

### 3.3.2 Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five years



**ACHARYA NARENDRA DEV COLLEGE**

U N I V E R S I T Y   O F   D E L H I

DBT STAR STATUS COLLEGE

All India NIRF 2022 Ranking-18, NAAC Score-3.31

Govindpuri, Kalkaji, New Delhi 110019

**3.3.2.1. Total number of books and chapters in edited volumes/  
books published and papers in national/ international  
conference proceedings year wise during last five years**



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U N I V E R S I T Y   O F   D E L H I

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# ACHARYA NARENDRA DEV COLLEGE

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## CRITERIA 3- RESEARCH, INNOVATIONS AND EXTENSION

### Supporting Document for Criterion 3.3.2

#### 3.3.2.1 : Total number of books and chapters in edited volumes/books published and papers in national/international conference proceedings year wise during last five years.

Change Input (Optional) :

2021-22	2020-21	2019-20	2018-19	2017-18
25	25	20	16	10

Attached documents are :

#### **1. PDF File**

Containing Web-link of book showing ISBN number to be given by title, author, Department/ School/ Division/ Centre/ Unit/ Cell, name and year of publication.

#### **2. Proof containing Cover page, content page and first page of the publications.**

3.3.2: Number of books and chapters in edited volumes/books published and papers published in national/ international conference proceedings per teacher during last five years.

PROOF PDF No.	2017-18								ISBN/ISSN number of the proceeding	Affiliating Institute at the time of publication	Name of the publisher	Proofs links
	Previous Sl. No.	Name of the teacher	Title of the book/chapters published	Title of the paper	Title of the proceedings of the conference	Name of the conference	National / International	Year of publication				
1	1	Dr Gagan Dhawan	NA	Influenza pandemics and the associated bacterial infections; Basic and Clinical Virology	NA	NA	International	2017	ISSN: 2471-0296	Acharya Narendra Dev College	Austin J Microbiol - Volume 3 Issue 1 - 2017 Austin Publishing Group, USA	<a href="https://austinpublishinggroup.com/microbiology/fulltext/ajm-v3-1d1017.pdf">https://austinpublishinggroup.com/microbiology/fulltext/ajm-v3-1d1017.pdf</a>
2	2	Dr. Sunita Hooda	NA	Magnetic graphene oxide for adsorption of organic dyes from aqueous solution.	2nd International Conference on Condensed matter and applied physics	2nd International Conference on Condensed matter and applied physics	National	2017	ISBN: 978-0-7354-1648-2	Acharya Narendra Dev College		<a href="https://doi.org/10.1063/1.5032617">https://doi.org/10.1063/1.5032617</a>
3	5	Dr. Sharanjeet Kaur	NA	Leveraging Hierarchy and Community Structure for Determining Influencers in Networks .	International Conference Big Data Analytics and Knowledge Discovery	International Conference Big Data Analytics and Knowledge Discovery	International	2017	ISBN: 978-3-319-64283-3	Acharya Narendra Dev College		<a href="#">Leveraging Hierarchy and Community Structure for Determining Influencers in Networks. I</a> SpringerLink
4	6	Mr Manoj Kumar Garg	Basic Business Communication	NA	NA	NA	National	2017	9789382209256	Acharya Narendra Dev College	Scholar Tech Press, New Delhi 2	<a href="#">Urbanbae - Basic Business Communication By Manoj Kumar Garg</a>
5	7	Dr Laxmi Narain	Mathematica Programming on Numerical Methods Differential Equations Modeling using Mathematica Modeling of calculus problems using Mathematica	NA	NA	NA	National	2017	978-93-87374-13-3	Acharya Narendra Dev College	Research India Publication	<a href="https://www.ripublication.com/our_books.htm">https://www.ripublication.com/our_books.htm</a>
6	8	Dr Sarita Kumar	Exploring Biology for Class VI	NA	NA	NA	National	2017	978-81-8350-740-0	Acharya Narendra Dev College	Sultan Chand and Sons	<a href="#">Exploring Biology: Textbook for ICSE Class 6 (2023-24 Examination) : Sarita Kumar.</a> Amazon.in: Books
7	9	Dr Sarita Kumar	Exploring Biology for Class VII	NA	NA	NA	National	2017	978-81-8350-731-1	Acharya Narendra Dev College	Sultan Chand and Sons	<a href="#">Amazon.in: Buy ICSE Exploring Biology for Class 7 (2018-19 Session) Book Online at Low Prices in India   ICSE Exploring Biology for Class 7 (2018-19 Session) Reviews &amp; Ratings</a>
8	10	Dr Sarita Kumar	Exploring Biology for Class VIII	NA	NA	NA	National	2017	978-81-8350-753-0	Acharya Narendra Dev College	Sultan Chand and Sons	<a href="#">Exploring Biology: Textbook for ICSE Class 8 (2023-24 Session) : Sarita Kumar.</a> Amazon.in: Books
9	11	Dr Seema Makhija and Dr Ravi Toteja	Protozoa: Ciliophora (Ciliates). In K. Chandra, K.C. Gopi, D.V. Rao, K. Valarmathi and J.R.B. Alfred (Eds.), Current Status of Freshwater Faunal Diversity in India	NA	NA	NA	National	2017	978-81-8171-462-6	Acharya Narendra Dev College	Zoological Survey of India,	<a href="#">(PDF) Current Status of Freshwater Faunal Diversity in India (researchgate.net)</a>
10	12	Dr Seema Makhija and Dr Ravi Toteja	Cell Biology: Practical Manual	NA	NA	NA	International	2018	978-81-93-6512-1-6	Acharya Narendra Dev College	Prestige Publisher	<a href="#">(PDF) Cell Biology : Practical Manual (researchgate.net)</a>
2018-2019												
11	19	Dr Rashmi Sharma (Botany)	Neurotransmitters in Plants: Perspectives and Applications	Role of Acetylcholine System in Allelopathy of Plants	NA	Book Chapter	International	2018	ISBN:13: 978-1-1385-6077-2	Acharya Narendra Dev College	CRC Press Taylor & Francis Group	<a href="https://www.taylorfrancis.com/chapters/edit/10.1201/b22467-15/role-acetylcholine-system-allelopathy-plants-rashmi-sharma-rajendra-gupta">https://www.taylorfrancis.com/chapters/edit/10.1201/b22467-15/role-acetylcholine-system-allelopathy-plants-rashmi-sharma-rajendra-gupta</a>
12	20	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Cytokinins	NA	Book Chapter	International	2018	ISBN: 978-981-13-2023-1	Acharya Narendra Dev College	Springer-Nature Switzerland	
13	21	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Gibberelins	NA	Book Chapter	International	2018	ISBN: 978-981-13-2023-3	Acharya Narendra Dev College	Springer-Nature Switzerland	
14	22	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Abscisic Acid	NA	Book Chapter	International	2018	ISBN: 978-981-13-2023-2	Acharya Narendra Dev College	Springer-Nature Switzerland	<a href="https://link.springer.com/book/10.1007/978-981-13-2023-1">https://link.springer.com/book/10.1007/978-981-13-2023-1</a>
15	23	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Physiology of Flowering	NA	Book Chapter	International	2018	ISBN: 978-981-13-2023-4	Acharya Narendra Dev College	Springer-Nature Switzerland	
16	24	Dr Geetika Kalra (Botany)	Plant Physiology, Development and Metabolism	Senescence and Program cell Death	NA	Book Chapter	International	2018	ISBN: 978-981-13-2023-5	Acharya Narendra Dev College	Springer-Nature Switzerland	
17	25	Dr. Sharanjit Kaur (Computer Science)	Class XI Computer Science	Textbook	NA	NA	National / International	2019	978-93-5292-117-1	Acharya Narendra Dev College, University of Delhi	NCERT	<a href="https://ncert.nic.in/textbook.php?kecs1=ps-11">https://ncert.nic.in/textbook.php?kecs1=ps-11</a>
18	26	Dr. Harita Ahuja (Computer Science)	Class XI Computer Science	Textbook	NA	NA	National / International	2019	978-93-5292-117-1	Acharya Narendra Dev College, University of Delhi	NCERT	
19	27	Dr. Amit Garg (Electronics), Dr. Arijit Chowdhuri (Physics)	Conference Proceedings	Effect of concentration variation in Graphene Oxide (GO) membranes for water flux optimization	AIP Conference Proceedings 1953, 030280 (2018)	2nd International conference on Condensed Matter and Applied Physics (ICC-2017), Bikaner, Rajasthan, 24-25 November, 2017.	International	2018	978-0-7354-1648-2	Acharya Narendra Dev College, University of Delhi	AIP Publishing	<a href="https://doi.org/10.1063/1.5032615978-0-7354-1648-2">doi.org/10.1063/1.5032615978-0-7354-1648-2</a>

