apoptosis inducing ligand) indicates programmed cell death specific to cancers and without any toxic effect to normal cells. TRAIL in association with the death receptor DR4 and/or DR5 mediates programmed cell death [14, 15]. However, decrease in the expression of pro-apoptotic proteins, TRAIL-R1 and TRAIL-R2 (death receptors) with concurrent upsurge in the level of anti-apoptotic proteins in tumor cells mediates TRAIL-resistance [16]. Szliszka *et al*. (2010) reported that the TRAIL-induced programmed cell death and cytotoxicity enhanced in prostate cancer cells by chalcones and dihydrochalcones such as phloretin. Their results show the

CHAPTER 5

Regulation/Inhibition of Human Lactate Dehydrogenase A: An Innovative and Potential Approach for Anti-Cancer Drugs Development

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Abstract: Human lactate dehydrogenase (*h*LDH-A), a glycolytic enzyme responsible for the conversion of pyruvate to lactate coupled with oxidation of NADH to NAD^+, plays a crucial role in the promotion of glycolysis in invasive tumor cells. *h*LDH-A has been considered a vital therapeutic target for invasive cancers therefore, *h*LDH-A inhibition reflects a valuable attempt in the development of innovative anticancer strategies. Reagents that regulate or inhibit *h*LDH-A enzyme/ gene can play a role in the prevention and treatment of various cancers and related diseases. In fact, selective inhibition of *h*LDH-A using small molecules holds potential prospects for the treatment of cancer. Consequently, significant progress has been made in the discovery of small-molecules, the selective inhibitors of *h*LDH-A displaying remarkable inhibitory potency. The LDH-based approaches in the development of anticancer therapy and treatment of related diseases are worthwhile because of the existence of LDH enzyme at the end of glycolytic pathway. In this book chapter, 59 review and research articles, and 15 patents filed on LDH and its application are discussed. Latest contributions in regulation/inhibition of the LDH-A enzyme by various agents are summarized in this book chapter.

Keywords: Aerobic glycolysis, anaerobic glycolysis, anti-inflammatory activity, anti-proliferative activity, cancer cell metabolism, cancer cell proliferation, epileptic treatment, FDG-PET, FRET, glycolytic pathway, gossypol, human lactate dehydrogenase A, human lactate dehydrogenase B, isostere of pyruvate, metabolic switch, mitochondrial dysfunction, NADH/NAD^+, nanosensor, *N*-hydroxy-indole, pyruvate dehydrogenase complex, selective *h*LDH5 inhibitors, tumor glycolysis, warburg effect.

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1. INTRODUCTION

Cancer is one major cause among the leading causes of morbidity and mortality worldwide. According to the World Health Organization (WHO) approximately 14 million new cases of cancers and 8.2 million cancer related deaths were reported in 2012 worldwide and among them, most common causes of cancer death are cancers of lung (1.59 million deaths), liver (745 000 deaths), stomach (723 000 deaths), colorectal (694 000 deaths), breast (521 000 deaths) and oesophageal cancer (400 000 deaths) [1]. This data reflect the serious threats of cancer posed to human health, and the development of promising anticancer agents is, therefore, urgently required. WHO launched the global action plan in 2013, for the prevention, control and treatment of non-communicable diseases during 2013-2020 by aiming to reduce premature mortality from cancers. Common conventional approaches that are clinically used for the treatment of cancers, including surgery, chemo- and radiation therapy have some limitations due to serious side effects [2]. Various research studies confirm that cancer is a complex process and many enzymes including glycolytic enzymes are involved in initiation, maintenance and survival of various human cancers and some of them are thus considered as innovative targets for the development of anticancer agents [3]. Significant inhibition as well as reduction of enzyme activity involved in cancer by means of small molecules or other agents is a current and significant approach for drug development. Great efforts have been dedicated to design and develop 'drug-like' small molecules by following target-, structure- and fragment-based approaches for selective enzyme inhibition for the treatment of cancers [4].

2. CANCER CELL METABOLISM

The metabolic properties of cancer cells differ significantly from those of the normal cells. Unlike normal cells, most cancer cells rely on the enhanced rate of glycolysis that tends to ferment glucose into lactate, even under aerobic conditions. In fact, cancer cells are abnormally dependent on aerobic glycolysis for energy production at higher rate for maintenance of cancers [5]. It is hard to discuss the cancer cell metabolism without first mentioning the German scientist "Otto Warburg" who made a striking discovery in the 1920's. For the first time, he observed that the cancer cells hold the metabolic switch from oxidative phosphorylation (OXPHOS) towards aerobic glycolysis (Warburg effect) and thus, established a link between cancer and the peculiar glucose metabolism in cancer cells [6]. Since then "Warburg effect" has been validated in various human tumors and the parallel increase in enhanced glucose uptake has been exploited clinically for the diagnosis, staging, and monitoring of various cancers, including nonHodgkins lymphoma (NHL) by using fluorodeoxyglucose positron emission tomography (FDG-PET). It is a useful and sensitive modality for assessing

disease activity in thyroid lymphoma and in cancer metastasis. In this technique, the biologically active molecule, an analogue of glucose i.e. fluorodeoxyglucose (FDG), is used for PET where the concentration of FDG tracer indicates metabolic activity of the tissue that corresponds to the regional glucose uptake [7]. Besides tumor imaging, Warburg effect can be exploited for drug designing to treat human cancers. Initially, Warburg hypothesized that the metabolic alteration specific to cancer cells is caused by a mitochondrial defect where complete oxidation of glucose is lost; however, it was later proven that this metabolic alteration is from oncogene-directed metabolic reprogramming, not from mitochondrial dysfunction [8 - 10]. The unique characteristic of tumor glycolysis of being highly functional is accompanied by high glucose consumption due to lower efficiency in energy production that ensures an adequate and rapid energy supply and biosynthetic intermediates for rapidly growing cancer cells [10 - 12]. In essence, cancer cells are hungrier for nutrients than normal cells are; thus, tumor glycolysis provides selective advantages to tumor cells for survival and proliferation. Succinctly, cancer is a metabolic disease and can be targeted by the following two facts (i) to produce enough energy to survive when supplies and waste disposal are limited, and (ii) to distract abundant metabolic intermediates to the biosynthetic pathways supporting cell proliferation. Recently, keen research interest in tumor glycolysis has emerged due to the strong metabolic dependencies of cancer cells. Despite various key factors (enzymes and transporters) that are intricate, tumor glycolysis is thus considered a promising target [10, 12].

3. GLYCOLYSIS AND LDHA

Glycolysis is a metabolic process, which comprises ten successive steps catalyzed by specific enzymes in the cytoplasm of the cells. At the end of glycolysis, two pyruvate molecules are formed by the catabolism of one glucose molecule with concurrent generation of two ATP molecules and two NADH (Nicotinamide Adenine Reduced Dinucleotide) molecules. Glycolysis can take place in both conditions; i) in the presence of oxygen i.e. aerobic condition and, ii) in the absence of oxygen i.e. anaerobic condition [13]. Although, in both the situations, the final products viz. two molecules of pyruvate, two molecules of ATP and two molecules of NADH are the same but depending upon the presence or absence of oxygen, further pyruvate can follow two different pathways. In aerobic (normoxia) condition, two molecules of pyruvate are transported into mitochondrial matrix where these molecules are decarboxylated and then enter into Krebs cycle (TCA; tricarboxylic acid) cycle to produce 36 molecules of ATP, carbon dioxide and water by oxidative phosphorylation (Fig. **1A**). In normal cells under normoxia, glycolysis and oxidative phosphorylation are tightly coupled processes. In contrast, in an anaerobic (hypoxia) condition pyruvate is red-

CHAPTER 6

Cancer Chemo-Immunotherapeutics

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Abstract: Cancer chemo-immunotherapeutics has evolved with a strategic slogan - 'marrying chemotherapy with immunotherapy' - in order to optimize the chance for cure. The ultimate goal is to execute a 'two hit' impact, able on the one hand to mount a robust anti-tumour immune response, and on the other hand, selectively eradicate tumour growth and progression. Tremendous progress has been, and being, made in this regard by testing various 'chemotherapy-immunotherapy' drug combinations in the clinic, and also implementing multiple pharmacological and biological interventions against fundamental regulatory pathways involved in tumour development, progression, and tumour immune escape mechanisms. This chapter discusses the current 'chemotherapy-immunotherapy' combinations in clinical studies/trials, as well as the pharmacological manipulation of host-tumour cell interactions mapping the road ahead to a novel trend/concept of 'two hit' chemo-immunotherapeutics. At the end, we also discuss the patents issued and recent patent applications stating the novel chemo-immunotherapy methods with diverse interventional combinations, some of which produce synergistic anti-tumour effects, to treat multiple advanced cancers.

Keywords: ARG, Cancer, Chemotherapy, Chemo-immunotherapy, Cancer vaccines, CIK cells, CTLA4, Cytokine, FOLFOX, GVAX, IDO, Immune suppression, Immuno-oncology, Kinase inhibition, mAbs, mTOR, MAPK, PKA, R-CHOP, TroVax®.

1. INTRODUCTION

Cancer chemo-immunotherapeutics implements treatment regimens that both maximize tumour regression and the anti-tumour immune response for the long

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term clinical benefit of cancer patients [1]. Although cancer chemotherapy has historically been considered as immunosuppressive, emerging evidence indicates that certain chemotherapies can augment tumour immunity through multiple mechanisms including induction of immunogenic cell death and by disrupting strategies that tumours use to evade immune recognition [2 - 4]. This dual role, cytotoxicity and immune activation, from chemotherapy has prompted the scientific community to call for a radical but strategic shift in the way tumours are treated in order to achieve better clinical outcomes [1]. To this regard, cancer chemo-immunotherapeutics has evolved with a strategic slogan - 'marrying chemotherapy with immunotherapy' - in order to optimize the chance for cure [5, 6]. The ultimate goal is to execute a 'two hit' impact, able on the one hand to mount a robust anti-tumour immune response, and on the other hand, selectively eradicate tumour growth and progression. Tremendous progress has been, and being, made in this regard by implementing multiple chemotherapy-immunotherapy drug combinations with complimentary mechanisms of action to attain additive or synergistic anti-tumour effects [7, 8]. Apart from this, the complex interactions between host and tumour cells within the tumour microenvironment may lead to 'tumour-associated immune suppression', which is characterized by diverse mechanisms of oncogenic signaling pathways that play critical roles in tumour initiation, progression, and immunoescape [9]. Emerging data indicate that small-molecule based therapeutic interventions against such signaling pathways may have the potential to provide a 'two-hit' chemo-immunotherapeutic opportunity: direct killing of tumour cells, and the rescuing of endogenous anti-tumour immunity [10 - 12]. The purpose of this chapter is to discuss the clinical significance of current chemo- and immuno-therapy drug combinations, as well as highlight the 'two hit' chemo-immunotherapeutic potential of targeting the oncogenic signaling pathways that play crucial roles in tumour growth and progression, and in tumour-associated immune suppression. Moreover, we also discuss patents issued and recent patent applications demonstrating novel chemo-immunotherapeutic methods/formulations for the treatment of cancer.

2. CURRENT CHEMO-IMMUNOTHERAPEUTIC DRUG COMBINATIONS IN CLINICAL STUDIES

In recent decades, a general trend of harnessing endogenous anti-tumour immunity by modifying the diverse mechanisms of immunosuppressive tumour immune microenvironment has provided the knowledge and techniques to develop novel immunotherapeutic approaches for the treatment of cancer [7]. These include:

a. Antibodies, such as monoclonal antibody drugs (mAbs) and the recent immune checkpoint-modulating antibodies;
b. Vaccines, such as tumour cell-based autologous vaccines and dendritic cell (DC)-based vaccines; and
c. Immunostimulatory cytokines, and cytokine-induced killer (CIK) cells.

Several combinations of these immunotherapeutics with traditional chemotherapy are in various phases of clinical trials (Table **1**). In addition, superior clinical benefits of chemotherapy-immunotherapy combinations have also been convincingly demonstrated in the settings of large randomized trials.

Table 1. Summary of Currently Ongoing Clinical Trials Involving Cancer Chemo-Immunotherapy.

Chemo-Immunotherapy	Target of the Listed Antibody	Type of Cancer	Phase	Reference (NCT ID)
Chemotherapy-mAbs Combinations				
Doxorubicin, vincristine, cytarabine, etoposide, cyclophosphamide, methotrexate, leucovorin, filgrastim, epratuzumab	CD22	Acute lymphoblastic leukemia	Phase I/II	NCT00098839
Bendamustine, lenalidomide, rituximab	CD20	Chronic lymphocytic leukemia; Small lymphocytic lymphoma	Phase II	NCT01754857
Cyclophosphamide, fludarabine, ofatumumab	CD20	B-cell lymphoid leukemia	Phase II	NCT01762202
Bendamustine + ofatumumab	CD20	Mantle cell lymphoma	Phase II	NCT01437709
Carboplatin, paclitaxel, oregovomab	CA125	Ovarian neoplasms	Phase II	NCT01616303
Cisplatin, docetaxel, cetuximab	EGF receptor	Lung cancer	Phase II	NCT01059188
Fludarabine, cyclophosphamide, ofatumumab	CD20	Chronic lymphocytic leukemia; Small lymphocytic lymphoma	Phase II	NCT01145209
Paclitaxel, lapatinib, trastuzumab	HER2/neu	Breast carcinoma	Phase II	NCT01891357
Cyclophosphamide, fludarabine, rituximab	CD20	Multiple leukemias and lymphomas	Phase III	NCT02048813
CHOP chemotherapy (cyclophosphamide, hydroxydaunorubicin, vincristine, prednisone) plus G-CSF, combined with alemtuzumab	CD52	T-cell lymphoma	Phase III	NCT00646854
Fludarabine, rituximab	CD20	Chronic lymphocytic leukemia	Phase III	NCT00513747

CHAPTER 7

Recent Advances and Challenges in microRNA-Based Cancer Therapeutics

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Abstract: Despite significant advancements in understanding the cancer-associated signaling cascades, effective treatment strategies remain scarce. This intricacy of cancer enigma highlights a pressing need to develop novel therapeutics. The seminal discovery of microRNAs (miRNAs), a class of natural RNA-interfering agents, provides a new hope for accomplishing this task. Bolstered by a novel mode of action, the ability to function as tiny master regulators of cellular processes, ease of administration and sufficient uptake along with apparent lack of toxicity in normal tissues give miRNAs an extra edge and make them an ideal candidate for emerging therapeutic developments. Genome-wide investigations have shown more than half of the human miRNA genes being located on genomic regions or at fragile sites associated with cancer, unveiling the substantial significance of these small RNAs. Very soon after the discovery of the first miRNA, miRNA-based therapeutics has entered clinical trials and has shown fascinating results in preclinical development. This rapid progress through the discovery pipeline into clinical development imitates the significance of miRNAs as critical regulators in human diseases, and holds the pledge of yielding a novel class of therapeutics that could signify an attractive addition to the existing drug pipeline of Big Pharma. In this chapter, we will give an overview of the recent miRNA-based therapeutic approaches (patents: EP3110951, WO2017005771, EP3126496, EP3106168, WO2017005773, US9399773, EP2217248 and US9469854), and will discuss current translational challenges and further potential developments. These patents describe the potential of different miRNAs inhibitors/mimics for treating various types of cancers, these miRNAs include miR-34 mimic to treat hematologic malignancy/solid tumors; miR-409-5p, miR-379 and miR-154 inhibitors to treat prostate cancer and drug resistant lung cancer; miR-548z, miR-624-5p, let-7i-3p, miR-885-5p, miR-449b-3p to treat hepatoblastoma cancer; pre-miR-302 (an miRNA precursor) for cancer reversion; miR-21, miR-125a-5p, miR-191, miR-210, miR-222, miR-378, miR-423-3p, miR-638 inhibitors to treat hepatocellular carcinoma (HCC); hsa-miR-4510, hsa-miR-548aa, hsa-miR- 548v and hsa-miR-37-b-3p mimics to treat HCC; sorafenib- miR- 34-mimic/ miR-215 mimic combination therapy for treating liver cancer and miR-21-3p mimic for treating liver diseases. The outcome of these patents may hopefully provide exciting opportunities and deeper

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insights into novel anti-cancer paradigms. Compared to conventional drug therapies, miRNA-based therapeutics appears to hold great promise to combat cancer, at least for those cancers where other treatment options have plateaued. Further developments in miRNA-based therapeutics are anticipated to translate miRNA-based therapeutic strategies into a clinical reality and may create a paradigm shift in medicine and pharmaceutical industry.

Keywords: Anti-miR oligonucleotides, cancer, cancer therapy, cancerous cells, clinical trials, drug resistance, drug target, *in vivo* studies, miRNA inhibitor, miRNA masking, miRNA mimic, miRNAs sponges, miRNA therapeutics, mouse models, mRNAs, Non-coding RNAs, oncogenic miRNAs, pre-clinical trials, siRNAs, tumor suppressor miRNAs.

1. INTRODUCTION

The genesis of the current non-coding RNAs' (ncRNAs) scientific paradigm can easily be traced to the influential discovery of a microRNA (miRNA) gene in 1993 by a group led by Ambros [1]. Extensive research on these evolutionarily conserved, small, regulatory RNAs in the last decade has shown fascinating breakthroughs of recent times [2]. Concomitantly, experimental confirmation of the results attained by the human genome project further revealed that several transcripts are actually non-coding transcripts, and that miRNAs signify the most important class of ncRNA molecules. The involvement of miRNAs in the development of cancer was initially reported in 2002: since then, the role of miRNAs has been intensively investigated in manifold human disorders [3, 4]. The noteworthy increment in the number of patent application filings over the last 10 years reflects a considerable amount of novelty in this area.

miRNAs are currently considered as master regulators of the human genome [5]. Clinical and functional implications of miRNAs in various disorders have hauled up these tiny cellular components to the ranks of ideal drug targets [6]. In eukaryotes, they serve as significant modulators of gene expression. They influence the transcriptome and proteome by targeting protein coding transcripts, hence aiding in cell fate determination. Furthermore, miRNAs have loomed as vital molecules in cancer research and they have proved to hold potential in cancer. They have the ability to repress stability of protein-coding transcripts and cellular translation by targeting the 3′ untranslated regions (UTRs) in a sequential manner [7, 8]. This nature of selective silencing of gene expression by miRNAs is known to have a significant effect on human health and disease [9]. The therapeutic functioning of miRNA is based upon the catalytic process of the naturally occurring 15-22 nucleotide single stranded RNA, that enters the cytoplasmic multiprotein complex RNA-Induced Silencing Complex (RISC) to pair with mRNAs carrying complementary sequences and, as a result, repress

gene expression. Over 500 miRNAs of distinct nature have been identified in humans and more than 1000 have been predicted in total [10, 11]. Furthermore, exploration of the human genome sequences facilitated the discovery of the fact that miRNA genes frequently resides in fragile sites and genomic regions which are hot spots for chromosomal abnormalities [12]. Chromosomal abnormalities have been shown to be important for the etiology of various cancers. Various studies based on genome-wide approaches have reported strong association between various cytogenetic and molecular abnormalities and the location of miRNA genes [13 - 15]. Wey *et al*. investigated the genome-wide miRNA expression profiling in Intraductal papillary mucinous neoplasms (IPMNs) tissue and discovered six miRNAs (miR-100, miR-99b, miR-99a, miR-342-3p, miR-126, miR-130a) that may differentiate 'high-risk' IPMNs from 'low-risk' IPMNs [14]. Faltejskova *et al*. studied genome-wide miRNA expression profiling in colorectal cancer patients in order to discover miRNA signatures (miR-122, miR-122*, miR-885-5p, miR-10b, miR-143, and miR 28-5p) that would enable differentiation between primary tumors and their corresponding matched liver metastases [15, 16].

The ability of miRNAs to target multiple genes may hold the key to therapeutic accomplishment in cancer which is a heterogenic disease and cannot be effectively treated by targeting a single gene of interest. Calin *et al*. first reported the role of miRNAs in cancer through the characterization of chromosome 13q14 done on chronic lymphocytic leukemia [3]. Successively, numerous studies gave strong evidences of deregulated miRNA expression in the hallmarks of cancer [17, 18]. In cancer, various cellular mechanisms are involved in the miRNA dysregulation such as genetic mutations [19], aberrant DNA methylation [20] and histone acetylation [21] along with alternative splicing, changes in the miRNA processing machinery and polyadenylation may cause hindrance in the maturation of miRNA [9, 22]. Abnormal gain or loss of miRNAs plays a role in initiation, progression, and metastasis and drug resistance in a variety of cancers. They can act as either oncogenes or tumor suppressors, depending upon the pathway or genes they impact. For instance, miRNAs of the let-7 family are a class of tumor suppressors. Let-7 expression has been reported to be downregulated in breast, head, neck, ovarian, lung and prostate cancers [23]. Additional miRNAs, namely miR-17/92 cluster, miR-221, miR-222, miR-21, miR-155 and miR-9 are upregulated in various cancers [24]. The therapeutic and diagnostic significance of miRNAs is remarkable since they have unique profiles and high stability in biological samples. For cancer therapy, miRNA expression modulation is under investigation but therapeutic tempering is attained by oncogenic inhibition of miRNAs, or by altering tumor suppressor miRNAs [9]. Furthermore, Phytonutrients that modulate expression and action of miRNA which are functionally involved in cancer pathobiology may have a potential to consider as a

Author Index

SUBJECT INDEX

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

X

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Atta-ur-Rahman, Ph.D. in organic chemistry from Cambridge University (1968), has 1080 international publications in several fields of organic chemistry including 751 research publications, 37 international patents, 69 chapters in books and 221 books published largely by major U.S. and European presses. He is the Editor-in-Chief of eight European Chemistry journals. He is Editor of the world's leading encyclopedic series of volumes on natural products "Studies in Natural Product Chemistry" 54 volumes of which have been published under his Editorship by Elsevier during the last two decades.

Prof. Rahman won the UNESCO Science Prize (1999) and was elected as Fellow of the prestigious Royal Society (London) in July 2006. He has been conferred honorary doctorate degrees by many universities including (Sc.D.) by the Cambridge University (UK) (1987). He was elected Honorary Life Fellow of Kings College, Cambridge University, UK, conferred the TWAS (Italy) Prize and the Austrian government has honoured him with its high civil award ("Grosse Goldene Ehrenzeischen am Bande") (2007). He is Foreign Fellow of Chinese and Korean Academy of Sciences, Foreign Fellow of the Chinese Chemical Society and former President of Pakistan Academy of Sciences.

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MIRDEC-4th, International Academic Conference on
Social Science, Multidisciplinary and Globalization Studies,
04-07 July 2017, Madrid, Spain

KEYNOTE SPEAKERS

Professor Marta Mas Machuca
Universitat Internacional de Catalunya,
Barcelona, Spain

Dr. Avkash Jadhav
St. Xavier College, University of Mumbai,
India

Dr. Maria del Populo Pablo Romero
University of Seville, Spain

Keynote Session Chair:

Diana K. Kerr
University of St. Andrews, United Kingdom

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TABLE OF CONTENTS

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AVKASH JADHAV[1]

THE TRANSITION OF POLITICAL IMPERIALISM TO ECONOMIC IMPERIALISM: A HISTORICAL STUDY OF THE GENESIS OF THE NATIVE CAPITALIST CLASS IN THE TEXTILE INDUSTRY OF BOMBAY IN THE 19th CENTURY

Abstract

The advent of the British in India as the East India Company is documented with the arrival of Vasco De Gama when he landed at Calicut in 1498. In the span of four centuries the country witnessed various stages of imperialism, from requesting concessions for trading to acquiring their spheres of influence over certain territories, then declaring certain provinces as their protectorate to establishing it as their presidency. In all we can easily distinguish the changing interests in the way they slowly and gradually unfolded their demands in India. What started as merely exploration of the world soon became a tool of introducing trading designs which ultimately culminated into establishing political hegemony in India. The administrative control of the country became their primary goal until the revolt of 1857, which brought with it the beginning of a new chapter of governance in the colonial history of India. The direct control of the British crown was responsible for changing the priorities of controlling the affairs in the country. We strongly witness the influx of various ideas and patterns of England being experimented, under the 'mirage of development' and creating new opportunities for growth. This paper will discuss the introduction of a new native class of Indian capitalist, who equally contributed towards Britain's economic imperialism in India. This new class was became the native entrepreneurs and the capitalists of the country. The introduction of cotton textile mills in Bombay gave them enough scope to follow the same exploitative imperialist designs of their European masters. It is equally interesting to note that the mill owners of Bombay established their association called 'Bombay Mill Owners Association' in 1875, ie within two decades of the opening of the first mill in Bombay in 1854. Whereas the workers working in these mills almost took six decades to realize the importance of forming union or association to safeguard their rights. This paper will primarily discuss that how the native Indian capitalist class slowly replaced the colonial masters in exploiting co Indians under the 'mirage of development' which was never inclusive, but exclusive unlike the Europeans.

Keywords: Bombay, mills, working class.

JEL Codes: N85

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India has always attracted the attention of the world since ancient times, through the writings of Herodotus to the era of geographical discoveries in medieval age. The European world was always intrigued with the unexplainable wealth of the Far East, which was equally adorned by its rich heritage and culture. The expansion of the West to the East under the pretext of reviving the sea or trade routes opened up the new eco- political developments, there by introducing a new pattern under the guise as the foreign policy which was defined as imperialism. The term 'imperialism' came into common usage in England in the 1890s as a development of the older term "empire" by the advocates of a major effort to extend the British Empire.

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The term was rapidly taken into other languages to describe the contest between rival European states to secure colonies and spheres of influence in Africa and Asia, a contest that dominated international politics from the mid-1880s to 1914, and caused this period to be named the "age of imperialism". The first systematic critique of imperialism was made by the English bourgeois social-reformist and economist John Atkinson Hobson (1858-1940) in his 1902 book 'Imperialism: A Study'[2]. Imperialism emerged as the development and direct continuation of the fundamental characteristics of capitalism in general. But capitalism only became capitalist imperialism at a definite and very high stage of its development, when certain of its fundamental characteristics began to change into their opposites, when the features of the epoch of transition from capitalism to a higher social and economic system had taken shape and revealed themselves in all spheres. If it were necessary to give the briefest possible definition of imperialism 'we should have to say that imperialism is the monopoly stage of capitalism'[3].

Karl Kautsky, the principal Marxian theoretician defines it is as follows: 'Imperialism is a product of highly developed industrial capitalism. It consists in the striving of every industrial capitalist nation to bring under its control or to annex all large areas of agrarian territory, irrespective of what nations inhabit it'[4].

The characteristic features of imperialism is precisely that it strives to annex not only agrarian territories, but even most highly industrialised regions (German appetite for Belgium; French appetite for Lorraine), because (1) the fact that the world is already partitioned obliges those contemplating a redivision to reach out for every kind of territory, and (2) an essential feature of imperialism is the rivalry between several great powers in the striving for hegemony, i.e. for the conquest of territory, not so much directly for themselves as to weaken the adversary and undermine his hegemony.

English writer Hobson puts it as, 'the new imperialism differs from the older, first, in substituting for the ambition of a single growing empire the theory and the practice of competing empires, each motivated by similar lusts of political aggrandisement and commercial gain; secondly, in the dominance of financial or investing over mercantile interests'[5].

The description of 'British imperialism' in Schulze-Gaevernitz's book *British Imperialism and English Free Trade at the Beginning of the 20th century* reveals the same parasitical traits. The 'national income of Great Britain approximately doubled from 1865 to 1898, while the income from abroad increased nine fold in the same period[6]. The US President Abraham Lincoln believed 'When the white man governs himself, that is self-government; but when he governs himself and also governs others, it is no longer self-government; it is despotism'[7]. In its economic essence imperialism is monopoly capitalism. This in itself determines its place in history, 'for monopoly that grows out of the soil of free competition, and precisely out of free competition, is the transition from the capitalist system to a higher socio-economic order'[8].