20	28	Dr. Monika Bhattacharya (Electronics)	Conference Proceedings	Impact of donor-layer doping & thickness, gate-length and temperature on potential and electron concentration in AlGaN/GaN Double-Heterostructure and Single-Heterostructure HEMT	Proceedings of IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON) (pp. 1-5). IEEE.	IEEE Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON) (pp. 1-5). IEEE.	International	2018	ISBN 978-1-5386-5003-5	Acharya Narendra Dev College, University of Delhi	DOI: 10.1109/UPCON.2018.8596967	<a href="#">IEEE Xplore - Conference Table of Contents</a>
21	29	Mr. Manoj Kumar Garg (English)	Business Communication for undergraduate students	Reference Book	NA	Book		2018	ISBN: 978-93-87253-30-8		Kitab Mahal Publishers, New Delhi	<a href="https://www.sapnaonline.com/books/general-english-undergraduate-students-manoj-kumar-9387253295-9789387253292">https://www.sapnaonline.com/books/general-english-undergraduate-students-manoj-kumar-9387253295-9789387253292</a>
22	30	Mr. Manoj Kumar Garg (English)	General English	Reference Book	NA	Book		2018	ISBN: 978-93-87253-29-2		Kitab Mahal Publishers, New Delhi	<a href="https://www.sapnaonline.com/books/general-english-undergraduate-students-manoj-kumar-9387253295-9789387253292">https://www.sapnaonline.com/books/general-english-undergraduate-students-manoj-kumar-9387253295-9789387253292</a>
23	31	Dr. Sarita Kumar (Zoology)	Hindi Vishwakosh (MHRD, Gol)	Reference Book	NA	Book	National	2019	978-93-88359-38-2		Sasta Sahitya Mandal	Online link not available
24	34	Dr. Rakesh K. Sonker (Physics)	Gas Sensors	Design and growth of metal oxide film as Liquefied Petroleum Gas Sensors				2019	978-1-78985-160-1 Print ISBN: 978-1-78985-159-5 EBOOK (PDF) ISBN: 978-1-63880-501-2	ANDC	Intech Open	<a href="https://www.intechopen.com/chapters/66425">https://www.intechopen.com/chapters/66425</a>
25	35	Prof. Arijit Chowdhuri (Physics), Dr. Amit Garg (Electronics)		Effect of Concentration Variation in Graphene Oxide (GO) Membranes For Water Flux Optimization	AIP Conference Proceedings 1953, 030280	doi: 10.1063/1.5032615	INTERNATIONAL	2018	ISBN: 978-0-7354-1648-2	ANDC	aip	<a href="https://aip.scitation.org/doi/pdf/10.1063/1.5032615">https://aip.scitation.org/doi/pdf/10.1063/1.5032615</a>
26	38	Dr. Harita Ahuja (Computer Science)	Textbook for IX Information and Communication Technology (ICT) , NCERT					2019	978-93-5292-118-8	ANDC	NCERT	<a href="https://ncert.nic.in/textbook.php?ilt1=ps-8">https://ncert.nic.in/textbook.php?ilt1=ps-8</a>
<b>2019-2020</b>												
27	41	Dr. Sharanjit Kaur(Computer Science)	Textbook for XI Information Practices, NCERT					2019	978-93-5292-148-5	Acharya Narendra Dev College, University of Delhi	NCERT	<a href="https://ncert.nic.in/textbook.php?keip1=0-8">https://ncert.nic.in/textbook.php?keip1=0-8</a>
28	42	Dr. Harita Ahuja(Computer Science)	Textbook for XI Information Practices, NCERT					2019		Acharya Narendra Dev College, University of Delhi		
29	44	Dr.Udaibir Singh(Electronics)	NA	Impact of fabrication of pyramidal structure on silicon wafers surface in ZnO/Si heterojunction	AIP Conference Proceedings	AIP Conference	International	2020	ISSN 1551-7616	Acharya Narendra Dev College, University of Delhi	AIP Publisher	<a href="https://aip.scitation.org/doi/10.1063/5.0001996">https://aip.scitation.org/doi/10.1063/5.0001996</a>
30	45	Dr.Udaibir Singh(Electronics)	NA	Absorption enhancement by surface texturing in ZnO/Si heterojunction	AIP Conference Proceedings	AIP Conference	International	2020		Acharya Narendra Dev College, University of Delhi	AIP Publisher	<a href="https://aip.scitation.org/doi/10.1063/5.0001997">https://aip.scitation.org/doi/10.1063/5.0001997</a>
31	48	Dr. Siddhartha(Physics),Dr.Neelakshi N K Borah(Physics)	Advances in Electronics and Communication Engineering (Vol-2)	Semiconductor materials in electronic devices			National	2020	978-93-90420-82-7	Acharya Narendra Dev College, University of Delhi	Akinik Publications	<a href="https://www.akinik.com/products/969/advances-in-electronics-and-communication-engineering">https://www.akinik.com/products/969/advances-in-electronics-and-communication-engineering</a>
32	50	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Biochemical characterization of acetamiprid resistance in laboratory-bred population of Aedes aegypti L. larvae.	ICCESI 2019	International Conference and the 10th congress of the Entomological Society of Indonesia	International (Bali, Indonesia)	October, 6-9, 2019		Entomological Society of Indonesia	Entomological Society of Indonesia	<a href="https://www.atlantispress.com/proceedings/iccresi-19/125940403">https://www.atlantispress.com/proceedings/iccresi-19/125940403</a>
33	51	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Lufenuron: A potential chitin synthesis inhibitor against Aedes aegypti L.	ICCESI 2019	International Conference and the 10th congress of the Entomological Society of Indonesia	International (Bali, Indonesia)	October, 6-9, 2019	9781713811534	Entomological Society of Indonesia	Entomological Society of Indonesia	<a href="https://www.atlantispress.com/proceedings/iccresi-19/125940374">https://www.atlantispress.com/proceedings/iccresi-19/125940374</a>
34	52	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Assessment of toxicity and growth regulatory effects of beta-cyfluthrin against Red Cotton Bug, Dysdercus koenigii (Fabr.) (Heteroptera: Pyrrhocoridae): An emerging cotton pest.	ICCESI 2019	International Conference and the 10th congress of the Entomological Society of Indonesia	International (Bali, Indonesia)	October, 6-9, 2019		Entomological Society of Indonesia	Entomological Society of Indonesia	<a href="https://www.researchgate.net/publication/341477181_Assessment_of_Toxicity_and_Growth_Regulatory_Effects_of_Beta-Cyfluthrin_Against_Red_Cotton_Bug_Dysdercus_koenigii_Fabr_Hemiptera_Pyrrhocoridae_An_Emerging_Cotton_Pest">https://www.researchgate.net/publication/341477181_Assessment_of_Toxicity_and_Growth_Regulatory_Effects_of_Beta-Cyfluthrin_Against_Red_Cotton_Bug_Dysdercus_koenigii_Fabr_Hemiptera_Pyrrhocoridae_An_Emerging_Cotton_Pest</a>
35	61	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Bio-efficacy of Achyrantes aspera-derived silver nanocomposites against early fourth instars of Aedes aegypti L.	International Conference on Natural Products and Human Health – 2020 (ICNPHH-2020)	Natural Products and Human Health – 2020	International	Feb 27-29, 2020	9788194428237	Deshbandhu College, University of Delhi	Deshbandhu College, University of Delhi	
36	62	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Sankar, M, Samal, R.R. and Kumar, S. (2020) Knockdown and Irritability Response to Deltamethrin in the Susceptible and Deltamethrin-resistant adults of Culex quinquefasciatus.	International Conference on Natural Products and Human Health – 2020 (ICNPHH-2020)	Natural Products and Human Health – 2020	International	Feb 27-29, 2020	9788194428237	Deshbandhu College, University of Delhi	Deshbandhu College, University of Delhi	<a href="https://www.deshbandhucollege.ac.in/icnphh2020/index.php">https://www.deshbandhucollege.ac.in/icnphh2020/index.php</a>
37	63	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Effect of Emamectin Benzoate-induced dietary stress on the nutritional performance of American Bollworm, Helicoverpa armigera.	International Conference on Natural Products and Human Health – 2020 (ICNPHH-2020)	Natural Products and Human Health – 2020	International	Feb 27-29, 2020	9788194428237	Deshbandhu College, University of Delhi	Deshbandhu College, University of Delhi	
38	64	Dr. Monisha Khanna Kapur(Zoology)	A Closer Look at Actinomycetes	Metabolic Profiling of Streptomyces sp. Strain 51 for Detection of Bioactive Compounds	NA	NA	International	2020	978-1-53617-046-7	Acharya Narendra Dev College, University of Delhi	Nova Science Publishers, Inc., USA	<a href="https://www.researchgate.net/publication/340296974_Chapter_7_Metabolic_profiling_of_Streptomyces_sp_strain_51_for_detection_of_bioactive_compounds">https://www.researchgate.net/publication/340296974_Chapter_7_Metabolic_profiling_of_Streptomyces_sp_strain_51_for_detection_of_bioactive_compounds</a>
39	69	Dr Yash Mangla(Botany)	Plant Reproductive Ecology: Patterns and Processes. Tandon et al.	Dynamics of Eco-evolutionary Forces in Shaping Diocety	-	-	-	2020	ISBN 978-981-15-4210-7	Acharya Narendra Dev College	Springer-Nature.	<a href="https://link.springer.com/chapter/10.1007/978-981-15-4210-7_9">https://link.springer.com/chapter/10.1007/978-981-15-4210-7_9</a>