We need to understand the different aspects of monopoly; firstly, monopoly arose out of the concentration of production at a very high stage. This refers to the monopolist capitalist associations, cartels, syndicates and trusts. We have seen the important part these play in present-day economic life. Secondly, monopolies have stimulated the seizure of the most important sources of raw materials, especially for the basic and most highly cartelised industries in capitalist society: the coal and the iron

[2] Lenin.V.I, Imperialism the Highest stage of Capitalism, Resistance Marxist Library, Resistance Books , Australia, 1999, p. 7.
[3] Ibid. p. 91.
[4] Schulze-Gaevernitz, British Imperialism and English Free Trade at the Beginning of the 20th Century, Leipzig, 1906, p. 318.
[5] Siegmund Schilder, Trends of Development of World Economy, Berlin, pp. 1912. 160-161.
[6] Schulze Op.cit. p. 104
[7] Patouillet O J , L'impérialisme Américain, Dijon, 1904, p. 272.
[8] Lenin. Op.cit. p. 104.

industries. Thirdly, monopoly has sprung from the banks. 'The banks have developed from humble middleman enterprises into the monopolists of finance capital'[9]. The British imperialism was more pragmatic than that of other colonial powers. Its motivation was economic, not evangelical. The main changes which the British made in Indian society were at the top, but the lower strata were thoroughly exploited. They replaced the wasteful warlord aristocracy by a bureaucratic-military establishment, carefully designed by utilitarian technocrats, which was very efficient in maintaining law and order. The greater efficiency of government permitted a substantial reduction in the fiscal burden, and a bigger share of the national product was available for landlords, capitalists and the new professional classes. Some of this upper class income was siphoned off to the UK, but the bulk was spent in India. However, the pattern of consumption changed as the new upper class no longer kept harems and palaces, nor did they wear fine muslins and damascened swords. We witness the emergence of the new towns and urban amenities with segregated suburbs and housing for them were created. Their habits were copied by the new professional elite of lawyers, doctors, teachers, journalists and businessmen. Within this group, old caste barriers were eased and social mobility increased.

The striking thing about the British raj is that it was operated by few people. There were only 31,000 British in India in 1805 (of which 22,000 were in the army and 2,000 in civil government)[10]. The number increased substantially after the revolt of 1857, but thereafter remained steady. In 1911, there were 164,000 British (106,000 employed, of which 66,000 were in the army and police and 4,000 in civil government) [11].

In the Mughal period or medieval India, the zamindars would usually keep a tenth of the land revenue to themselves, but by the end of the British rule their income from rents was a multiple of the tax they paid to the state. In Bihar, for instance, it was five-sixths of the total sum levied was rent by 1850 and only one-sixth revenue[12]. Under the British, transfers became much more frequent, particularly into the hands of moneylenders. The moneylenders frequently presented as squeezing out poor peasants and tenantry and thus promoted the concentration of wealth, but the evidence of what happened to zamindar estates suggests that 'village moneylenders may also have helped to break up concentrations of wealth[13]. Nevertheless, there were some economic consequences of the new legal situation as because of the emergence of clear titles under the British rule, it was now possible for the Indian farmers to mortgage their land. The status of moneylenders also improved due to the change from the Muslim law to the British law. Though the moneylenders were there during the Mughal period, but 'their importance grew substantially under the British rule, and over time a considerable amount of land changed hands through foreclosures'[14].

It was close to 1870's, India built up her own textile manufacturing industry which displaced the British imports. The British imports entered India duty free, and when a small tariff was required for revenue purposes Lancashire pressure led to the imposition of a corresponding excise duty on Indian products to prevent them gaining a competitive advantage. This undoubtedly handicapped industrial development. If India had been politically independent, her tax structure would probably have been different. In the '1880s, Indian customs revenues were only 2.2 per cent of the trade turnover, i.e. the lowest ratio in any country. In Brazil, by contrast, import duties at that period were 21 per cent of trade turnover'[15]. Indian firms in industry, insurance and banking were given a boost from 1905 onwards by the swadeshi movement, which was a nationalist boycott of British goods in favour of Indian enterprise. During the

[9] Lenin. Op.cit. p. 120.
[10] D.A.B. Bhattacharya (ed.), Report on the Population Estimates of India (1820-30), Census of India 1961, Government of India, Registrar General, Delhi, 1963, pp. 4-5.
[11] Census of India 1911, Vol. I, India, Part II, Tables, Calcutta, 1913, pp. 374-6.
[12] D. Warriner, Land Reform in Principle and Practice, Oxford University Press, 1969, p. 158.
[13] W.C. Neale, Economic Change in Rural India, Yale University Press, 1962, p. 63.
[14] M.L. Darling, The Punjab Peasant in Prosperity and Debt, Oxford University Press, London, 1947, p. 178.
[15] M.G. Mulhall, The Dictionary of Statistics, Routledge, London, 1899, pp. 172 and 258.

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First World War, lack of British imports strengthened the hold of Indian firms on the home market for textiles and steel. After the First World War, under the nationalist pressure, the government started to favour Indian enterprise in its purchase of stores and it agreed to create a tariff commission in 1921 which started raising tariffs for protective reasons. By 1925, the average tariff level was 14 per cent compared with 5 per cent pre-war[16]. The procedure for fixing tariffs was lengthy and tariff protection was granted more readily to foreign-owned than to Indian firms, but in the 1930s protection was sharply increased[17].

From the beginning of the British conquest in 1757 to its independence in 1947, it seems unlikely that per capita income could have increased by more than a third and it probably did not increase at all. In the UK it there was a tenfold increase in the per capita income over these two centuries. The most noticeable change in the economy was the rise in population from about 170 million to 420 million from 1757 to 1947 in India. However, there were some significant changes in social structure and in the pattern of output. The social pyramid was truncated because the British lopped off most of the top three layers of the Mughal hierarchy, i.e. the Mughal court, the Mughal aristocracy and quasi-autonomous prices (a quarter of these survived), and the local chieftainry (zamindars who survived in about 40 per cent of India). In place of these people the British installed a modern bureaucracy which took a smaller share of national income. The newcomers had a more modest life-style than the Mughals, but siphoned a large part of their savings out of the country and provided almost no market for India's luxury handicrafts. The modern factory sector which they created produced only 7.5 per cent of national income at the end of British rule and thus did little more than replace the old luxury handicrafts and part of the village textile production.

The British reduced the tax squeeze on agriculture and turned warlords into landlords, but the new order had little dynamism. A good deal of the old fuzziness about property rights remained, and landlords were still largely parasitic. The bigger zamindars copied the Mughal lifestyle by maintaining hordes of retainers and huge mansions, the smaller landowner's ambition was to stop working and enhance his ritual purity by establishing a seedy gentility, very little incentive was provided for investment and almost nothing was done to promote technical changes in agriculture. At the bottom of society the position of sharecropping tenantry and landless labourers remained wretched.

In urban areas a new westernized 'middle class' of Indians emerged and became the major challenge to the British raj. The British were a very thin layer at the top of society but they took about 5 per cent of national income. Their allies, the native princes and zamindars, took about 3 per cent, eight per cent is a sizeable proportion for the ruling class but, under the Mughal regime, the equivalent group collected 15 per cent of national income in taxes and spent most of it on their own consumption. Immediately under this group were two new indigenous classes - capitalists and professionals - who became the dominant elite in independent India. They were relatively larger in number and probably had a bigger share of national income than their counterparts. Within the village society the social structure was probably similar to that in Mughal India, with the two top economic groups corresponding to the old dominant castes, the next group to peasant castes, and the bottom group consisting largely of untouchables.

The main difference from the Mughal economy is that village proprietors and tenants-in-chief were no longer heavily squeezed by taxation and their share of national income had probably increased. Thus the main gainers from the British regime (apart from the British) were the so called ‘middle’ class of Indian capitalists and professionals, and the village hierarchy. Most of these were high caste Hindus though the Parsis and Sikhs did fairly well. The main losers were the Muslims who had formed the major part of the Mughal aristocracy, officer corps, lawyers, and artisans in the luxury handicrafts.

[16] W.A. Lewis, Economic Survey, 1919-39, Allen and Unwin, London, 1949, p. 48.
[17] M. Kidron, I, Oxford University Press, London, 1965, p. 13.

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The development of capitalism in India was therefore a very tortuous process. The Indian working-class movement too consequently also developed at a much later stage. The development of capitalism, so to say, a change-over from the old feudal economic order to the modern capitalist economy was a long drawn-out process starting from the mid 16th century to 18th century, the characteristics form of capitalist production was to manufacture for pure profit. In the era before manufacture also, the workers depended on selling their labour-power, but they still had the real chance of eventually becoming independent. But the manufacture era involved extensive division of labour between many workers concentrated under one roof. The social division of labour and specialization of functions led to the downgrading and subordination of the individual who became a completely isolated component, cut off from the process of production as a whole and subjected to rigorous discipline. All that the worker required was a highly specialized dexterity losing his general skill as a craftsman and his ability for independent work. The products of seasoned craftsmanship in the era before manufacture transformed itself into the products of 'collective labour' of a few skilled and many unskilled workers in the era of manufacture. However, it was characterized not only by the invention and introduction of machinery, but also by the appearance of new basic classes, 'the bourgeoisie who owned the factories and the means of production and exploited the workers, and the proletariat, i.e. the wage-laboures who did not possess the means of production'[18].

The industrial revolution had therefore two aspects-the technical, i.e. the invention and the introduction of machinery and the passing away of the old feudal order and the formation of new basic social classes-the bourgeoisie and the proletariat in the newly emerging capitalist economic order. But in this continuously expanding revolution with the machine as the starting-point, the human organ was superseded by mechanical organization, independent of the limitations of human power. This totally transformed the whole production process. At the beginning of this process, in manufacture era the organization of social labour was purely subjective in the sense that it required a combination of different operations, but the new modern industry had in machinery a purely objective productive organism which converted the labour into a mere appendage of an already existing material condition of production[19].

It is interesting to note that when Marx analysed the Indian society, industrial revolution had already taken place in England and capitalism was expanding from England to the other European countries. This traditional system of Indian industry and agriculture was, however, laid waste by the imperialist plunder age. The establishment of the railways and certain connected industries in furtherance of colonial interest completed the process. In the first volume of 'Capital' Marx presents a vivid description of this old economic and social system.

'These small and extremely ancient Indian communities, some of which have continued down to this day, are based on possession in common of the land, on the blending of agriculture and handicrafts, and on the unalterable division of labour, which serves, whenever a new community is started, as a plan and scheme ready cut and dried. Occupying areas of form 100 up to several thousand acres, each forms a compact whole producing all it requires. The chief part of the products is destined for direct use by the community itself and does not take the form of a commodity. Hence, production here is independent of that division of labour brought about in Indian society as a whole, by means of the exchange of commodities. It is the surplus alone that becomes a commodity and a portion of even that, not until it has reached the hands of the State, into whose hands from time immemorial a certain quantity of these products has found its way in the shape of rent in kind. The constitution of these communities varies in different parts of India. In those of the simplest form, the land is tilled in common and the produce divided among the members. At the same time spinning and weaving are carried on in each family as subsidiary industries. Side by side with the masses thus occupied with one and the same work, we find the 'Chief inhabitant', who is judge, police and tax-gatherer in one; the book-keeper, who keeps the

[18] Sukomal Sen Working class of India. History of Emergence and Movement 1830-1970, published by K.P. Bagchi& Company, Calcutta,1970. pp. 1-2.
[19] Ibid. p. 3.

amounts of the village and registers everything relating thereto; another official who prosecutes criminals, protects strangers travelling through and escorts them to the next village; the boundary man, who guards the boundaries against neighbouring communities; the water-overseer, who distributes the water from the common tanks for irrigation; the Brahmin, who conducts the religious services; the schoolmaster who on the sand teaches the children reading and writing; the calendar-Brahmin, or astrologer, who makes known the lucky or unlucky days for seed-time and harvest, and for every other kind of agricultural work; a smith and a carpenter, who make and repair all the agricultural implements; the potter, who makes all the pottery of the village; the barber, the washer man, who washes clothes, the silversmith, here and there the poet, who in some communities replaces the silversmith, in others the school-master. This dozen of individuals is maintained at the expense of the whole community. If the population increases, a new community is founded, on the pattern of the old one, on unoccupied land. The whole mechanism discloses a systematic division of labour; but a division like that in manufacturer is impossible, since the smith and the carpenter find an unchanging market, and at the most there occur, according to the sizes of the villages, two or three of each, instead of one. The law that regulates the division of labour in the community acts with irresistible authority of law of nature, at the same time that each individual artificer, the smith, the carpenter, and so on conducts in his workshop all the operations of his handicraft in the traditional way, but independently and without recognizing any authority over him. The simplicity of the organization for production in these self-sufficient communities that constantly reproduces themselves in the same form, and when accidentally destroyed, spring up again on the spot and with the same name-this simplicity supplies the key to the secret of the unchangeableness of Asiatic societies, an unchangeableness in such striking contrast with the constant dissolution and refounding of Asiatic contrast states, and the never-ceasing changes of dynasty. The structure of the economical elements of society remains untouched by the storm-clouds of the political sky'[20].

The colonial rule and the exploitation by the British imperialists completely ruined the system of production of these traditional and self-sufficient societies. As the British army advanced and occupied different territories of India as a sequel to the victory in the battle of Plassey in 1757, the old economic system and social divisions of labour obtaining in those territories were also shattered simultaneously. Along with this occupation, the surplus products of the occupied zones also fell into the hands of the colonialists who then started direct plundering of and exporting the wealth of India to England. Imposing a high rate of taxation on internal trade of India and simultaneously engaging itself in money-lending business, the East India Company extorted a huge sum of money from the Indian people.