40	70	Dr Vineet Kumar Singh(Botany)	Plant Reproductive Ecology: Patterns and Processes. Tandon et al. I	Secondary Pollen Presentation in Flowering Plants					2020	ISBN 978-981-15-4210-7	Acharya Narendra Dev College	Springer-Nature.	<a href="https://link.springer.com/chapter/10.1007/978-981-15-4210-7_10">https://link.springer.com/chapter/10.1007/978-981-15-4210-7_10</a>
41	71	Mr. Manoj Kumar Garg(English)	Easy English Grammar						2019	ISBN: 978-93-87253-46-9	Acharya Narendra Dev College	Kitab Mahal Publishers, New Delhi	<a href="https://www.amazon.in/Easy-English-Grammar-Manoj-Kumar/dp/9387253465">https://www.amazon.in/Easy-English-Grammar-Manoj-Kumar/dp/9387253465</a>
42	72	Mr. Manoj Kumar Garg(English)	English Fluency (Part 1)						2019	ISBN 10: 9387273520; ISBN 13: 978-9387273528	Acharya Narendra Dev College	MKM Publishers Pvt. Ltd, New Delhi	<a href="https://www.amazon.in/English-Fluency-Part-Manoj-Kumar/dp/9387273520/ref=st_1_1?crid=1YIGV3ZQPK5O78&amp;keywords=english+fluency+part+1+Manoj+kumar+garg&amp;qid=1677913660&amp;s=books&amp;prefix=english+fluency+part+1+manoj+kumar+garg%2Cstripbooks%2C202&amp;sr=1-1">https://www.amazon.in/English-Fluency-Part-Manoj-Kumar/dp/9387273520/ref=st_1_1?crid=1YIGV3ZQPK5O78&amp;keywords=english+fluency+part+1+Manoj+kumar+garg&amp;qid=1677913660&amp;s=books&amp;prefix=english+fluency+part+1+manoj+kumar+garg%2Cstripbooks%2C202&amp;sr=1-1</a>
43	73	Mr. Manoj Kumar Garg(English)	English Language						2019	ISBN: 978-93-87253-50-6	Acharya Narendra Dev College	Kitab Mahal Publishers, New Delhi	chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/ <a href="https://www.kitabmahalpublishers.com/uploads/catalogue/kitab-mahal-publisher-final-catalogue-2021.pdf">https://www.kitabmahalpublishers.com/uploads/catalogue/kitab-mahal-publisher-final-catalogue-2021.pdf</a>
44	74	Mr. Manoj Kumar Garg(English)	Essential Business Communication						2019	ISBN: 978-93-87253-49-0	Acharya Narendra Dev College	Kitab Mahal Publishers, New Delhi	<a href="https://www.kitabmahalpublishers.com/home/product_view/266/Essential-Business-Communication">https://www.kitabmahalpublishers.com/home/product_view/266/Essential-Business-Communication</a>
45	77	Dr Gagan Dhawan(BMS)	Nanobiotechnology: Current and Future Perspectives in Combating Microbial Pathogenesis.				International		2019	978-981-32-9449-3	Acharya Narendra Dev College, University of Delhi	Springer, Singapore	<a href="https://link.springer.com/chapter/10.1007/978-981-32-9449-3_17">https://link.springer.com/chapter/10.1007/978-981-32-9449-3_17</a>
46	81	Dr. Sarita Kumar(Zoology)	Conference Proceedings	Acetamidrid resistance in <i>Aedes aegypti</i> : Evaluation of metabolic detoxification and target site mutations as defense mechanisms	<i>International Conference on Natural Products and Human Health – 2020 (ICNPHH-2020)</i>	International Conference on Natural Products and Human Health-2020 (ICNPHH-2020)	International		2020		Acharya Narendra Dev College, University of Delhi		<a href="https://www.deshbandhucollege.ac.in/cnphh2020/index.php">https://www.deshbandhucollege.ac.in/cnphh2020/index.php</a>
<b>2020-21</b>													
47	82	Dr. Sharanjit Kaur	Class XII Computer Science	Textbook	NA	NA	National		2020	978-93-5292-361-8	ANDC	NCERT	NCERT
48	83	Dr. Harita Ahuja	Class XII Computer Science	Textbook	NA	NA	National		2020	978-93-5292-361-8	ANDC	NCERT	NCERT
49	84	Dr. Sharanjit Kaur	Class XII IP	Textbook	NA	NA	National		2020	978-93-5292-338-0	ANDC	NCERT	NCERT
50	85	Dr. Harita Ahuja	Class XII IP	Textbook	NA	NA	National		2020	978-93-5292-338-0	ANDC	NCERT	NCERT
51	86	Dr. Chandra Kanta Samal	The Internet of Drones: AI Applications for Smart Solutions	"Real Time Monitoring and Analysis of Troposphere Pollutants Using a Multipurpose Surveillance Drone"	Development and Future of Internet of Drones(IoD): Insights,Trends and Road Ahead, Chapter-4 (International)	IoD2020	International		2021	Hard ISBN: 9781774639856	ANDC	Apple Academic Press (CRC Press , a Taylor & Francis Group)	<a href="https://www.researchgate.net/publication/343787403_Real-Time-Monitoring-and-Analysis-of-Troposphere-Pollutants-Using-a-Multipurpose-Surveillance-Drone">Real-Time Monitoring and Analysis of Troposphere Pollutants Using a Multipurpose Surveillance Drone   Request PDF</a> (researchgate.net)
52	87	Dr. Chandra Kanta Samal	Advance Computing	"Programmable Joint Computing Filter For Low-Power and High-Performance Applications"	NA	NA	International		2021	Print ISBN: 978-981-16-0403-4 , Electronic ISBN: 978-981-16-0404-1	ANDC	Published by Springer Nature Singapore Pte Ltd. 2021	<a href="https://www.springer.com/9789811604034">Programmable Joint Computing Filter for Low-Power and High-Performance Applications   SpringerLink</a>
53	88	Dr. Joita Dhar Rakshit	Travel Writing	Criticism of the British Raj in the Writings of Nineteenth Century British Women Travellers to India	NA	NA			2021	ISBN 978-93-5529-128-8		Authors Press, New Delhi	<a href="https://www.amazon.in/Buy-Travel-Writing-Critical-Explorations-Book-Online-at-Low-Prices-in-India-Travel-Writing-Critical-Explorations-Reviews-Ratings-Amazon/dp/9355291288">Buy Travel Writing: Critical Explorations Book Online at Low Prices in India   Travel Writing: Critical Explorations Reviews &amp; Ratings - Amazon.in</a>
54	89	Mr. Vishal Dhingra, Dr. Amit Garg and Dr. Arijit Chowdhuri	Conference Proceedings	Varying sonication conditions to tailor surface morphology of GO thin films for enhanced gas sensing performance	AIP Conference Proceedings	AIP Conference Proceedings 2369, 020109 (2021);	International		2021 Accepted in (2020-21), published in (2021-2022)	978-0-7354-4121-7	Acharya Narendra Dev College, University of Delhi	NA	<a href="https://doi.org/10.1063/5.0060996">doi.org/10.1063/5.0060996</a>
55	90	Dr. Sarita Kumar	Textbook for Class XII	Illustrated Biology	NA	Book	National		2021	978-81-94946-8-4		Sultan Chand & Sons (P) Ltd., New Delhi	<a href="https://www.amazon.in/Buy-Illustrated-Biology-Textbook-for-CBSE-Class-12-(2021-22-Session)-Book-Online-at-Low-Prices-in-India-Illustrated-Biology-Textbook-for-CBSE-Class-12-(2021-22-Session)-Reviews-Ratings/dp/819494684">Amazon.in: Buy Illustrated Biology: Textbook for CBSE Class 12 (2021-22 Session) Book Online at Low Prices in India   Illustrated Biology: Textbook for CBSE Class 12 (2021-22 Session) Reviews &amp; Ratings</a>
56	91	Dr. Sarita Kumar	Pyrethroids: Exposure, Applications and Resistance	Status of pyrethroid resistance and mechanism in the dengue vector, <i>Aedes aegypti</i> L. (Diptera: Culicidae).	NA	Book Chapter	International		2020	978-1-53618-198-2		Nova Science Publishers, Inc., New York, USA.	<a href="https://www.novapublishers.com/Pyrethroids-Exposure-Applications-and-Resistance--Nova-Science-Publishers">Pyrethroids: Exposure, Applications and Resistance – Nova Science Publishers (novapublishers.com)</a>
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**BOOKS/ BOOK CHAPTERS – 2017-18**

## Mini Review

# Influenza Pandemics and the Associated Bacterial Infections

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## Introduction

Influenza A virus is major respiratory pathogen responsible for causing highly contagious and acute respiratory disease. It belongs to the family of RNA viruses “Orthomyxoviridae” and has a 13.5kb genome with eight single-stranded (ss) RNA segments. These negative-sense ssRNA segments encode eleven proteins: HA, PB1, PB2, PA, NP, NEP, M1, NA, NS1, M2 and PB1-F2. HA protein facilitates entry of virus in the host cell, polymerase subunits PB1, PB2, PA and NP (nucleoprotein) assist in replication and transcription of viral RNAs. Nuclear export protein (NEP/NS2) and matrix protein (M1) plays a role in export of viral nucleoprotein from the nucleus to cytoplasm and their assembly into virion at plasma membrane. The NA protein assist in the release of virus from infected cells and NS1 protein acts as interferon antagonist inhibiting the host immune response. M2 protein is an integral part of viral envelope, forming pH regulated and highly sensitive proton conducting channels, essential for viral replication. PB1-F2 protein is an important determinant of virulence of influenza virus, increases the severity of secondary bacterial infections and also induces apoptosis [1].

In Influenza A virus, aquatic birds act as natural reservoir but it has the ability to infect variety of hosts like birds, human beings and swine [3]. Due to segmented nature of the genome, influenza A virus has high variability thereby undergoing re-assortment when a cell is infected with more than one virus [4]. This process of genetic reassortment results in generation of novel strains of influenza virus thus preventing the acquired immune response from previous infections, leading to recurrent epidemics and global pandemics.

Influenza virus pandemics have been defined as global outbreaks

of the disease due to emergence of viruses with new antigenic subtypes. There have been four pandemics: the 1918 Spanish influenza, the 1957 Asian influenza, the 1968 Hong Kong influenza and the 2009 Swine influenza, resulting in more than a million deaths [5]. Between these episodes of pandemics, there have been various epidemics of grave severity. Influenza pandemics and epidemics are initiated by the introduction and successful adaptation of antigenic variation in the surface glycoproteins, Hemagglutinin (HA) and Neuraminidase (NA) assisting the virus in evading the host immune response [6,7]. On the basis of sequence analysis, a total of sixteen HA (H1-H16) and eleven NA (N1-N11) have been identified, combination of which results in major outbreaks [3]. The variation in viral genome occurs either as a result of minor antigenic changes over a period of time, facilitating escape from the existing immune response, known as “antigenic drift”, producing outbreaks of seasonal flu or by sudden major change in the genome as a result of genetic re-assortment where the genomes of two different strains of viruses are re-assorted creating a novel viral strain, process known as “genetic shift” [8]. The outbreaks of seasonal influenza are the result of frequent anti-genic drift, however in case of genetic shift, if the novel strain has virulence for human; it may give rise to pandemic situation, since humans are unlikely to generate appreciable immune response against the new virus.

Earlier FDA had approved the drugs Amantidine and Rimantidine (M2 proton-selective ion channel protein inhibitors), but these drugs are abandoned for treatment owing to the high resistance (>99%) of Influenza A (H3N2, H1N1'09) virus for these drugs (CDC) Existing influenza treatment is limited to neuraminidase inhibitors and increasing number of drug resistance cases against these inhibitors has been reported which is serious matter of concern [9]. The most efficient treatment for influenza virus infection is through vaccination, thereby reducing the impact of pandemic influenza [10]. The currently approved vaccine provides an effective counter-measure against influenza virus, but they provide humoral immunity against the surface antigen, which often undergoes antigenic drift. Hence, these vaccines need to be reformulated annually in order to generate immune response against the specific strain of virus that is predicted to circulate in the next season, which is a major limitation [11].

## Bacterial Infections

Influenza usually does not advance to death in healthy children and adults, however serious sequelae can occur with secondary or co-infection with bacterial pathogens, especially in immune-compromised individuals with chronic health conditions like respiratory ailment, cardiac disease etc. Bacterial associated pneumonia is the most common source of increased mortality during the pandemic season. Bacterial pathogens may infect concurrently with the viral infection, the co-infection results in pneumonia thereby

increasing the severity of disease. Bacterial infection may also occur after the influenza virus has been cleared from lungs, and the host is more susceptible to secondary infections [12]. Secondary infections are facilitated by influenza-associated impairment of immune system, caused by enhanced release of inflammatory cytokines or by decreasing the ability to clear bacterial infections.

Clinicians now have several ways to alleviate pneumonia through vaccines, antibiotics and antiviral therapies, thereby contributing to decreasing the burden of disease globally. It has been observed that influenza and pneumococcal vaccine in synergy, reduced hospitalization due to influenza and pneumonia significantly [13]. In the cases of suspected invasive bacterial infection, early initiation of antiviral therapy and appropriate antibiotics should be administered to increase the efficiency of the treatment.

These measures however have limitations, which restrain their effectiveness. The over usage of antibiotics to combat bacterial infections, has contributed severely to the antibiotic resistance with evidence that MRSA (Methicillin-resistant *Staphylococcus aureus*) infections is responsible for increase in morbidity and mortality, especially among the children diagnosed with influenza [14]. Limitations include the delay in production of vaccines and stockpiling of antiviral and antibacterial drugs [15].

## Pandemics

### 1918 H1N1 Pandemic

The 1918 Pandemic “Spanish flu” remains unprecedented in terms of severity, killing about 50-100 million people globally, hence often known as “mother of all pandemics” [16,17]. The causative organism was the H1N1 subtype of Influenza A virus with avian ancestral source. It was highly intriguing how the viruses of avian origin adapt to mammalian hosts and infect such different cell types. The examination of genome revealed the possibility of de novo adaptation of the avian virus by parallel evolution of genes in a novel (human) host [18]. The pandemic is believed to have originated from china and occurred in three waves, starting from a mild wave in spring season, followed by the most catastrophic and severe wave in fall and then the final mild wave in winter of 1918-1919 [19]. Pandemic reached Indian subcontinent through Bombay, thereby spreading North and south simultaneously, increasing the death toll to 10-20 million (38% of global mortality), making India the worst affected country in terms of mortality [16,19,20].