Referring to this direct plunder Karl Marx observed 'during the whole course of the 18th century the treasures transported from India to England were gained much less by comparatively insignificant commerce, than by the direct exploitation of that country, and by the colossal fortunes there extorted and transmitted to England'[21]. The sweat and blood of the Indian people, reduced to money became one of the principal sources of the primitive accumulation of capital in Britain. According to obviously minimized statistics, the British colonialists derived from India during the period of 55 years between 1757 and 1812 a direct income exceeding 100,000,000.Conspiratorial military victory and plundering of the wealth of the conquered areas continued for several decades. Subsequently the colonialists realized that the exploitation should be regulated and legalized in some way to ensure permanent revenues and consolidations of British rule, Data of Committee of Correspondence, submitted to the Board of Directors of the East India Company, February 9, 1813[22].

[20] Karl Marx, Capital, Vol 1, Foreign Languages Publishing House, Moscow, 1954, pp. 357-58.
[21] Karl Marx, The East India Company-Its History And Results, contained in On Colonialism by K. Marx an F. Engels, Foreign Languages Publishing House, Moscow, p. 51.
[22] Hansard's Parliamentary Debates, Vol. 25,p. 28,quoted from Capitalism in India-Basic Trends in its Development, Peoples' Publishing House, New Delhi, by A. I. Levkovsky, p. 10.

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In 1793 during the viceroyalty of Lord Cornwallis, the British colonialists passed the Act of Permanent Settlement, fixing a constant rate of taxation to be exacted from the zamindars of Eastern India. The 1793 Act and subsequent Acts conferred the formal rights of land-ownership to none but the zamindars, the hereditary rights of village community members and petty feudal lords were not recognized. This system at once dispossessed the people of Bengal Presidency of their hereditary claims to the soil in favour of the native tax-gatherers called zamindars. Despite securing a kind of right to land-ownership, the feudal zamindars was compelled to turn over ten-eleventh of the rent to the British colonial state, failing which, the state sold his land to anyone who could pay the sum. So in a bid to satisfy the colonial rulers and also for self-aggrandizement, the zamindars intensified exploitation of the peasantry and not infrequently raised it to inhuman heights. While their own instalments payable to the government were fixed, the zamindars enjoyed the freedom of increasing the rate of taxation on the peasantry. With the disappearance of the ancient Indian feudal nobility through this process, a new stratum of landlords originated from the moneylenders, tradesmen and colonial officials appeared on the scene. A series of parasitic middlemen also sprouted out between the cultivator and the zamindars each one of whom sought to extort his own pound of flesh thereby sharpening the exploitation of the peasantry beyond all proportions.

In the south of India the colonialists introduced the ryotwari system to exploit the peasantry. The peasant became a permanent tenant of a plot of land, a toiler of the soil entangled with obligations and in fact chained to the land as a serf. Thus the zamindari and the ryotwari systems were the two principal ways in which the modified feudal methods of exploiting the peasants were preserved. These systems while fully sub served the interests of the colonialists degraded the peasantry to the position of semi-slaves. Simultaneously with the exporting of the plundered wealth of India to England in furtherance of her Industrial Revolution, the English capitalists felt the need of marketing in India the industrial products of England. This in other words meant a free trade with India. The exclusive monopoly of trade with India so long enjoyed by the East India Company since the battle of Plassey in 1757 did not protect the interest of free trade of the British capitalist class as a whole. Prompted by an energetic search for new markets, the English bourgeoisie unleashed a large-scale campaign to abolish the privileges of the East India Company.

In 1813 the East India Company's monopoly in the trade with India was abolished opening the door of free trade with India. This in fact indicated a new phase in the economic exploitation of India. The East India Company had so long been earning profits mainly be exporting to and selling Indian silk, muslin and other luxury goods in England, but after 1813 Indian market was laid open to the British industrial commodities resulting in a rapid increase of British exports to India. 'From 1,600,000 in 1814 it grew to 5,800,000 in 1828, or one-eighth of all British export. The total tonnage of British ships engaged in trade with India in 1828 reached nearly 110,000 tons. In 1814 Britain shipped 213,000 yards of plain and 800,000 yards of coloured cotton textiles to India; in 1826 the totals were 16 and 26 millions yards respectively'[23]. The process of development of capitalism over the ruins of feudalism as it was in the case of Europe was not to be found in India. Although the Imperialist rulers devastated the old Indian economy, they did not supplant it by unleashing the forces of modern capitalist economy. So, the growth of capitalist economy in India followed a different path with accompaniment of strange contradictions, impediments and untold sufferings for the Indian people. Despite this, British rule in India produced two kinds of results, one destructive and the other regenerating. To consolidate colonial exploitation, it on the one hand annihilated the old Asiatic society and on the other was constrained to take some steps, the objective consequences of which rendered the growth of capitalist economy irresistible, although through a very halting and painful course.

[23] A. I. Levkovsky, Capitalism in India-Basic Trends in its Development, Peoples' Publishing House, New Delhi, p. 19.

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Introduction of railways in India was the event of foremost importance in this process. For transportation of the goods imported from England from the ports of India to the interior of the country, for carrying the raw materials from the countryside to the ports, for quick movement of the army to suppress the Indian people through military might-in a word to consolidate colonial rule and exploitation, introduction of railways in India turned out to be an indispensable task for the British imperialists.

In 1853 Viceroy, Lord Dalhousie, wrote his 'famous minute' pointing out the great social, political and commercial advantages to be gained from connecting the three Presidency cities-and these with the north-west frontier-by rail'. It is pertinent to quote here Marx's famous saying regarding the future results of British rule in India as he keenly observed this new aspect. With an amazing capacity of foresight he wrote: "I know that the English millocracy intend to endow India with railways with the exclusive view of extracting at diminished expenses the cotton and other raw materials for their manufacturers. But when you have once introduced machinery into the locomotion of a country, which possesses iron and coals, you are unable to withhold it from its fabrication. You cannot maintain a net of railways over an immense country without introducing all those industrial processes necessary to meet the immediate and current wants of railway locomotion and out of which there must grow the application of machinery to those branches of industry not immediately connected with railways. The railway system will therefore, become, in India, truly the forerunner of modern industry'[24].

The exploitation of the Indian working class was expressed chiefly in the fact that both British and Indian capitalists secured absolute surplus value. The working hours of maximum length, from dawn to dusk and often even longer was the most striking indication of the brutal manner in which labour was exploited. Even the official report of the Indian Factory Labour Commission which was appointed in 1908 to enquire into various recommendations made by the Freer Smith Committee in respect of certain amendments in the existing Factory Act, could not hide this inhuman picture. According to this report, in Ahmedabad the average working period in a day was 12 hours, and at some factories using electric power it was no less than 14 hours. In 'Bombay also the average was 12 hours, but in 60 out of 85 cotton mills where electricity was used, the labourers had to work not less than 13 to 15 hours. In Broach, Gujarat division the working period lasted 14 ½ to 13 ½ hours, in Delhi 13 ½ to 14 ½ hours in Agra it ranged from 13 hours 45 minutes to 15 hours 15 minutes, in Amritsar and Lahore from 13 to 13 hours 40 minutes. But the British capitalists owning the jute mills of Calcutta set the record making the weavers of these mills worked for 15 hours and also from 15 ½ to 16 hours in some cases[25]. The employers did not show any sense of proportion or any human consideration in exploiting female and child labour. Children even of such tender age as between 5 years and 7 years were employed most cruelly everywhere. Investigations conducted by the Indian Factory Labour Commission of 1908 revealed that half of the time, 30 to 40 per cent of those employed in the factories were tender-aged children.

The Report of the Royal Commission on Labour in India, 1931 also testified, 'When the Factory Commission of1908 made the investigations, many textiles mills were working from 13 to 15 hours a day with a single set of workers, and before that this practice had been fairly general'[26]. This was further confirmed by Mr. N. A. Moss, the Chief Inspector of Factories, Bombay, according to whom, 'Strikes have been many two should be put down every year for each factory, but all of them have been short-lived and in the end it is always the operatives who have given in, in some cases with fines and in some

[24] Karl Marx, The Future Results of the British Rule in India, contained in On Colonialism by K. Marx and F. Engels, Foreign Languages Publishing House, Moscow, p. 87.
[25] Sen.op.cit. pp. 37-38.
[26] Ibid. p. 40

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cases with loss of arrears of wages. The reasons leading the men to strike are mostly temporary, reduction of wages without any notice whatsoever'[27].

Class-consciousness of the proletariat, as a general rule, rises in proportion to the advance of economic struggles against capitalist exploitation. But in a colony, some specific features of exploitation as distinct from that in a metropolitan country impede the development of economic struggles of the workers and in consequences retard the growth of their class political consciousness. The general nature of capitalist exploitation in colonial India was thus rendered further oppressive by these specific features.

A colonial regime means the open dictatorship of imperialism in its crudest forms, implying thereby that in a colony the oppression of the working class grows immeasurably, assuming the most ugly and monstrous character. In the context of colonial India it is not only national oppression to which, in addition to social oppression, the working class was subjected as a section of the entire Indian people, the capitalist exploitation in itself was so altered that its burden on the working class increased tremendously. Successful economic struggle is admittedly one of the main factors determining the conditions for the sale of labour-power and the degree of capitalist exploitation. Further, 'this struggle puts a limit on the otherwise boundless quest for profit to which capital is impelled by competition'[28]. When the capitalists were confronted with growing resistance from the workers, a tendency on the part of the employers and the government officials towards presenting a little exaggerated view of the situation cannot, however, be ruled out-in this respect, the study made by the factory Labour Commission of the existing labour condition seems to be more balanced.

According to the Commission, 'The history of movement in Bombay and of similar movements in other industrial centres shows clearly that while the operatives fully understand the machinery of local strikes and have repeatedly forced employers to comply with their demands in isolated cases, they are as yet unable to combine over any large area with the object of securing a common end by concerted action'[29]. The history of all the countries shows that the working class exclusively by its own effort, is able to develop only trade-union consciousness, i.e. 'the conviction that it is necessary to combine in unions, fight the employers, and strive to compel the government to pass necessary legislation, etc'[30]. Japan's bid to capture market as a formidable rival to western capital further worsened the condition of India's industry. This cut-throat competition of international capital combined with extreme impoverishment of the Indian people resulted in a serious shrinkage of the country's market. Confronted with this unfavourable situation, the Indian textile mill owners conveniently directed attacks on the working class in a bid to strengthen their own position. The mill owners attempted 'to reduce wages of the workers. It is a particular misfortune of the colonial working class that they have ultimately to fall victim to the intense rivalry between the imperialists and native capitalists'[31]. Economic development is as much concerned with human and institutional aspects as its more emphasized aspects of capital-formation and better exploitation of the resources of a given country. Hence in a developing economy (or a country aspiring for economic development) 'it is highly essential to minutely examine all the existing and potential forms of human institutions so as to discover their impacts upon the economic growth of the community'[32].

Although both industrial and agricultural workers are affected by this process of capital accumulation, usually the industrial workers first try to protect themselves from the impact of the strains of capital

[27] British Parliamentary Paper, XXXVI, Vol. II, Part V, 1892, p. 120, British Parliamentary Paper, XXXVI, Vol. II, Part V, 1892, p. 107, British Parliamentary Paper, XXXVI, Vol. II, Part V, 1892, p. 107.
[28] Sen.op.cit. pp. 87-88.
[29] Report of the Factory Labour Committee, 1906, 1907.
[30] V. I. Lenin, Collected Works, Moscow, 1964, Vol. 5, p. 375.
[31] Sen.op.cit. p. 205.
[32] Subratesh Ghosh, Trade Unionism In The Underdeveloped Countries, published by Book and Private Ltd, Calcutta,1960. p 3.

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accumulation, since in the urban society they have to come more directly in contact with the rich industrialists and other people belonging to the upper income brackets and hence, are more exposed to what is now known as the demonstration effect. The high standard of living and the conspicuous consumption by the rich in the urban society make them more conscious about their own miseries and intensify their discontent. And in spite of higher money wages 'the loss of the accustomed way of life which the new recruits to the industries in the developing economy used to enjoy in their rural society together with the great insecurity of the industrial life make their condition more intolerable an compared to those of the agricultural workers'[33].

Machinery-inventions made large-scale production an easy possibility. But this large-scale production, of course, necessitated large investments in machinery plantations, which brought into existence a class of men, who could make such investments, the class of capitalists. Mechanical production and output far superseded that of the home industries and village or guild-industries of the Medieval Ages. The ruin of these industries threw the old independent guild-labour-hands out of employment and thus brought them to the feet of the capitalists, who could propose their own terms to the labourers. The 'labourers could do nothing but offer themselves to these new masters on their conditions'[34]. The possibility to carry on unlimited production through machinery in a very short time, gave to the capitalists means of making vast profits, which intensified the feeling of acquisitiveness, vanity, rivalry and love of power. This made them disregard the condition of the labourers that they employed and whom in course of time they began to consider as another piece of machinery.

The old lords, serfs and slaves were abolished; but new kinds of lords and slaves came into existence, without those obnoxious titles, under the name of capitalists and wage-earners. The whole wealth thus obtained by starving the labourers at home and ruining labourers abroad, through competition, went to satisfy the lust of the capitalists. The labourers were men as much as the capital-owners were. Political parties and state mechanisms with their pretention of democratic representations were dominated by their purses. Thus becoming 'masters of the political wheel, which alone is competent to effect reform in society, they could suppress the cry of lessening the miseries of the working-class'[35].

The capitalists that is the possessors of the means and implements of labour, namely lands, factories, ready money and raw material; contractors that is the heads and initiators of labour, commercial men, who represent or ought to represent intellect and the working men, who represent manual labour. The capitalists have become 'the masters of the new slaves, who are not given the rights of human beings, even'[36]. Capital cares nothing for the length of life of labour power. All that concerns it is, simply and solely the maximum of labour power that can be rendered fluent in a working day. It attains this end by 'shortening the extent of the labourer's life as a greedy farmer snatches increased produce from the soil by robbing it of its fertility'[37]. Large populated areas in industrial towns well exhibit to what level of life wage-earners was being reduced. The industrial society began to breed the class of capitalists, which was the source of so much evil in Europe. When the cost of living rose extraordinarily high in times of war, the Indian capitalists showed as much implacability towards the demands of starving Indian labour as the European capitalists did. White capitalists can at least be excused on the ground that it is in their very nature and breeding to behave so towards the Indians, but the Indian capitalists equally followed their path. Most of the trade in foreign and inland was centered in the hands of the Shethias of the Gujarathi community, the Marwaris, the Parsis and the Bohras. These capitalist communities were naturally opposed to the attempts of native Indian workers emancipation. And they in their turn

[33] Ghosh. op.cit.pp. 21-22
[34] Bani Deshpande, Roza Deshpande, Umakant Mokashi, (ed), Selected Writings : S. A. Dange, Lok Vangmaya Griha publication vol-1 Bombay, 1974. p. 63.
[35] Ibid. pp. 63-65.
[36] Ibid. p. 66.
[37] Ibid. p. 66.