Although there were various theories regarding the severity of 1918 pandemic, the experts reached a consensus that the high mortality rate was due to secondary infections caused by bacterial pathogens (*pneumococci*, *streptococci*, *staphylococci*) colonizing the upper respiratory tract [21]. Experts believed that bacterial invaders infected in sequential manner, after the influenza virus cripple the pulmonary tissue [22]. Most commonly identified bacteria in the pandemic patients were *S. pneumoniae*, *S. pyogenes* and less commonly *S. aureus* and *H. influenzae* [23]. One of the most puzzling features of 1918 Pandemic was the W-shaped Influenza mortality curve with unusual burden among the young adults (healthy population between 20-40 years), instead of the usual U-shaped curve [6,18,24]. Various reports have shown that the increased mortality in otherwise healthy young could be contributed by the excessive release

of pro-inflammatory cytokines (IL-6, IL-8) and tumor necrosis factor (TNF- $\alpha$ ) [25-27].

Another reason for the devastation by 1918 pandemic could be the rudimentary health practices with limited knowledge about disease prevention and control. The development of antivirals, vaccines and antibiotics to treat the secondary infections were still decades away, hence efforts to control the outbreaks were restricted to Non-Pharmaceutical Interventions (NPIs), which included quarantine, prohibition of public gatherings and use of facemasks [28].

Spanish flu is still believed to be the worst public disaster in the history, killing millions of people. However, it brought to light the urgency to improve the public health care conditions across the globe, which led to major advancements in medical sciences, awareness and better preparedness for such un-anticipated outbreaks.

### 1957 H2N2 Pandemic

After almost 40 years of Spanish flu, a novel strain of Influenza virus (H2N2) of avian origin, emerged in China in February 1957, and gave rise to a pandemic situation, killing around 500,000 to 2 million people worldwide [29]. After spreading across China, the Asian flu progressed to Singapore, Japan and Taiwan before traversing across the globe. The H2N2 strain was the product of re-assortment between the circulating human virus that introduced N2 and avian virus with H2 HA, as revealed from phylogenetic studies [1,30]. As with Spanish Flu, H2N2 virus would reappear in successive waves, second one being more severe than the previous one [31]. Asian flu reached India in May 1957 through the port of Madras, thereafter spreading throughout the country, leading to the death of about 1098 people from May 1957- February 1958 [32].

The Asian influenza had similar characteristics of increased deaths due to bacterial pneumonia with *S. aureus*, *H. influenzae* and *S. pneumoniae* being the major pathogens that were isolated [21,22]. The Influenza mortality curve shifted towards younger age group, similar to 1918 Pandemic, suggesting the presence of pre-existing antibodies in elderly from the prior exposure [33]. By the time of Asian flu, global surveillance was used to determine the disease burden through a network of laboratories worldwide, linked to Influenza Research Center based in London [34]. After the catastrophic effect of Spanish flu, several measures were taken in the field of influenza research to be better prepared for such unforeseen situations, although the expertise was still inadequate. The 1957 pandemic was the first event to study the response of vaccination in large population that has not been exposed to the novel H<sub>2</sub>N<sub>2</sub> strain of virus, but did not have a significant impact due to limited supply [35]. Antibiotics reduced the disease burden due to secondary bacterial infection; however they were not effective against viral infections [34]. The usage of non-pharmaceutical interventions was minimum and the antivirals were yet to be developed [36]. Asian flu, though mild pandemic, emerged as a reminder of persisting global threat of Influenza virus.

### 1968 H3N2 Pandemic

A decade after its emergence, Asian flu underwent genetic re-assortment between human and avian strain via antigenic shift, giving rise to a novel H3N2 strain and triggering a new pandemic situation known as Hong Kong flu. Even though this strain of virus was highly contagious leading to rapid dissemination globally, it was still milder

than Asian flu with the mortality estimates of 500,000 to 2 million deaths worldwide [29]. After being first reported in Hong Kong in July 1968, it spread throughout Asia before reaching west coast of United States in August, England and Australia by September, Canada in December and France by January 1969 [30,33]. The H3N2 virus reached Madras, India in September from Singapore followed by the reported decline in influenza activity during end of November and December in Madras. It gradually spread to entire Indian subcontinent with the appearance of most severe manifestation among children [37].

A characteristic shift in mortality curve was observed with highest fatality cases being reported among the children and elderly, forming a U-shaped mortality curve [38]. Similar to previous pandemics, it spread in two successive waves but the distinctive feature of this pandemic was that the number of associated deaths in the two waves varied with geographic location, with United states and Canada being more affected by the first wave, whereas Europe and Asia by the second wave, thereby following a smoldering pattern [33]. The relative amelioration of infection rates can be the consequence of the pre-existing antibodies to neuraminidase antigen (N2), similar to its antecedent Asian flu (H2N2) strain.

The foremost complication during the Hong Kong pandemic was pneumonia (associated with Influenza and *staphylococcus*), but due to advances in the field of antibacterial therapies, the mortality rate was higher from primary influenza associated pneumonia rather than in synergy with secondary bacterial infections [22,38]. Similar to the other infective parts of the world, in India the pandemic was relatively mild with few complications like pneumonia, bronchopneumonia, *streptococci* and *staphylococcus* isolation from sputum, gastrointestinal symptoms etc. [37]. Due to less severity and low mortality rates, the control measures ascertain the use of vaccines and antibiotics in the case of secondary bacterial infections (pneumonia), rather than more costly non-pharmaceutical interventions [39]. The vaccines were developed against the circulating virus but were made available only when the pandemic had peaked indicating towards the lack of progress in healthcare strategies from 1957 Asian flu pandemic [40].

### 2009 H1N1 Pandemic

The H1N1/09 virus commonly known as swine flu, emerged in April 2009 with Mexico being the epicenter and was declared as the first global pandemic of 21st century on 11 June 2009 by WHO [3,6,8]. Swine flu is believed to be the fourth generation descendant of Swine flu that was first described in 1918 and emerged from the triple re-assortment between human, swine and avian influenza A virus to form the H1N1/09 pandemic strain [3,6,31]. After the pandemic declaration, national pandemic preparedness plans were put in motion globally, which included the use of antiviral therapy, disease alleviation and treatment [41]. The virus spread at unprecedented speed across the world with the mortality estimates of 575,000. Similar to the previous pandemics of 20<sup>th</sup> century, the swine flu exhibited the wave pattern of dissemination, which varied geographically. For example in North America, the pandemic had a two-wave behavior with the peaks being observed during spring-summer and fall [42]. In India however three wave patterns was observed, with peaks during September 2009, December 2009 and August 2010 [43]. The index cases in India were identified from Pune, which soon spread to the

entire nation [44].

The characteristics of Influenza H1N1/09 were similar to the seasonal influenza, infected individuals became more prone to underlying conditions, which further exacerbated the infection and increased the number of cases requiring hospitalization [45]. Complications seen in the patients included bacterial and viral pneumonia, asthma, lung and heart disease etc. Pneumonia caused by secondary bacterial infections and acute respiratory distress syndromes were the major cause of serious complications and mortality during 1918 Spanish flu [21,46]. Bacterial co-infections also played a major role in fatal cases of H1N1/09 pandemic with the *S. pneumonia* being most prevalent, followed by *S. pyogenes*, *S. aureus* (MRSA), *S. mitis*, *H. influenzae* being isolated from lung specimen of fatal cases [47]. Similarly in India, the severity of pandemic was associated mainly by secondary infections, like primary viral pneumonia and secondary bacterial pneumonia along with exacerbation of other chronic health conditions [48]. Apart from secondary bacterial infections, there were reports of viral co-infection leading to further exacerbation of the disease. The respiratory viruses like RSV, rhino virus, corona virus, metapneumovirus, parainfluenza co-infected the pandemic H1N1 cases, increasing the severity of the disease [22]. There was a shift in mortality curve, with the younger populations (children, young adults and pregnant women), being worst affected because the elderly are more likely to contain neutralizing antibodies from previous exposure to H1N1 virus [49,50].

Since its emergence, H1N1/09 virus was more susceptible to antivirals that were neuraminidase inhibitors (oseltamivir, zanamivir) and resistant to adamantanes (amantadines, rimantadines). The antivirals were found to be most effective in patients with severe influenza illness and reducing secondary bacterial infections, when started within 48 hours of the onset of symptoms [22,50]. In the area of limited antiviral availability, the decision to start the antiviral therapy was based on clinicians judgment, as the patients with mild symptoms did not require the antivirals unless they are at the risk of associated complications [46]. Clinician also prescribed antibacterial drugs in case bacterial co-infection was suspected, taking into account the data regarding the frequency of pathogen isolated during the cases of co-infection [3]. The alternative mode of treatment was vaccines, which were developed within 6 months and were the best tools to prevent the unforeseen spread of pandemic. Two types of vaccines were developed which were approved by FDA, adjuvant and non-adjuvant, both of which were safe and immunogenic, hence used widely during 2009 Pandemic situation.

The overall response to 2009 pandemic situation displayed a significant improvement in the preparedness plans by better surveillance schemes to ensure rapid detection and response to pandemics [50]. In comparison to previous pandemics, the pandemic of the 21<sup>st</sup> century was dealt with combined use of vaccines and antivirals, which undoubtedly reduced the morbidity and mortality. The non-pharmaceutical interventions like hand hygiene, isolation of symptomatic individuals, played an important role in containment of influenza pandemic [51].

Overall, the 2009 pandemic were mild but it caused a major socio-economic burden, which was more comprehensively documented than previous pandemics of last century. Though it reinforced

optimism about better preparedness, but the cost-effectiveness of the healthcare facilities were still a matter of concern.

## Conclusion

Influenza pandemics are one of the major threats to the world because of their high morbidity and mortality. The influenza related mortalities are mostly not due to primary viral infection but due to secondary viral and bacterial pneumonia. Hence, strategy for prevention of future pandemics should give emphasis on the control of both bacterial and viral associated community acquired pneumonia. Another measure for better preparedness could be easy accessibility to antivirals, antibiotics and vaccines, hence priority should be given to better infrastructure facilities for rapid production of vaccines, stockpiling of antivirals and antibiotics. In addition to this, better sanitation and improved nutritional status of the society will go a long way in controlling the disease. The mortality surveillance plans would be helpful for better understanding of disease burden of influenza, the pathogens contributing to the mortality and the most vulnerable age group. It shall be helpful in designing more specific preventive strategies and thereby reducing the catastrophic effects of influenza.

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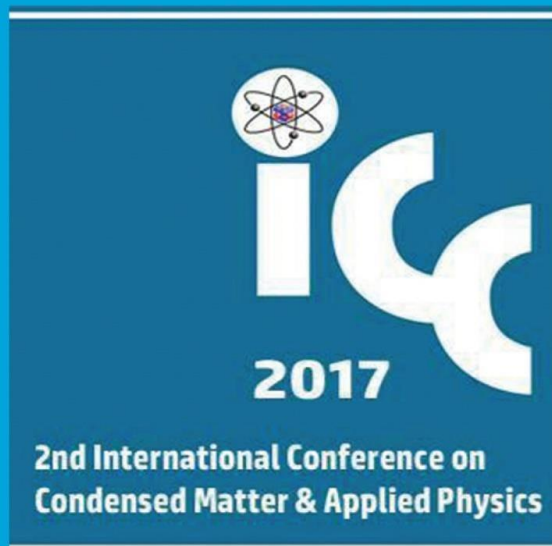
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# Magnetic graphene oxide for adsorption of organic dyes from aqueous solution

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## ABSTRACT

Graphene oxide (GO), a 2-D carbon nanomaterial, large surface area, oxygen-containing groups (like: hydroxyl, epoxy and carboxyl) and excellent water dispersibility due to it is good adsorbent dye removal from pollutant water<sup>1</sup>. But it's difficult to separate GO from water after adsorption. Therefore, Iron oxide was introduced in Graphene oxide by decorating method to make separation more efficient<sup>2</sup>. We present herein a one step process to prepare Magnetic Graphene oxide (MGO). The Fourier transform infrared spectrometer (FT-IR), X-ray diffraction (XRD) and Raman Spectroscopy characterized the chemical structure of the MGO composite. The adsorption of dyes onto MGO was studied in relation to initial concentration of Dyes, contact time, adsorbent dose, temperature and pH value of solution. We have studied adsorption capacity of different dyes (Methylene blue and crystal violet) by MGO.

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# Magnetic Graphene Oxide for Adsorption of Organic Dyes from Aqueous Solution

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**Abstract:** Graphene oxide (GO), a 2-D carbon nanomaterial, large surface area, oxygen-containing groups (like hydroxyl, epoxy and carboxyl) and excellent water dispersibility due to it is good adsorbent dye removal from pollutant water<sup>1</sup>. But it's difficult to separate GO from water after adsorption. Therefore, Iron oxide was introduced in Graphene oxide by decorating method to make separation more efficient<sup>2</sup>. We present herein a one step process to prepare Magnetic Graphene oxide (MGO). The Fourier transform infrared spectrometer (FT-IR), X-ray diffraction (XRD) and Raman Spectroscopy characterized the chemical structure of the MGO composite. The adsorption of dyes onto MGO was studied in relation to initial concentration of Dyes, contact time, adsorbent dose, temperature and pH value of solution. We have studied adsorption capacity of different dyes (Methylene blue and crystal violet) by MGO.

**Keywords:** Graphene oxide, Iron oxide, methylene blue, crystal violet and Adsorption.

## INTRODUCTION

The contaminants (dyes, heavy metals etc.) in water are growing rapidly due to the lack of knowledge about their effect on living species these contaminate effecting our life slowly but regularly. Therefore, we need a technology that can reduce effect of these contaminants. So many technologies are being used, adsorption technology is one of the growing technologies because it can be used in large scale and it is cost effective. For maximum adsorption a material should contain maximum oxide group, there are so many adsorbent materials available in the market. The new era going to start in the field of electronics, bio-sensing, gas-sensing, optics, water purification, mechanical, catalyst, and drug delivery agent etc.,<sup>3</sup> due to the world first 2-D material (Graphene) has arrived. Graphene is a one atom thick, single sheet of carbon atom arranged in honeycomb structure. Its sister materials are also gaining tremendous interest of researchers in the above applications. Graphene oxide, oxidized form of Graphene is a unique 2-D material which has different types of oxide groups (-OH, -C-O-C-, C=O and -COOH) available on its basal plane<sup>4</sup>, therefore GO is very suitable for adsorption of contaminants. But for maximum use of adsorbent material recyclability should be high. The recyclability of GO is low to overcome this drawback in GO, magnetic nanoparticles comes in the role<sup>5</sup>. In this paper we have synthesized MGO by co-precipitations method<sup>2</sup> and two dyes (methylene blue and crystal violet) were used for adsorption for different temperature, pH, contact time and concentration of dosage.

## EXPERIMENTAL SECTION

**Materials:** All the chemicals used e.g. Graphite, methylene blue Sulfuric acid, KMnO<sub>4</sub>, sodium nitrate, and hydrogen peroxide were all of analytical grade.

**Graphene oxide preparation:** Graphene oxide (GO) will be prepared from graphite powder by a Hummer's method. In this method Graphite (1 g), sodium nitrate (NaNO<sub>3</sub>, 0.50 g) and concentrated sulfuric acid (H<sub>2</sub>SO<sub>4</sub>, 23 ml) added into a 500 ml flask kept at 5°C in an ice bath under continuous stirring for 5 min. Then, potassium

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## Leveraging Hierarchy and Community Structure for Determining Influencers in Networks

Sharanjit Kaur<sup>1</sup>, Rakhi Saxena<sup>2(✉)</sup>, and Vasudha Bhatnagar<sup>3</sup>

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**Abstract.** Predicting influencers is an important task in social network analysis. Prerequisite for understanding the spreading dynamics in online social networks, it finds applications in product marketing, promotions of innovative ideas, constraining negative information etc.

The proposed prediction method IPRI (Influence scoring using Position, Reachability and Interaction) leverages prevailing hierarchy, interaction patterns and community structure in the network for identifying influential actors. The proposal is based on the hypothesis that capacity to influence other social actors is an interplay of three facets of an actor viz. (i) position in social hierarchy (ii) reach to diverse homophilic groups in network, and (iii) intensity of interactions with neighbours. Preliminary comparative performance evaluation of IPRI method against classical and state-of-the-art methods finds it effective.

**Keywords:** k-truss · Hierarchy · Topology · Community · Interaction

### 1 Introduction

Predicting influential spreaders in Online Social Networks (OSNs) is an important task because of the critical role they play in dissemination of information. The task is also crucial for accelerating the spread of positive vibes and blocking cascade of negative vibes in highly linked contemporary society [1,11].

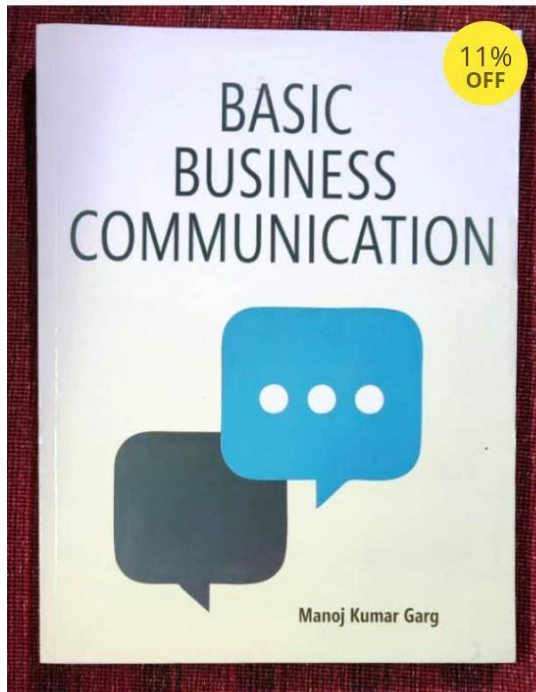
Early methods for finding influencers in networks were based on classical centrality measures and their variants [2,6,11]. Prediction quality of these methods leaves much to be desired due to limited view of node attributes they take into account and network topology they scrutinize. Taking cues from the real-world, researchers have considered intensity of interactions between individuals for identifying influential nodes [8,9]. Number of links of an actor in diverse communities provides a unique vantage point in aiding spread of information. Method proposed in [16] exploits this idea and uses community structure in addition to weight of links to identify influential nodes. Role of hierarchy in influence spread is admitted and shown to be effective in [6,12].

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# Mathematica Programming for Numerical Methods

**Dr. Laxmi Narain**



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## PREFACE

This book entitled *Mathematica Programming for Numerical Methods* provides an introduction to the numerical methods that are typically encountered (and used) in science and engineering undergraduate courses. The material is developed in tandem with Mathematica which allows rapid prototyping and testing of the methods. The package Mathematica provides an environment in which students can learn to programme and explore the structure of the numerical methods. The methods included here are of a basic nature. This book is divided into seven chapters

*Chapter 1:* provides an introduction to basic concepts of Mathematica. It includes introduction to Mathematica basics, functions, equations, lists, rules, graphics, animate and manipulate data and turning a notebook into a report.

*Chapter 2:* contains basic concepts of Mathematica programming. It includes looping constructs (iterations), Logical Expressions, conditionals (decision statements), user-defined functions, procedural programming and file I/O in Mathematica.

*Chapter 3:* in this chapter we consider one of the most basic problem of numerical approximation, the *root-finding problem*. We will consider the iterative methods: Bisection, Regula Falsi, Secant and Newton Raphson.

*Chapter 4:* in this chapter we describe iterative techniques used for solving linear systems of equations. We will consider the Jacobi and the Gauss-Seidel iterative methods.

*Chapter 5:* contains the problems of approximating a given function by polynomials i.e., interpolation. In this chapter we will study about two such methods - Lagrange interpolation and Newton divided difference interpolation polynomial.