'exhibited all the greediness, idleness and cruelty, luxurious and demoralized life consequent upon capitalism in every form and in every country'[38].

Thus the Indian capitalists were committing three sins. 'They supported the foreign despotism, they demoralize and ruin the peasantry and the wage-earning classes of the society, by doing this they supported and fed the capitalists of Europe and thus helped the cause of misery of the workers of that continent also'[39].

The instruments like the mills in Bombay were not merely for producing cloth; they also had special, social significance. They were instruments of exploiting wage-labourers. The capitalist obtained their profits because they owned the means of production which ultimately meant capital. Thus the distribution of the means of production determined the distribution of the products. The owner of the means of producing cloth had all of it while to the share of the worker falls little of it. It was 'these class relations which determined in the first place the outline of society, its economic structure'[40].

In the modern imperialist epoch it requires very little arguments to prove that the State conforms to the economic structure. In capitalists society, 'the capitalists control the means of production, naturally they control the State also'[41]. The British imperialism in India deprived the feudal order of its political power, but retained its socio-economic character, making it serve the needs of the imperialist country. To 'serve the needs of British industry means to serve as its suppliers of raw materials and markets'[42].

The 'vast wealth taken from India had given a stable basis of liquid capital to British industries, but it disturbed state of affairs in India, and unregulated rapacious Company control, wherein the traders were directly administrators both of the political rule and commercial development'[43]. The handicraft and manufactures were destroyed first by extra-economic force and violent destruction and a vast number of artisans were thrown out of the land. The character of agriculture was thoroughly changed. The growing of crops was subjected to the needs of the exchange market and the peasants economy was brought within the orbit of capital it market. The low level of productive forces, 'the poor national income was burdened with an expensive bureaucracy and disproportionate militarism, the resulting discrepancy was filled up by high taxation and public debt'[44].

A highly industrialized society requires a great deal of accounting to be done. The needs of modern production and distribution have to carry out the inventory of the world in all matters. Without the 'highly organized system of accounting, modern large scale production and international exchange of goods would not be possible'[45]. The Indian worker had to work in such inhuman conditions that for all time there was a permanent fund of grievances justifying a strike. The material conditions of the working-class, on the admission of responsible commissions, were forcing them into class struggle. While in capitalist Europe they secured the 8-hour day and in Soviet Russia they were working even a 7-hour day, but in India during the same time they had to work for minimum 10 hours a day and in the native states it was extended to 14 hours also. He had 'no right to fall sick and become old and if he does, he must starve and die, there was no insurance for him'[46].

[38] Ibid. pp. 71-72.
[39] Ibid. p. 73.
[40] Ibid. p. 34.
[41] Ibid. p. 36.
[42] Ibid. p. 319.
[43] Ibid. p. 325
[44] Ibid. p. 328
[45] Ibid. p. 461
[46] Ibid. p. 478.

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The workers assembling in modern industrial sectors were mainly expropriated peasant class from villages, to which they were linked with family ties or through their holdings of increasingly smaller pieces of land heavily encumbered with debt. The poorest and the most downtrodden and the menials were the first to leave the villages, as they found their roots threatened and had to face a precarious survival commensurate with the growing misery in the rural India. The emerging working class had to face crude exploitative control of the employers which had its roots somewhere in the character of a despotic social set up supported from past a well as the very logical need of modern capitalism. The exploitation of the working class reached an extreme step due to the dual socio-economic pressure generated from the well entrenched feudal social set up and "Commoditism" of the modern capitalism[47]. The replacement of the man with machine made his survival merely mechanical and the native Indian capitalists conveniently replaced the British rule and role even after the independence of India.

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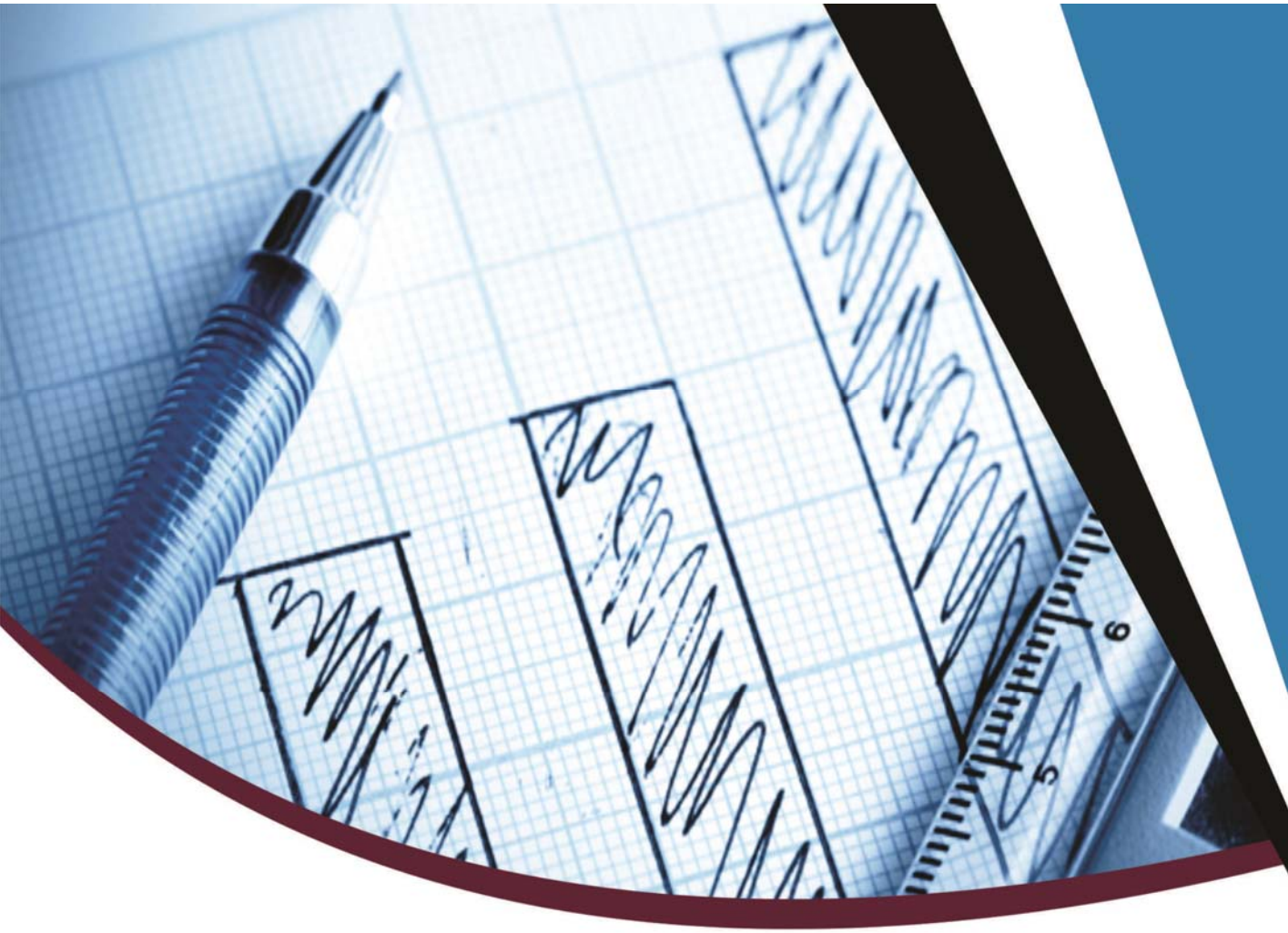

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PREFACE

It gives us immense pleasure to present the first revised edition of ***Commerce - II*** at the F.Y.B.Com. level, Semester II, as per University of Mumbai, revised syllabus w.e.f. June 2016.

In this edition, the subject matter in the entire chapter is added, updated and modified in a compact manner. The book contains objectives and question bank after each and every module. There are three sets of model question paper at the end of the book. We hope that this book will meet all the requirements of students in their regular study and semester end examination.

Our special thanks to the publisher Mr. Pandey and his team have been very helpful and supportive.

We welcome constructive suggestions for improving the contents of the book.

Authors

SYLLABUS

Sr. No.	Models	No. of Lectures
1.	Concept of Services	12
2.	Retailing	12
3.	Recent Trends in Service Sector	10
4.	E-Commerce	11
	Total	**45**

Sr. No.	Models/Units
1	**Concept of Services** **Introduction:** Meaning, Characteristics, Scope and Classification of Services, Importance of Service Sector in India. **Marketing Mix Services:** Consumer Expectation, Service Mix, Product, Place, Price, Promotion, Process of Services Delivery, Physical Evidence and People. **Service Strategies:** Market Research and Service Development Cycle, Managing Demand and Capacity, Opportunities and Challenges in Service Sector.
2	**Retailing** **Introduction:** Concept of Organised and Unorganised Retailing, Trends in Retailing, Growth of Organised Retailing in India, Survival Strategies for Unorganised Retailers. **Retail Format:** Store Format, Non-store Format, Store Planning – Design and Layout. **Retail Scenario:** Retail Scenario in India and Global Context, Prospects and Challenges in India, Mall Management, Retail Franchising, FDI in Retailing, Careers in Retailing.
3	**Recent Trends in Service Sector** **ITES Sector:** Concept and Scope of BPO, KPO, LPO and ERP. **Banking and Insurance Sector:** ATM, Debit and Credit Cards, Internet Banking, Opening of Insurance Sector for Private Players, FDI and its Impact on Banking and Insurance Sector in India. **Logistics:** Networking, Importance and Challenges.
4	**E-Commerce** **Introduction:** Meaning, Features, Functions and Scope of E-Commerce, Importance and Limitations of E-Commerce **Types of E-Commerce:** Basic Ideas and Major Activities of B2C, B2B and C2C. **Present Status of E-Commerce in India:** Transition to E-Commerce in India, E-Transition Challenges for Indian Corporates, Online Marketing Research.

PAPER PATTERN

Maximum Marks: 100
Questions to be Set: 06
Duration: 03 Hours

Sr. No.	Questions	Marks
Q.1	Objective Questions (A) Sub-questions to be Asked (12) and to be Answered (any 10) (B) Sub-questions to be Asked (12) and to be Answered (any 10) (*Multiple Choice/True or False/Match the Columns/Fill in the Blanks)	20
Q.2	Full Length Practical Question	15
	OR	
Q.2	Full Length Practical Question	15
Q.3	Full Length Practical Question	15
	OR	
Q.3	Full Length Practical Question	15
Q.4	Full Length Practical Question	15
	OR	
Q.4	Full Length Practical Question	15
Q.5	Full Length Practical Question	15
	OR	
Q.5	Full Length Practical Question	15
Q.6	(A) Theory Questions	10
	(B) Theory Questions	10
	OR	
Q.6	Short Notes To be Asked (06) To be Answered (04)	20

CONTENTS

CHAPTER 1

Concept of Services

1.1 Introduction

Service sector represents different services used by the consumers and different sectors of the society. All the services like banking, insurance, telecommunication, hotel, construction, retail trade, transport, catering, tourism and so all collectively come under the service sector. It helps to increase the GDP of the country, which in turn helps to increase the economy of the country.

Service sector is the fast growing sector in India. It helps to generate employment, increase the nation's income and also helps to raise the standard of the living of the consumers. The service is of two types: one who provides the service and the other who uses the service. Service cannot be stored and the same service cannot be used again and again. Any person who uses the service has to actually pay for the same. Service are intangible, they cannot be seen or touched but they can be felt. Service most of the time is followed by the goods.

The service sector has flourished after the liberalisation, privatisation and globalisation in India.

Definitions of Service

1. Philip Kotler defines Service as "A service is any activity or benefit that one party can offer to another that is essentially intangible and does not result in the ownership of anything."
2. The American Marketing Association defines Services as, "activities, benefits and satisfactions which are offered for sale or are provided in connection with the sale of goods."

Characteristics/Features of Services

The characteristics or distinctive features of service are given below:

1. **Intangibility:** Services are intangible in nature. They cannot be seen or touched but can be felt. The services provided by the banks, insurance, hotels, trade, transport and so on are only felt by the consumer. A student paying fees for tuition is actually paying for getting knowledge, which is not seen or touched, but it is felt. So, unlike products, services are only felt, not seen or touched. It is the feeling of satisfaction or may be dissatisfaction.
2. **Inseparability:** Services cannot be separated from the service providers. It comes hand in hand with the service provider. The production and consumption of service happens at the same time. For example, a travel agent explaining to the tourist about the travel place. As the service cannot be separated, direct sale is the only channel of distribution and a maid has

to be physically present to cook the food; a teacher has to be present to explain things to the students. The rights of ownership of service are not transferred to the service users.

3. **Perishability:** The service cannot be stored. It is perishable in nature. One cannot store the service and use it another time. For instance, the railway or bus ticket will last only for that particular journey and not for the next one. Similarly, a movie ticket will be used for that particular show and not for the next show.
4. **Non-transferable Ownership:** Services are of non-transferable ownership. A person pays to get the service, but not to own the service. For instance, a person makes the payment to book a room in a hotel or books a table for dinner, but he does not own the hotel or restaurant. This shows that the ownership lies with the service provider.
5. **Inconsistency:** Services are inconsistent or heterogeneous in nature. A repeated service will never be same. It also depends upon the customer's wants and desires. Services are customised in nature. For instance, a musician performing in Navratri for nine nights may definitely be inconsistent, as it is very difficult to perform same all the time. A teacher in a school or college may explain differently the same topic every year. Services cannot be homogeneous.
6. **Cannot be Produced in Anticipation:** Service cannot be produced in anticipation or expectations of demand. On the contrary, products are made for future demand like pen, television sets, books and so on. Services cannot be produced first and then used later. For instance, a maid service cannot be taken on one day and used the same for the remaining six days of the week. It has to be produced or taken every day.
7. **Non-returnable:** Services once taken cannot be returned back to the service providers. If it were a product, it would be easily returned or exchanged, but it is not possible in case of service. A defective mobile or laptop can be exchanged or returned back, but poor service of banks, employees or maids cannot be given back to them, nor can they be exchanged. Only after using the entire service, one understands its quality.
8. **Needs Communication:** To provide service, one needs to communicate with the service users or customers. The needs have to be clearly understood by the service provider. For instance, in a restaurant, the customers order for spicy food or less spicy food, it has to be communicated properly. Even for the services provided by the lawyer, both the victim and lawyer need to interact about their views, so that the service is properly provided.
9. **Proper Recruitment:** It is very important to have the right person for the right job. Recruiting the right staff and also providing training to them helps in delivering service in the correct manner. The consumers or customers compare the service and make their ideas for the next time.
10. **Goods Follow Services:** Services at times are followed by the goods. No product can be sold without service. For instance, a television set cannot be sold without a salesman giving his service. In this case, television is a product which is tangible and the salesman's service is an intangible in nature. So, service may come alone (separately) like in case of a singer or teacher or it may be followed by a product.

Scope of Services

Services have many sub-sectors, they are connected with each other. The following are the various areas/scope of services:

1. **Transportation:** It brings place utility. It helps in moving the goods from one place to another Transportation includes roadways, railways, waterways and airways. It helps in bridging the gap between service provider and service user. Transportation helps to distribute the goods and services. It promotes industrial, agricultural and economic development.
2. **Warehousing:** Warehousing creates time utility. It is the storehouse or godown. It helps in storing the goods on a large scale. Warehousing also protects the goods from the sun, wind and rain. It helps in providing regular supply of goods to the consumer.
3. **Banking:** Banks provide loans and advances and also help in depositing money. Banks provide financial services to the individual as well as the corporate. It provides the ATM services, debit cards, credit cards, net banking, locker facility and so on. These services are helpful in increasing the companies' capital which in turn raise the GDP of the country.
4. **Insurance:** Insurance service is taken by the individuals as well as by the corporates.It helps in reducing risk in the personal as well as in the corporate life. Insurance is taken for protection of various risks and uncertainties like health, theft, natural calamity, fire and so on.
5. **Education:** Education is also a part of the service sector. It also adds to the economy of India. There are many universities and courses, nationally and internationally. Indian universities also have tie-ups with other foreign institutions. It gives a very wide variety and exposure in service sector.
6. **Information Technology (IT) Services:** IT is the leading service in our country now. It is important for the economic growth of India. Wipro, Drade Financial, Tata Consultancy and Infosys are a few well-known IT companies. IT generates lot of employment to India and also adds to the economic growth of our country.
7. **Tourism:** This sector has given a tremendous income to our country. It is the faster growing sector in India. There has been a steady rise in the total number of foreign tourists arriving in India. While 33.04 lakh foreign tourists arrived in 2014, it rose to about 36.36 lakh in the first five months of 2016 – a 13.48% rise. It brings lot of money to our country. The Government of India has allowed 100% FDI to this sector.
8. **Health:** Healthcare is one of the most important service sectors. There are many private and public hospitals in the society. Not only hospitals but there are many dispensaries, clinics and nursing homes to provide quality medical service to the patients. Health services also add to the GDP of our country.
9. **Retailing:** Retail sector is the growing sector in India. In India, unorganised retailing is very common like kirana shops, pan beedi shops, etc. India has a lot of scope in the organised sector like malls, departmental stores, multi-brand outlets, etc. The Government of India allowed 100% FDI in single brands and 51% FDI in multiple brands. It helps to promote the economic development of India.

10. **Hotel Industry:** Hotel industry is also an important service sector. As India has good holiday destinations, many tourists visit India. Internally also, many people travel from one part of the country to the other. This gives rise to the hotel industry, which also plays an important role in the economic development of India. Taj Group of Hotels, J.W. Marriott and ITC Hotels are a few reputed names in the hotel industries in India, with the best amenities and arrangements.
11. **Other Services:** There are many other services that are important in the day-to-day activities of the people. They also boost the economic and social development of India. They are:
    (a) Media
    (b) Communication
    (c) Repairs and maintenance
    (d) Recreation services
    (e) Defence services
    (f) Courier services.

Classification of Services

The services can be classified or segregated into various types. Following are the types of services.

1. **Degree of Tangibility:** Services are mostly intangible. Few services are followed by tangible goods or products. For instance, if a banker tries to explain the benefits of a new scheme, then he is purely selling services. But if a banker tries to explain the benefits of the new credit card and tries to sell it, then in this case, services are followed with goods.
2. **Degree of Relation with Customer:** Services are classified on the basis of customers' demands. It may be formal or informal in nature. For instance, if a teacher teaches in a class, then it is formal, but if a teacher gives tuition to weak student at home, then it is informal in nature.
3. **Degree of Customisation:** When the services are classified on the need of the customers, it is said to be customised service. For instance, if a readymade garment shop sells its products, it is less customised, but if it is stitched by a tailor as per the customer's needs, then it is giving a high degree of customisation.
4. **Degree of Skill:** Services are also divided on the basis of the employee's skill. If a service is divided on the basis of expertise, it may be professional or non-professional. Professional services may be like those of doctors, teachers and bankers. Non-professional services may be like the services provided by maids or domestic workers.
5. **Degree of Labour-intensiveness:** Services can also be divided on the basis of labour-intensiveness. Few services require a lot of labourers, like people working in a handicrafts or repairs unit. But few services are low labour-intensive, like ATMs or automatic packing of goods and other mechanised services.
6. **Degree of Discretion:** Services are biased in nature and differs from customer to customer. There may be discretion done by the service provider when he gives his service to the

customers. A doctor may be very polite and kind with his patients, but may be very harsh and strict with his staff at the dispensary.

7. **Degree of Business Goals:** Services may be also depend upon the business goals or objectives of a business objective is to earn profit, then the services provided may be very costly and if the business objective is to increase market share, the services may be slightly cheaper.
8. **Depends on Place and Time:** Services also depend on the place and time of service delivery. The service may be given at the place and time of service provider, like a beauty saloon, or it may be given at the place and time of the services user, *e.g.*, a beautician visiting home as per the customer needs.
9. **Degree of Government Rules:** Some services are highly governed by the government, like railways, defence, and so on. While some services have very little or no government control, like private cars or private schools and colleges.
10. **Facilities or Equipments Used:** Services may also be classified on the basis of facilities or equipments provided. For instance, a fitness centre may require more facilities and equipments than a house painter.

Importance of the Service Sector in India

Service sector is the fastest growing sector in India. It has contributed to the growing employment, increase in GDP and also raised the standard of living of the people in India. It also helps to generate foreign exchange in the country. The following are the details of growing importance of the service sector in India.

1. **Share of Services in GDP:** The contribution of service sector to GDP has tremendously grown. After 1991, the concept of liberalisation, privatisation and globalisation increased. It gave rise to the service sector. In 1950-51, GDP was 25%, it increased to 42.5% in 1990-91. After that in 2015-16, it was 64% and it will reach approximately to 90% by 2020.
2. **Revenue to the Government:** The sector provides revenue to the government in the form of service tax, corporate tax and individual tax. Services as a percentage of Gross Domestic Product (GDP) has increased from 50% in 2000-01 to nearby 60% in 2013-14. The effective service tax rate now is 12.36%
3. **Generates Employment:** It plays a very important role in generating employment. India has the second fastest growing service sector after China. The share of service sector is more in the urban areas, as compared to the rural areas in India. The service sector was contributing about 28% of the total employment in India in 2012.
4. **Service Sector Supports Other Sectors:** The other sectors like primary and secondary sector get the boost from service sector. The different services like banking, transportation, communication, warehousing, insurance services and so on are all very important for the primary as well as secondary sectors.
5. **It Helps in Social Development:** Service sector helps in the development of the society. It strengthens the social development. The services like education, health, insurance, media, etc. are very important for the social development of India.

6 **It Helps in Regional Development:** Service sector is the backbone of regional development. It helps in strengthening the region's infrastructure like transport, Information Technology (IT), warehouse facility, etc. It makes the region developed and reduces the regional imbalance. Service sector plays a very important role in backward areas like Bihar, Uttar Pradesh, Assam, Meghalaya, etc.

7. **It Helps to Improve Efficiency:** It plays an important role to improve the efficiency of the people in an organisation. It helps to improve through good education, training and development, research and development , etc. in various fields. The improvement in the person helps to improve the quality of the goods and services and reduce wastage of resources.
8. **It Builds Reputation:** Service sector development helps to build reputation of the country. It helps to create a goodwill in the global market for India due to the improvement in goods and efficiency in the service provided.
9. **Various Sector-wise Growth in Service Sector:** Service sector is the fastest growing industry in India. It includes various sectors like banking, insurance, telecommunication, IT, transportation, warehousing, hotels, travel and tourism, finance, real estate and so on. There is a rapid growth in the services. The fast growing sectors in the recent years are IT, travel and tourism, finance, banks and insurance sector.
10. **Increase in standard of living:** The service sector has a tremendous growth in the GDP of India. It has contributed to GDP about 64% in 2015-16 and employment of about 20% of the total workplace in 2012. This has led to improved standard of living for the citizens of our country, as the income of the employees has increased. The purchasing power of the people has also increased the country.

1.2 Marketing Mix Services

Customer Expectations

Customer expectations are beliefs about service delivery that function as standards or reference point against which performance is judged. Customers compare their perceptions of service delivery with these reference points when evaluating service quality and therefore knowing what customers expects is critical in gaining competitive advantage.

Levels of Customer Expectations

Customers hold different types of expectations about service, the highest type of these are desired service and adequate service.

1. **Desired Service:** This is the highest level of customer expectation. **Desired service is the level of service the customer hopes to receive.** It is a combination of what customers believe "can be" and "should be". It signals the level of customer hopes and wishes and belief that they may be fulfilled. Thus, failure to meet these expectations may result to customers cutting down on purchase.

For instance, in case of banking services, one expects prompt service, better complaint handling, high interest on savings, online availability of services, etc.

2. **Adequate Service:** Customers generally accept that the service would not always be performed according to their expectations and this is known as adequate service. **Adequate service is the level of service that customers will accept.** Though customers' hopes and wishes may still be high, they have a certain level of understanding in cases where receiving desired service does not seem possible at all.

For example, customers are used to the self-service approach used in supermarket and therefore have certain levels of understanding or tolerance towards food retailers' service delivery.

The Zone of Tolerance

Services are heterogeneous in that performance may vary across providers, across employees from the same provider, and even with the same service employee. The extent to which customers recognise and are willing to accept this variation is called the zone of tolerance. The zone of tolerance is defined as the degree to which customers recognise and are willing to accept service performance variations. Customers assess service performance on the basis of two boundaries: what they desire and what they consider acceptable.

- If service drops below adequate service level, customers get frustrated and this may cause dissatisfaction with the service provided by the company.
- If service is above the zone of tolerance, where service performed by the business exceeds the desired level, customers will have favourable responses to the business.

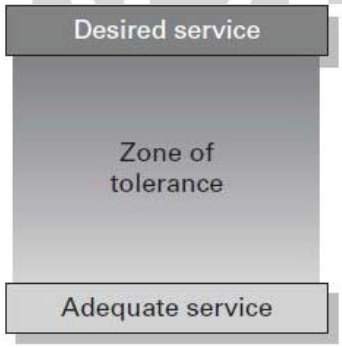

Fig. 1.1: The zone of tolerance

It is to be noted that:

- Different customers possess different zones of tolerance
- Zones of tolerance vary for service dimensions/attributes/factors

Factors Influencing Customer Expectations of Service

Because expectations play such a critical role in customer evaluation of services, marketers need and want to understand the factors that shape them.

Factors Influencing Desired Service Expectation: One of the largest influences on desired service level are personal needs and personal service philosophy.

1. **Personal Needs:** Personal needs are, those states essential to the physical or psychological well-being of the customer. For instance, a cinema-goer who regularly goes to see films straight from work, and is therefore thirsty and hungry, hopes and desires that the food and drink counters at the cinema will have short queues and attentive staff, whereas a cinema-goer who regularly has dinner elsewhere has a low or zero level of desired service from the food and drink counters.
2. **Personal Service Philosophy:** It is the customer's underlying generic attitude about the meaning of service and the proper conduct of service providers. For instance, if a person have ever been employed as a member of waiting staff in a restaurant, he is likely to have standards for restaurant service that were shaped by his training and experience in that role. He might, for example, believe that waiters should not keep customers waiting longer than 15 minutes to take their orders.
3. **Other Miscellaneous Factors:**
   - Generally, better the **image of the service organisation**, higher is the customer service expectation.
   - Customers expect high service level from the high charged/**priced** services, and *vice versa*.
   - Information about service.

Factors influencing adequate service expectations:

1. **Temporary Service Intensifiers:** It consists of short-term, individual factors that make a customer more aware of the need for service. Personal emergency situations in which service is urgently needed such as an accident raise the level of adequate service expectation.
2. **Perceived Service Alternatives:** These are other providers from whom the customer can obtain service. If customers have multiple service providers to choose from, or if they can provide the service for themselves (such as lawn care or personal grooming), their levels of adequate service are higher than those of customers who believe it is not possible to get better service elsewhere.

   For instance, an airline customer who lives in a provincial town with a small airport, for example, has a reduced set of options in airline travel. This customer will be more tolerant of the service performance of the carriers in the town because few alternatives exist. The customer's perception that service alternatives exist raises the level of adequate service and narrows the zone of tolerance.
3. **Customer's Self-perceived Service Role:** It is the customer perceptions of the degree to which customers exert an influence on the level of service they receive. In other words, customers' expectations are partly shaped by how well they believe they are performing their own roles in service delivery. For instance, a customer may give special instructions to the air hostess regarding specific services required, which raises his expectation level.
4. **Situational Factors:** It is defined as service performance conditions that customers view as beyond the control of the service provider. For example, during monsoon, delay in railway service. Customers who recognise that situational factors are not the fault of the service company may accept lower levels of adequate service given the context.