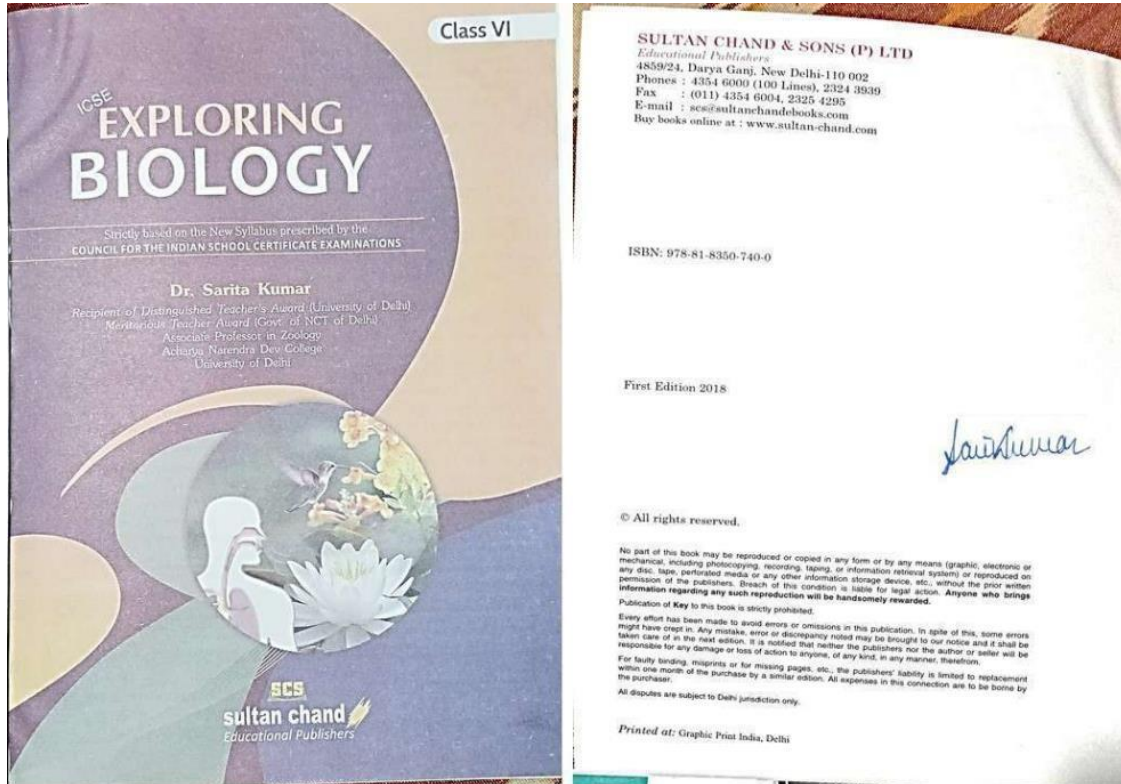
*Chapter 6:* contains methods that deal with approximation of integration. In this chapter we will study Trapezoidal rule, composite Trapezoidal rule, Simpson's rule and composite Simpson's rule which are commonly introduced in calculus courses.

*Chapter 7:* consider *initial-value problem*, that is, the solution to a differential equation that satisfies a given initial condition. In this chapter, we will consider

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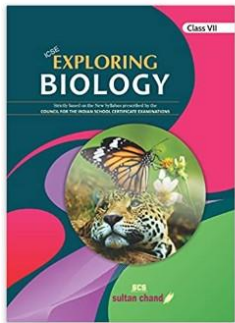
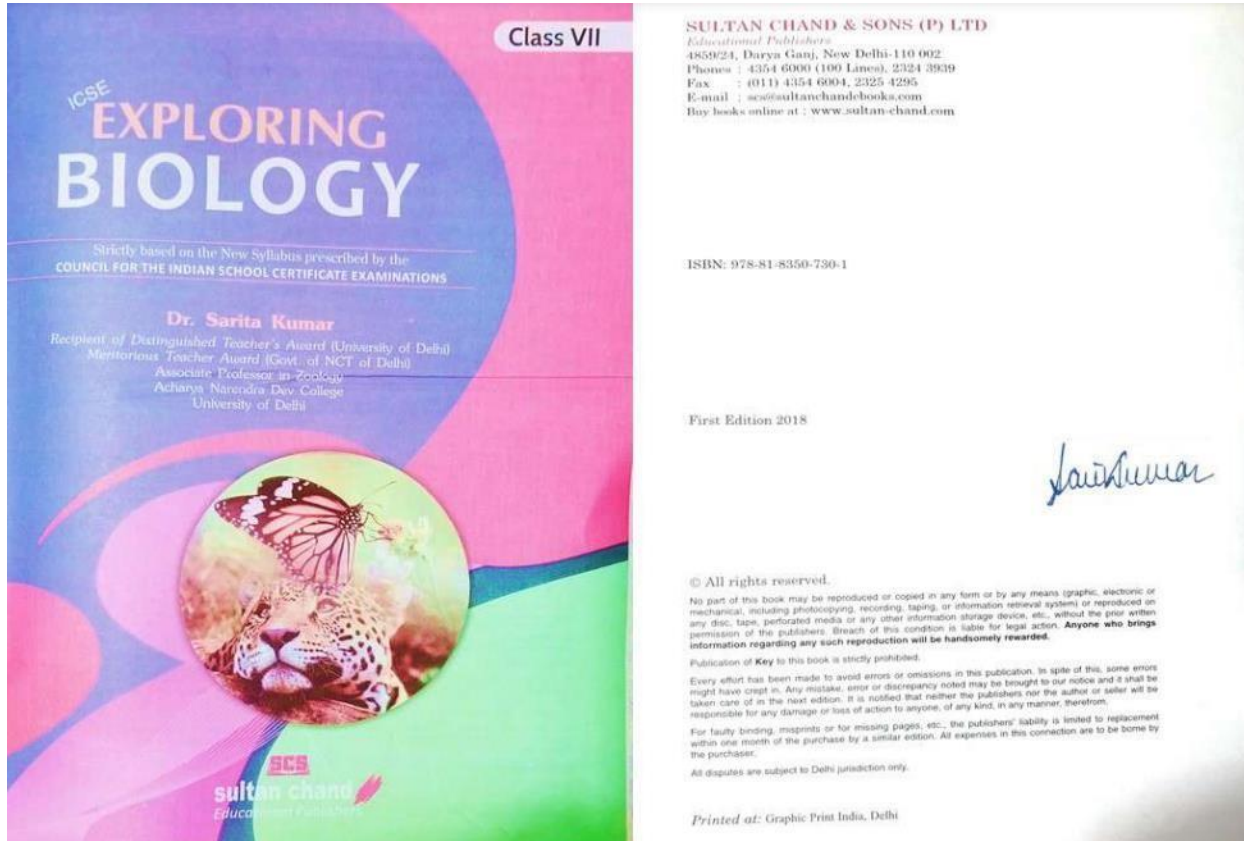
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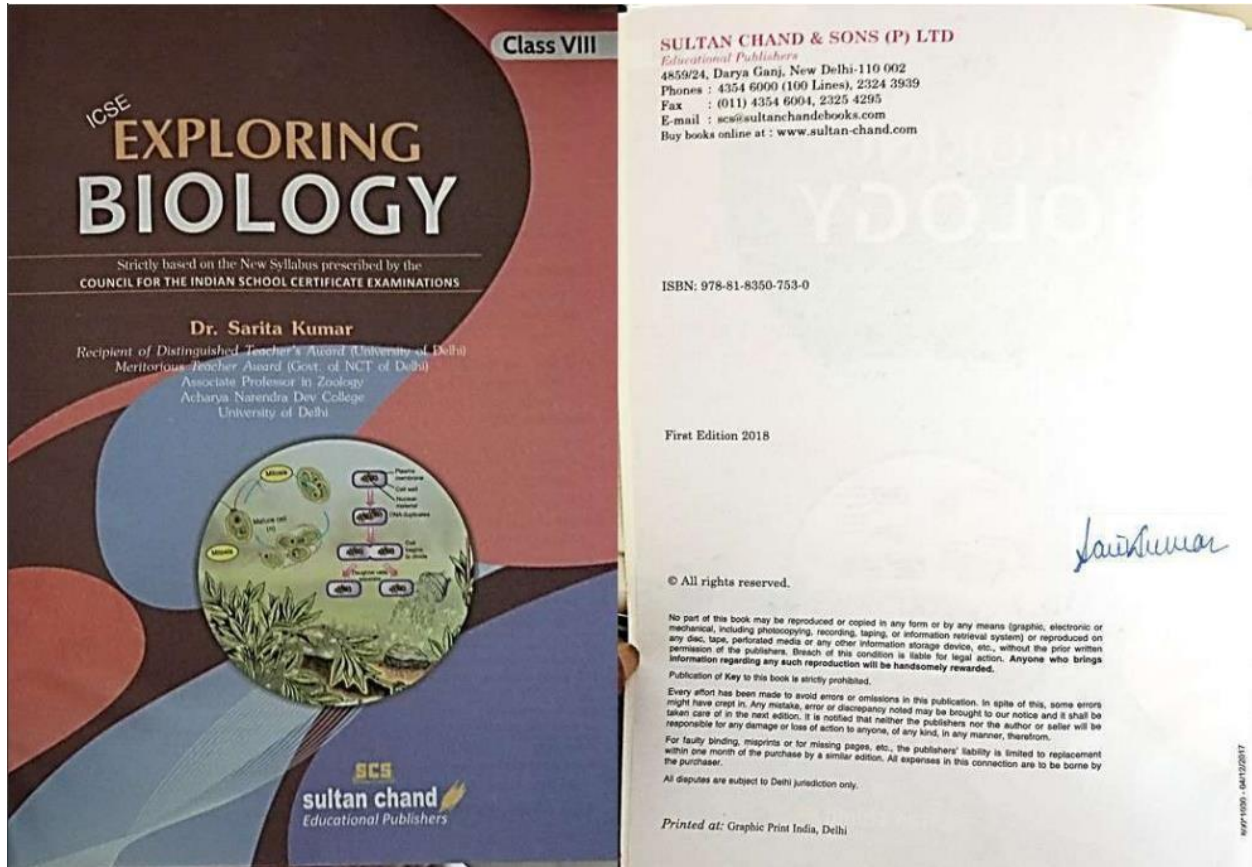
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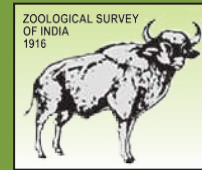
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## Chapter 3



## PrOTOzOA: CILIOPHOra (CILIATES)

JAsMINE PURUsHOTHAMAN<sup>1\*</sup>, BINDU L<sup>2</sup>, sEEMA MAKHIJA<sup>3</sup>,  
rAVI TOTEJA<sup>3</sup>, rENU GUPTA<sup>4</sup>

### ABsTrACT

Ciliates are one of the important members in the eukaryotic microbial community. In order to better understand the distribution pattern of freshwater ciliates in India, a comprehensive literature review was done and compiled the current status of ciliates diversity in India. Altogether 106 species of ciliates belonging to 58 genera and 36 families are described from the fresh water ecosystems of India so far. Majority of the species reported from India belongs to family Oxtrichidae. It is concluded that extensive research should be made to assess the seamless diversity of this less studied microbes.

**Key words:** Protozoa, Ciliates, Freshwater

### INTroDUCTION

Protozoans (ciliates and flagellates) are the main components of the “microbial loop”, which is a distinct and important element of the trophic food web in aquatic ecosystems (Azam *et al.*, 1983). Free living ciliates are an important intermediate link between primary producers and higher trophic levels in every estuarine and marine ecosystem (Zingell *et al.*, 2007). They prey on autotrophic and heterotrophic pico and nano plankton and are preyed upon by larger zooplankton and contribute to the remineralization and cycling of nutrients (Blomqvist *et al.*, 2001; Ventela *et al.*, 2002).