5. **Predicted Service:** It is the level of service that customers believe they are likely to get. This type of service expectation can be viewed as predictions made by customers about what is likely to happen during transaction. Higher the level of predicted service, higher the expectation of the customers.

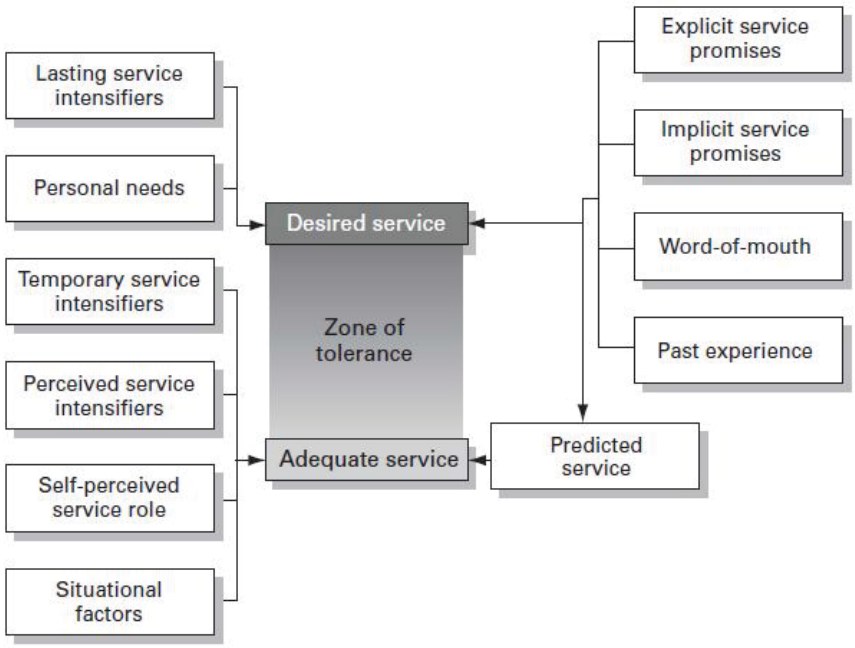

Fig. 1.2: Factors that influence desired and predicted service

Marketing Mix for Services

The service marketing mix is also known as an extended marketing mix. The product marketing mix consists of the 4Ps which are Product, Pricing, Promotions and Placement. The extended service marketing mix places 4 further Ps which include People, Process, Physical Evidence and Productivity and Quality. All of these factors are necessary for optimum service delivery.

1. **Product:** The product in service marketing mix is intangible in nature. At the same time, service products are heterogeneous, perishable and cannot be owned. The service product, thus, has to be designed with care. In the service industry, the production and consumption of the product are simultaneous and the product is intangible. The nature of this 'product' allows for on-the-spot customisation. Firms must try to differentiate its service product from other competitors so as to get competitive advantage in the market. For instance, ICICI Bank offers account opening at the doorstep of the customers. Some of the elements of a firm's product mix are:
   - core service offered
   - quality of service
   - service warranties and after-sale service
   - product line and related services, etc.

2. **Place:** Place in case of services determine where the service product is going to be located. As mentioned, the service is produced and consumed in the same place. It cannot be owned and taken away from the location. This is why the place at which this transaction occurs is of vital importance. The location of the service provision is carefully analysed to allow ease of access and the desire to make the effort to reach it. For instance, the best place to open up a petrol pump is on the highway or in the city. A place where there is minimum traffic is a wrong location to start a petrol pump. Elements of place mix are:
   - channel selection
   - transportation
   - area coverage
   - location of store.
3. **Price:** Since a service cannot be measured by what material goes into its creation nor is the actual tangible cost of production measurable, it can be challenging to put a price tag on it. There are some tangibles of course, such as the labour costs and overheads. Firm can add mark up to the cost to determine price. But additionally, the ambiance, the experience and the brand name are also factors in the final price offering.
4. **Promotion:** Promotions have become a critical factor in the service marketing mix. Services are easy to be duplicated and hence it is generally the brand which sets a service apart from its competitors. To prevent a service from becoming interchangeable with its competitors, it becomes vital to create a desirable brand image and name in the market. Thus, firm should adopt proper promotion mix. This will not only create awareness but will also attract both new and repeat customers. Elements of promotion mix are:
   - advertising
   - sales promotion (discounts, free gifts, etc.)
   - salesmanship
   - publicity.
5. **People:** This is a vitally important element of the service marketing mix. When a service is being delivered, the person delivering it is not different from the service itself. Customers make judgments about service provision and delivery based on the people representing organisation. This is because people are one of the few elements of the service that customers can see and interact with. The staff requires appropriate interpersonal skills, aptitude, and service knowledge in order to deliver a quality service. For instance, when dining at a restaurant, if a rude waiter is encountered, the entire experience will be labeled as bad service. Elements of people mix are:
   - recruitment
   - selection
   - training and development
   - performance appraisal
   - compensation
   - process.

6. **Process:** This is the way in which a service is delivered to the end customer. This element of the marketing mix looks at the systems used to deliver the service. All services need to be underpinned by clearly defined and efficient processes. This will avoid confusion and promote a consistent service. In other words, processes mean that everybody knows what to do and how to do it. For instance, service process, in case of Domino's pizza, states home delivery in 30 minutes. In case of banking service, process for depositing money can be:
   - taking token number
   - waiting for one's turn, till the token is called
   - interaction between service person and customer, whereby service persons verify details of the customers from record and counts the money
   - entering transaction details in the bank record by staff
   - issuing counterfoil to customer after stamping

   Elements of process mix are:
   - service procedure and process
   - quality control
   - follow-up of customers
7. **Physical Evidence:** Services are intangible in nature. However, to create a better customer experience, tangible elements are also delivered with the service. Often, physical evidence is used as a differentiator in service marketing. The level of comfort and attractiveness of a service location may make a lot of difference to the user experience. A calm and soothing environment, with thoughtful comfortable measures, may provide a sense of security to a new customer which will make them return. Customers will make judgments about the organisation based on the physical evidence. For example, imagine a private hospital and a government hospital. A private hospital will have plush offices and well-dressed staff. Same cannot be said for a government hospital. Thus, physical evidence acts as a differentiator.

   Key elements in physical evidence mix are:
   - appearance/ambience of the store
   - internal store decor (furniture, sanitation, lighting, ventilation, etc.)
   - appearance of the staff

Apart from these 7Ps, there is one more additional 'P' of service marketing.

8. **Productivity and Quality:** Productivity, which is sometimes known as performance, examines how well a company's services compete in the marketplace. This may include how consistent the service is and how well its features translate into benefits as it is being delivered.

   Productivity and quality must work hand in hand. Improving productivity is key to reducing costs. Improving and maintaining quality is essential for building customer satisfaction and loyalty. Ideally, strategies should be sought to improve both productivity and quality simultaneously.

1.3 Service Strategies

Market Research

Marketing research is a systematic method of finding solution to the marketing problems in the areas of product, pricing, promotion and distribution.

According to American Marketing Association, "Marketing research is systematic gathering, recording and analysing of data about problems relating to marketing of goods and services."

1. **Formulating the Problem:** Formulating a problem is the first step in the research process. In many ways, research starts with a problem that the management is facing. This problem needs to be understood, the cause diagnosed, and solutions developed. For instance, if the problem is 'declining sales', the firm should try to identify its cause from customers or sales staff. It may be due to poor quality, improper pricing, faulty promotion, poor after-sales service, etc. It provides information needed to solve the problem.
2. **Determining Data Needs:** The marketer should decide data needs and sources. Depending on the nature of the problem, primary or secondary data should be selected. Again, firm should decide on internal or external sources of data.
3. **Preparation of the Research Design:** Research design is an overall plan of the research investigation. It lays down structure within which research would be conducted. Research design involves the following elements:
   (i) Areas of study
   (ii) Sources of data
   (iii) Techniques and tools for collecting and analysing data
   (iv) Time available for research
   (v) Cost factor relating to study.

   The preparation of such design facilitates research to be efficient with minimum time, effort and money.
4. **Collection of Data:** This is the most important step in the research process. In this step, researcher collects information to solve a research problem. Data can be primary or secondary.
   - Primary data is first hand information. Primary data can be collected through experiments, surveys, observation, interview, or questionnaires.
   - Secondary data is in the form of various published sources such as journals, magazines, reports, etc.
   - The researcher should select appropriate method of data collection keeping in mind objective and scope of inquiry, finance and time available and nature of study.
5. **Organisation/Processing of Data:** The collected data is available in a raw form and needs to be processed. This processing involves classification, coding, editing and tabulation. This process is known as organising. Such organisation of data makes it ready for analysis.

6. **Data Analysis and Interpretation:** Data analysis involves application of different statistical tools such as percentages, coefficients on organised data. This enables a researcher to establish relation between the problem and the information.

   Analysis refers to conclusions arrived at from research findings. It involves generalisation of research findings.

7. **The Research Report:** The research process concludes with the research report. This report will include all of your information, including an accurate description of your research process, the results, conclusions, and recommended courses of action. The report should provide all the information the decision-maker needs to understand the project.

8. **Implementation of Findings:** Researchers should submit research report to the management for implementation. Findings and recommendations of research report should be implemented to solve research problems.

New Service Development Cycle

Developing a new service includes the complete journey from generating the initial idea to bringing the service product to the market.

By setting out the steps involved, and sticking to them, your product development will become a more focused and flexible approach that can be adapted for all different types of products and services.

1. **Idea Generation:** The development of a new service will start with the generation of idea about new service. Ideas can come from many different directions. Ideas can be generated through:
   - Undertaking market research
   - Listening to suggestions from target audience – including feedback on your current products' strengths and weaknesses
   - Encouraging suggestions from employees and partners
   - Looking at competitors' successes and failures.

2. **Idea Screening:** This step is crucial to ensure that unsuitable ideas, for whatever reason, are rejected as soon as possible. Ideas need to be considered objectively, ideally by a group or committee. Specific screening criteria like return on investment, affordability and market potential of the idea needs to be considered. Proper answers to above criteria help in avoiding product failure.

3. **Concept Development and Testing:** In case of new service development, concept testing means formulating the basic product definition and then presenting the same to consumers with descriptions to get their reactions. Along with clear definition of the concept, description of the service representing its specific features and characteristics are produced to the customers and employees to determine their response to the service. For instance, a bank may intend to offer insurance policy to their customers. Bank can explain the types and benefits of policies orally to their customers to find out their reactions. These reactions will help to understand the following things:
   - Do they understand the concept?
   - Do they want or need it?

This stage gives you a chance to develop the concept further, consider their feedback, and also start thinking about what your marketing message will be.

4. **Business Analysis:** Once the concept has been tested and finalised, a firm should assess whether the new product/service will be profitable. This should include a detailed marketing strategy, highlighting the target market, product positioning and the marketing mix that will be used.

   This analysis needs to include: whether there is a demand for the product, a full appraisal of the costs, competition and identification of a break-even point.

5. **Service Development:** If the new service is approved in analysis stage, it will be passed to the technical and marketing development stage. This means the firm investigates exact design and specifications. It develops value-added service attributes that brings customer satisfaction. At this stage, concept is refined after considering inputs from customers, employees and other stakeholders and service blueprint is developed. Blueprint describes service in terms of people, process and physical evidence.
6. **Test Marketing:** At this stage, before launching the service on large scale, it is launched in a limited market area to a small group of customers for a limited period at a special price. This stage aims to obtain customer feedback.
7. **Commercialisation:** If the test marketing results are favourable, final decisions needs to be made to move the product to its launch into the market. At this stage, the service goes live and introduced to the marketplace. Pricing and marketing plans need to be finalised and the sales teams and distributors are briefed, so that the service and company is ready for the launch. Proper promotion mix should be adopted to create product awareness.
8. **Post-production Evaluation:** At this stage, the information gathered during the commercialisation stage is reviewed and changes are made in the delivery process, staffing, marketing mix variables, etc. on the basis of the market response to the offerings.

Managing Demand and Capacity

Service, being intangible and perishable, cannot be produced in anticipation of demand and cannot be stocked. These features of service creates problem of managing demand and capacity in case of demand fluctuations. Demand fluctuations, in relation to supply capacity, results in three possible outcomes:

1. Excess demand (lower capacity)
2. Balance between demand and capacity
3. Excess capacity (lower demand)

There are two general approaches for accomplishing demand and capacity.

A. To smooth the demand fluctuations themselves by **shifting demand** to match existing supply.

B. To **adjust capacity** to match fluctuations in demand.

A. Shifting Demand to Match Capacity

By shifting demand and capacity, an organisation seeks to shift customers away from periods in which demand exceeds capacity. Perhaps by convincing them to use the service during periods of slow demand.

During periods of slow demand, the organisation seeks to attract more and/or different customers to utilise its productive capacity. Firm can use a variety of approaches listed below to increase demand to match capacity.

1. **Vary the Service Offering:** One approach is to change the nature of the service offering, depending on the season of the year, day of the week, or time of day. For instance, airlines can change the configuration of their plane seating to match the demand from different market segments. In some planes, there may be no first-class section at all. On routes with a large demand for first-class seating, a significant proportion of seats may be placed in first class. Movie theaters are sometimes rented during weekdays by business groups. It is an example of varying the service offering during a period of low demand.
2. **Communicate with Customers:** Another approach for shifting demand and capacity is to communicate with the customers. It helps them know the times of peak demand so that they can choose to use the service at alternative times and avoid crowding or delays. For example, signs in banks and post offices which let customers know their busiest hours and busiest days of the week can serve as a warning. This allows customers to shift their demand to another time if possible. In addition to signage communicating peak demand times to customers, advertising and other forms of promotion can emphasise different service benefits during peak and slow periods.
3. **Modify Timing and Location of Service Delivery:** Some firms adjust their hours and days of service delivery to match customer demand. For instance, banks can operate for extended hours, specially till evening or may operate on weekends to cater to working customers. Theaters also accommodate customer schedules by offering matinees on weekends and holidays when people are free during the day for entertainment.
4. **Differentiate on Price:** A firm can offer services at discounted prices during slow demand of the service. This strategy relies on basic economics of supply and demand, *i.e.*, demand rises when price falls. Any hotel, airline and restaurant can offer discounts during off-season. But the goal is always to ensure the highest level of capacity utilisation without sacrificing profits.

B. Adjust Capacity to Meet Demand

A second strategic approach to matching demand and capacity focuses on adjusting or flexing capacity. The idea here is to adjust, stretch and align capacity to match customer demand. During periods of peak demand, the organisation seeks to stretch or expand its capacity as much as possible. During periods of slow demand, it tries to shrink the capacity so as not to waste resources.

(i) Stretch Existing Capacity

The existing capacity of service resources can often be expanded temporarily to match demand. In such cases, no new resources are added. Rather people, facilities, and equipment are asked to work harder and longer to meet demand.

1. **Stretch Time:** It may be possible to extend the hours of service temporarily to accommodate demand. For instance, retailers are open longer hours during the Diwali shopping season. And accountants have extended appointment hours (evenings and Saturdays) before tax deadlines.
2. **Stretch Labour:** In many service organisations, employees are asked to work longer and harder during periods of peak demand. For example, service personnel in banks, tourist attractions, restaurants and telecommunication companies are asked to serve more customers per hour during busy times.
3. **Stretch Facilities:** Theatres, restaurants and classrooms can sometimes be expanded temporarily by the addition of tables, chairs, or other equipment needed by customers. Again, extra coach can be added in a train during peak season.
4. **Stretch Equipment:** Computers, telephone lines and maintenance equipment can often be stretched beyond what would be considered the maximum capacity for short periods to accommodate peak demand.

(ii) Align Capacity with Demand Fluctuations

By adjusting service resources creatively, organisations can match capacity with customer demand patterns. Specific actions might include the following:

1. **Use Part-time Employees:** In this case, the organisation's labour resource is being aligned with demand. Retailers hire part-time employees during the holiday rush, tax accountants engage temporary help during tax season, tourist resorts bring in extra workers during peak season and so on.
2. **Outsourcing:** Firms that find they have a temporary peak in demand for a service that they cannot perform themselves may choose to outsource the entire service. For example, firm can outsource some of its services like after-sales service (repairs and maintenance), especially when it is difficult to hire and train new staff for the same.
3. **Rent or Share Facilities or Equipment:** For some organisations, it is best to rent additional equipment or facilities during periods of peak demand. For example, express mail delivery services rent or lease trucks during the peak holiday delivery season. It would not make sense to buy trucks that would sit idle during the rest of the year.
4. **Schedule Downtime during Periods of Low Demand:** If people, equipment, and facilities are being used at maximum capacity during peak periods, then it is imperative to schedule repair, maintenance and renovations during off-peak periods. This ensures that the resources are in top condition when they are most needed. With regard to employees, this means that vacations and training are also scheduled during slow demand periods.

Opportunities in the Service Sector

Service sector is the fastest growing sector in India. It contributes to the GDP of India and provides a huge employee generation. Service sector has grown after 1991, where liberalisation, privatisation and globalisation (LPG) was introduced in the New Industrial policy, 1991.

Following are the reasons for the opportunities in the service sector.

1. **Various Sector-wise Growth in Service Sector:** Service sector is the fastest growing sector in India. After China, India ranks second in the contribution of service sector. The service sector includes IT, banking, insurance, telecommunication, transportation, warehousing, hotel, travel and tourism, finance, real estate and so on.
2. **Growing Income:** As the service sector grows, it generates a lot of employment. As the income of the people increase, their spending capacity also increases. Thus, the disposable income increases. It also increases the standard of the people in India.
3. **Globalisation:** Globalisation is migration of people from rural to urban areas. It is seen that cities have far better services and lifestyles. They have many facilities in health, education and telecommunication services. This attracts the people to shift to cities. This gives rise to the service sector of urban areas.
4. **Foreign Direct Investment (FDI):** FDI is one of the main reasons in the growth of service sector in India. It brings inflows of capital, skills, technology and also professionalism. Government of India has allowed FDI upto 100% in many of the sectors of services. For instance, single brand retailing, telecom, tourism and so on have 100% FDI inflow in India.
5. **Professionalism:** As FDI has increased, this has brought a lot of change in the working style of the service sector. After 1991, the Government has adopted the policy of liberalisation, privatisation and globalisation. This has led to change in the working system. This gave rise to professionalism in the service sector.
6. **Increase in Population:** India is the second largest country after China in terms of population. The population is growing at an alarming rate and soon India will be in the first position in the world in terms of population. As the population increases, so do services used or provided. This will gives rise to services like education, health, telecommunication, tourism, travel, banking, insurance, hotels and so on.
7. **Socio-economic Changes:** Nowadays, there is a lot of influence of the western culture among Indians. The society has undergone tremendous change in their living and earning style. The influence is seen on every service sector like banking, insurance, retailing, education, health, telecom, food or restaurants and so on. This is giving service more opportunity to expand.
8. **Foreign Trade:** The rise in the import and export services in India has brought opportunities for the entrepreneurs. India's total export contributes nearly 30% of the service sector. This will definitely increase in the near future and give a boost to the service sector.

Challenges in the Service Sector

1. **Challenges of Intangibility:** As the services are intangible, it becomes very difficult for the service user to decide whether to take the service or not. It cannot be judged or examined before taking the service. Hence, the service provider should provide learning to their employees, create trust among the customers by providing quality service and they should also try and maintain their loyal customers so that positive verbal publicity is spread.

2. **Challenges of Inseparability:** Services are not separated from the service provider. Both the service provider and user have to be present while getting the service. It may give rise to the problem of mobility of the service provider. For instance, a service provided by maids or servants is inseparable. The maid may not be in the position to go anywhere and everywhere to give her service, due to time and location constraints. This problem may be solved by outsourcing people, training, use of automated machines wherever possible.
3. **Challenges of Perishability:** Services cannot be stored nor can they be mass produced by the service provider. In this case, the service provider should give offers or discounted rates at non-peak hours. The service provider may use different pricing policies and various other complimentary services at non-peak hours.
4. **Challenges of Inconsistency:** Services are not consistent. They definitely differ and it is an uncontrollable feature. It may also affect the quality of the service. In order to solve the inconsistency problem, the service provider should give training to their employees, motivate the employees by giving them monetary or non-monetary benefits. The customers may also be allowed to give their suggestion and comments.
5. **Challenges in Trained Manpower:** The service sector requires skilled and qualified employees. The employees have to be uniformly trained in their field like banking, telecom, tourism, medical, insurance and so on. The training facilities are inadequate and less. The tools or techniques used for training are also insufficient. Thus, there are no sufficiently trained manpower.
6. **Challenges in Customer Retention:** In this competitive world, customers have a lot of variety in products and services. They tend to shift or switch to a new service very quickly. It becomes very difficult for the service provider to retain the customers. To retain the customer, the service provider must satisfy the customer needs, also take the customers' feedback and consider their suggestions. Innovative services should be introduced for retaining consumers.
7. **Gap between Education and Application in Career:** It is seen that the education system in India does not sync with the application in service sector careers. Theoretical knowledge and the curriculum does not help in the practical application. The youngsters, who have finished their education, find it difficult to apply the same knowledge practically in different service sectors, especially banking, insurance, health, telecommunication and so on.
8. **Employee Turnover:** It is very difficult to retain the employees in the same job, as there are growing opportunities in the service sector. The areas like IT, medical, banking, media, etc. require frequent change for the employees' experience and advancement in career. This results in lot of employee turnover. To retain employees, they should be given retention bonus, and motivated with monetary or non-monetary benefits. Exit interviews should be conducted to understand the problems and to get a solution to retain the employees.

Exercise

Match the Following

I.

A	B
1. Service product	(a) Channel of distribution
2. Price	(b) Physical presence
3. Place	(c) Core benefit
4. Physical evidence	(d) Exchange value
5. Process of delivery	(e) Delivery system/sequence

Ans: 1. (c), 2. (d), 3. (a), 4. (b), 5. (e).

II.

A	B
1. Concept testing	(a) Fastest growing service in India
2. Medical tourism	(b) Leads to customer dissatisfaction
3. Poor service quality	(c) Product acceptability
4. Services	(d) Rejection of ideas
5. Idea screening	(e) Perishable/intangible

Ans: 1. (c), 2. (a), 3. (b), 4. (e), 5. (d).

State Whether the Following are True/False

1. Service provider needs to conduct marketing research.
2. Idea generation is the starting point in new service development.
3. Services are durable in nature.
4. Services can be produced in anticipation of demand.
5. Services are produced and consumed at the same time.
6. Service sector plays an important role in the economic development of the nation.
7. Marketing mix variables are same for goods and services.
8. Services are tangible in nature.
9. When service performance is above the zone of tolerance, customers are dissatisfied.
10. Service sector faces challenge of customer retention.

Ans: True: 1, 2, 5, 6, 10.

False: 3, 4, 7, 8, 9.

Fill in the Blanks with Suitable Word/Words

1. Purchasing of service does not result in _____.
   (leadership, liability, ownership)

2. Services are _____.
   (tangible, intangible, durable)
3. _____ is an important feature of service.
   (Perishability, Tangibility, Durability)
4. Demand for services exceeds the maximum capacity during _____ period.
   (peak, non-peak, off-season)
5. Currently, service sector contributes about _____ of GDP.
   (30%, 50%, 60%)
6. Pre-purchase evaluation of service is _____.
   (simple, possible, not possible)
7. Extent to which customer are willing to accept the variation in service performance is called _____.
   (desired service, zone of tolerance, adequate service)
8. _____ is the highest level of service, which customer hopes to receive.
   (Desired service, Maximum service, Adequate service)
9. If service performance is below adequate level, customer is likely to be _____.
   (satisfied, dissatisfied, delighted)
10. _____ is a systematic method of finding solutions to the marketing problem.
    (Marketing research, Decision-making, Planning)
11. _____ is overall plan for research investigation.
    (Research design, Sample design, Data collection)
12. _____ can be offered to customers to shift demand during non-peak periods.
    (incentives, comfort, disincentives)

Ans: 1. ownership, 2. intangible, 3. perishability, 4. peak, 5. 60%, 6. not possible, 7. zone of tolerance, 8. Desired service, 9. dissatisfied, 10. Marketing research, 11. Research design, 12. comfort.

Define

1. Services
2. Consumer Expectations
3. Marketing Mix
4. Marketing Research
5. Market Testing

Write Shorts Notes on the Following

1. Service Sector
2. Classification of Service
3. Desired Service Expectations

4. Product
5. Price
6. Place
7. Promotion
8. Productivity
9. Physical Evidence
10. Process
11. People
12. Marketing Research
13. Managing Demand and Capacity
14. Challenges in Service Sector

Answer the Following

1. Define service. Explain its characteristics.
2. Discuss the scope of service.
3. Bring out the classification of services.
4. Explain the importance of service sector in Indian country.
5. Discuss different levels of consumer expectations.
6. What are the elements of service mix?
7. What are the steps in marketing research?
8. Briefly discuss new service development cycle.
9. Bring out various strategies of managing demand and capacity in service.
10. What are the opportunities in service sector?
11. What are the challenges in service sector?

Case Study 1 – Palace on Wheels

E-Tailors

Palace on Wheels takes tourists on a journey through Rajasthan, the land of sand dunes, and regal palaces and Agra, the land of the Taj Mahal. Rated as one among the ten best luxurious rail journeys in the world, it aims to provide the ultimate royal experience. The Palace on Wheels was started in 1982 as a heritage holiday train by joining the coaches of the original royal saloons owned by princely states of Gujarat, Rajputana, the Nizam of Hyderabad and the Viceroy of British India. Later, these coaches were replaced by modern air-conditioned coaches, but the royal ambience was maintained. Presently, the train has 14 saloons. Each coach has four twin-bedded chambers decorated in colourful Rajasthani art and the panels and ceilings are covered with miniature traditional motifs that reflect courtly life. The saloons are equipped with world-class facilities such as channel music, intercom, attached toilets, running hot and cold water, shower stalls and wall-to-wall carpeting. Each saloon has personal attendants called Khidmatgars at the beck and call of the guests. The train also has two

restaurants named "The Maharajah" and the "The Maharani" with a princely ambience where guests have a choice of Continental, Chinese, Indian and Rajasthani cuisines, prepared by the chefs in the adjacent kitchens. In addition, the train also has well-stocked bar and a library. The train travels mostly in the night and stops during the day to allow the guests to visit the palaces and the forts. The Palace on Wheel experience has become one of the most sought-after luxuries for international tourists, and has long passenger lists that require guests to book months in advance in order to get their share of the royal experience.

Questions:

1. What characteristics of services of Palace on Wheel make it attractive?
2. How services are modified over a period of time?

Case Study 2 – Service Differentiation

Indian Post, with more than 0.15 million post offices, majority of which are in rural areas, provides a useful distribution channel of non-postal services Although the advent of courier services has reduced the business of postal services in urban areas, it continues to be patronised by rural population of savings deposits, postal insurance, village telephone, etc., in addition to the regular postal services. Sensing an opportunity to increase the revenue and compensate for the reduction in person-to-person mailing, India Post has decided to increase the number of life insurance schemes in rural area along with the introduction of new schemes. The Indian postal network, the largest in the world, plans to tap rural families with its array of products. India Post is leveraging the personal contact and first-hand understanding of the local people by the postal staff to market the new service products in the rural areas. India Post is targeting about 50% of the revenue being generated from non-postal services for the effective implementation of the marketing efforts. India Post has decentralised the marketing and sales function to the divisional level.

Questions:

1. What are the reasons for decline in business of postal services?
2. What differentiation in services are offered to customers to maintain competitiveness?

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