The role of ciliates as an important component of the microbial loop in freshwaters is widely recognized (Wiackowski *et al.*, 2001). Ciliates are a significant trophic link in energy transfer from heterotrophic (bacteria) and autotrophic picoplankton to the higher consumers (Zingell *et al.*, 2007) and play a significant role in energy transfer and nutrient remineralization in aquatic environments (Cleven & Weisse, 2001). Ciliates are an essential food source for rotifers, cladocerans and copepods (Jack and Gilbert, 1997) and some fish larvae, for example the guppy (*Poecilia reticulata*) larvae, can use ciliates as food in their early life stages (Lair *et al.*, 1994). The importance of the microbial loop is greater in oligotrophic than eutrophic lakes, although, Weisse *et al.*, (1998) demonstrated that almost 50% of carbon passed through the microbial loop in meso-eutrophic lake.

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**Cell Biology**

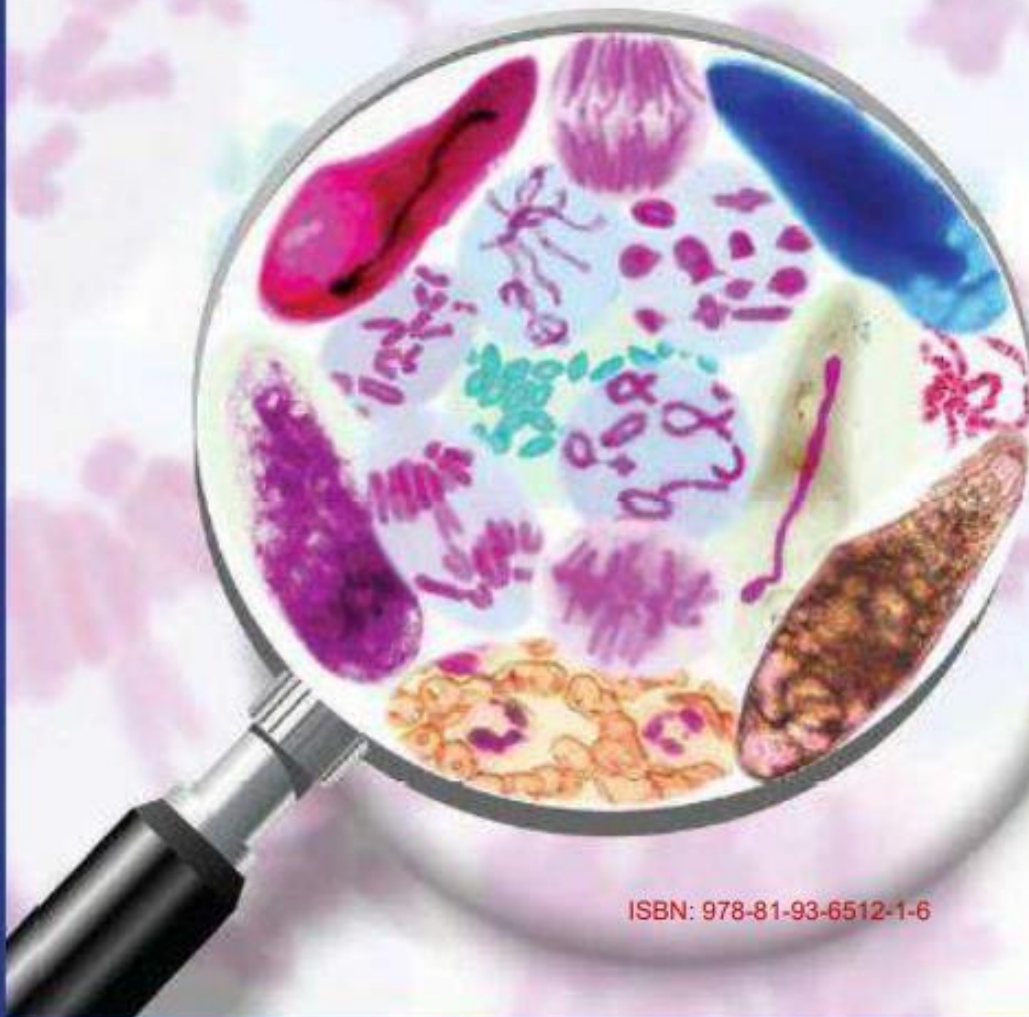
**Practical Manual**

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# Cell Biology

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### About the Book

The present practical manual has been written with reference to the syllabi in Indian Universities for Cell Biology as there has been a total lacuna in the availability of any Indian Cell Biology Practical Manual. The manual incorporates practical exercises widely covering the contents of undergraduate courses including the essential background information and protocols for observing and understanding cell morphology, structure and its components, for example, investigations of nucleic acids, carbohydrates etc. The chapters will enable the students to understand basic and advanced experimental procedures in the field concerned and provide a better understanding of specialized practical work. The manual covers a substantial range of methods for working on cytochemical staining, biological methods to culture and maintain model organism, details of cell division, barr body, comprehensive coverage of microscopy etc.

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# Cell Biology

Practical Manual

Dr. Renu Gupta  
Dr. Seema Makhija  
Dr. Ravi Toteja



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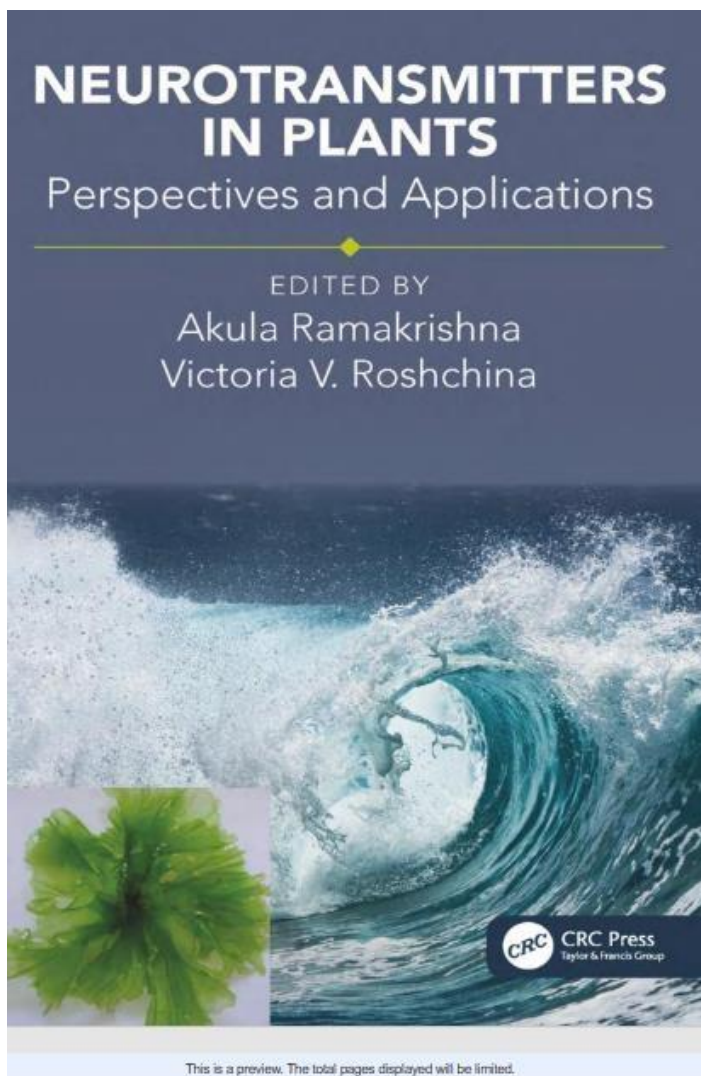
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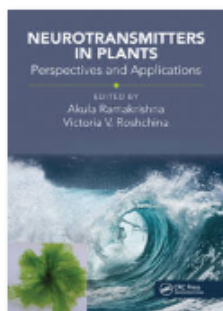
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Chapter

## Role of Acetylcholine System in Allelopathy of Plants

By *Rashmi Sharma, Rajendra Gupta*

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### ABSTRACT

Components of the cholinergic system—acetylcholine, acetylcholinesterase, and acetylcholine receptors—are the principal components of the nerve transmission in animals. Plants, though nerveless, have long been known to possess most of the components of the cholinergic system. Plants also have a repertoire of chemicals that inhibit various components of the acetylcholine system. A hitherto overlooked fact is that many of these anticholinergic chemicals present in some plants act as allelochemicals and help the plants to dominate their habitat by affecting the growth of other plants in their vicinity. Since the target sites of most of the allelochemicals in victim plants are unknown, the possibility of cholinergic chemicals as allelochemicals opens new areas of research in plant biology. We have shown earlier that the extract of *Cyperus rotundus* inhibits acetylcholinesterase activity in electric eel, wheat, and tomato and that it also inhibits germination and growth of root and shoot in tomato and wheat. Now, we present evidence that the methanolic extracts of 45 weeds, including invasive weeds like *Lantana camara*, *Ageratum conyzoides*, *Argemonemexicana*, *Ranunculus sceleratus*, and *Prosopis juliflora* contain very high levels of anticholinesterases. Anticholinesterases block the enzyme acetylcholinesterase, resulting in an increase in the levels of acetylcholine in the system. We propose that cholinergic chemicals act as allelochemicals in plants.

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Satish C Bhatla · Manju A. Lal

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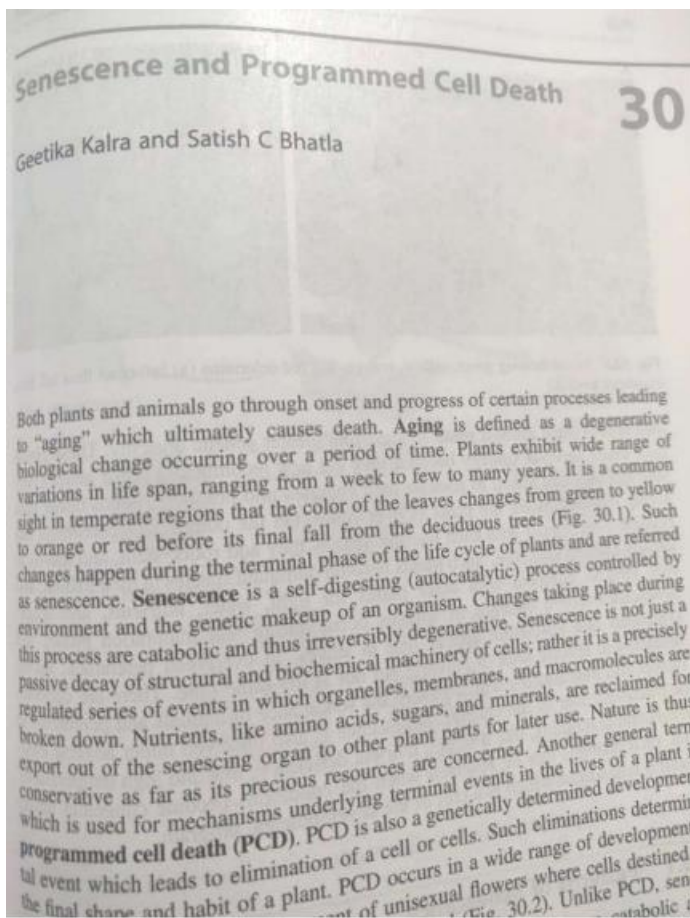


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# COMPUTER SCIENCE

TEXTBOOK FOR CLASS XI



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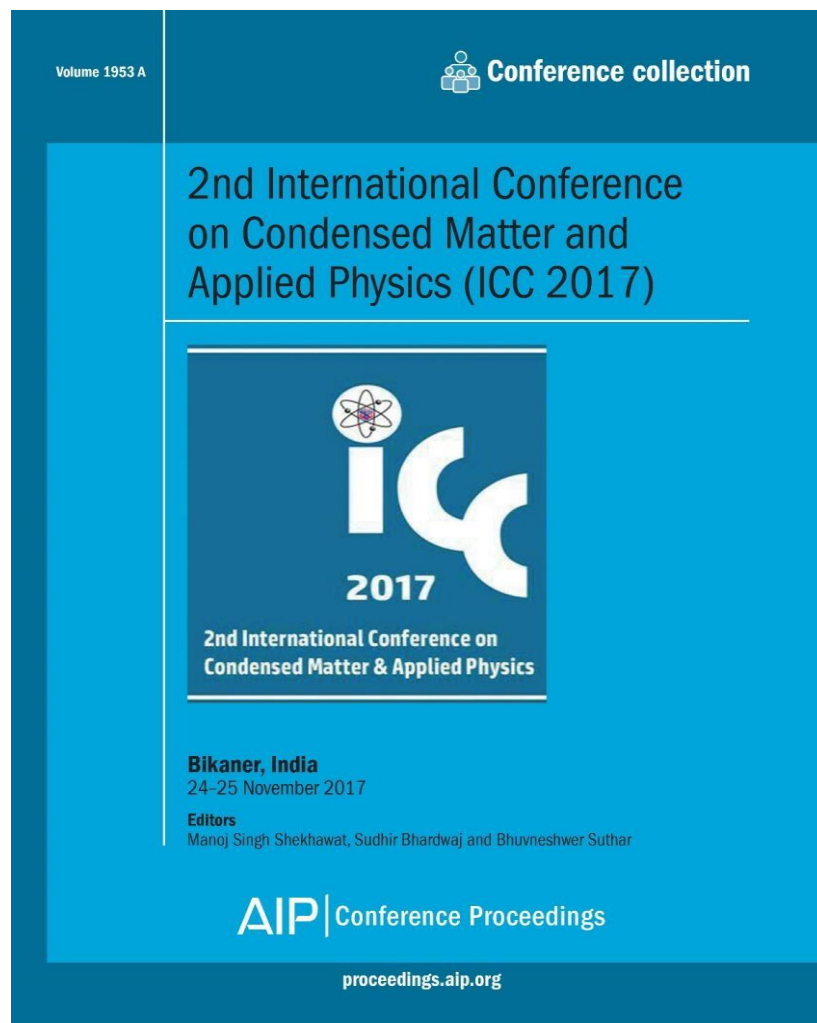
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# Effect of Concentration Variation In Graphene Oxide (GO) Membranes For Water Flux Optimization

Shani Kumar<sup>1,3)</sup>, Amit Garg<sup>1,\*)</sup>, Arijit Chowdhuri<sup>2)</sup>

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**Abstract:** Graphene oxide, sister material of Graphene has generated tremendous research interest in fields of energy storage, catalyst material, adsorbent material for heavy metals and dyes, green energy production, drug delivery agent, a gas sensing material as well as in membrane based water purification and desalination systems<sup>1-3</sup> etc. In this paper, we are reporting the effect of concentration variation in GO membranes on water flux. GO has been synthesized by Hummer's method with related characterizations like XRD, Raman, SEM and FTIR carried out. GO membranes have been developed using pressure assisted filtration assembly (Water Vac-100) over Cellulose Acetate membrane support (47 mm dia. and 0.45  $\mu\text{m}$  pore size), Millipore.

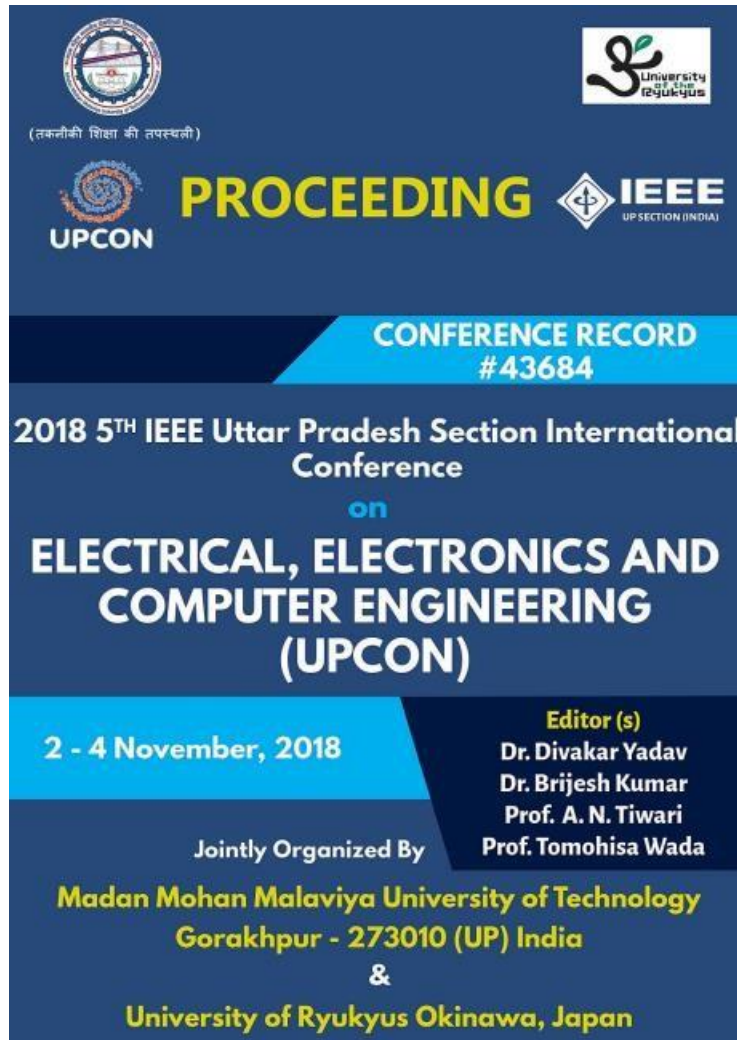
**Keywords:** Graphene oxide membrane, water flux, Hummer's method

## INTRODUCTION

Worldwide almost all countries are moving towards paucity of potable drinking water at a very rapid pace mainly due to anthropogenic activities. Therefore, conservation of this natural resource in conjunction with its recycling assumes importance and which necessitates development of an advanced water purification technique that could help overcome the problem of drinking water while offering the feasibility of scaling-up for industries. Literature indicates membrane based water purification techniques gaining interest wherein polymer based membranes are in demand due to low cost of development, high water flux and high life time. However, they suffer from problems including long term chemical, thermal and biological stability which reduce performance of these membranes<sup>4-6</sup>. Unusual properties of Graphite oxide membranes were reported by H.P. Boehm et al. who reported that the membranes are not permeable to gases but permeable to water vapors<sup>7</sup>. The same materials are now named mostly as graphene oxide papers or membranes. Interest in permeation properties of GO membranes was reborn recently by the study of Nair et al.,<sup>8</sup> which reported that water vapors permeate through the membranes but not vapors of several other solvents, e.g. ethanol. Recent experiments showed that GO membranes also demonstrate selective ion permeation and can be used for filtering of some organic molecules<sup>9</sup>. Beyond the traditional polymer membranes, GO based membranes, restacking from two-dimensional GO nanosheets, have been regarded as a promising candidate for water purification and desalination<sup>10-11</sup>. By taking advantages of its high mechanical strength/flexibility, excellent hydrophilic surface properties and 2D interconnected nanofluidic channels for ion and molecular transport, GO based membranes have exhibited extraordinary separation performance in respect of water flux and pollutant molecular/ions rejection<sup>12-14</sup>. However, there is a need to optimize graphene oxide membranes for water purification offering robust structural stability vis-à-vis efficient water purification capabilities. In the present work five different membranes over cellulose acetate support having varying concentration of GO solution, have been fabricated. The same are then checked for stability in performance and water flux so that amount of GO can be optimized (in mg over 40 mm effective Diameter of GO membrane) which can be further used for optimization of water flux and stability.

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# Impact of donor-layer doping & thickness, gate-length and temperature on potential and electron concentration in AlGa<sub>0.75</sub>N/GaN Double-Heterostructure and Single-Heterostructure HEMT

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**Abstract**—This paper presents a comparative simulation based analysis of the impact of donor-layer doping & thickness, gate-length and temperature on channel potential and electron concentration of Al<sub>0.75</sub>Ga<sub>0.25</sub>N/GaN/Al<sub>0.75</sub>Ga<sub>0.25</sub>N double heterostructure (DH) HEMT and Al<sub>0.75</sub>Ga<sub>0.25</sub>N/GaN single-heterostructure (SH) HEMT. Due to the formation of two 2-DEGs at the two hetero-interfaces, potential and electron concentration of a double-heterostructure HEMT is found to be more sensitive to variation in gate-length, donor-layer doping, donor-layer thickness and temperature as compared to SH-HEMT.

**Keywords**—channel potential, donor layer thickness, doping concentration, double-heterostructure high electron mobility transistor, electron concentration, gate-length, temperature

## I. INTRODUCTION

III-V nitride wide band gap semiconductor materials are receiving much interest recently for their potential use in high power and high frequency applications. This is primarily due to the large 2-D electron gas induced by the polarization charge at the AlGa<sub>0.75</sub>N/GaN hetero-interface [1]. GaN-based high-electron-mobility transistors in particular are being considered as the most suitable choice due to high sheet-carrier density and large breakdown field strength (~3.5 MV/cm) [2-4]. The major feature of an AlGa<sub>0.75</sub>N/GaN heterostructure system is spontaneous and piezoelectric polarization at the AlGa<sub>0.75</sub>N/GaN hetero-interface which results in a very high sheet-carrier concentration of the order of (2-6) × 10<sup>13</sup> cm<sup>-2</sup> [1]. Polarization results in confinement of high concentration of electrons or holes at the hetero-interface [5-6]. For a net positive polarization at the interface this confinement results into two dimensional electron gas (2-DEG) and for a net negative polarization, this results into two dimensional holes gas (2-DHG) [7].

An attempt to obtain even better performance for future military communications, radar and intelligence applications has led to continuous downscaling of gate-length to sub-100 nm level. However, in order to maintain the device aspect ratio and to avoid deterioration in the device

performance due to the emergence of various short-channel effects (shift of threshold voltage towards the more negative value, undesirable larger sub-threshold slope, deterioration of transconductance and output conductance etc), gate-length reduction has to be accompanied by shortening of gate-to-channel separation. To achieve larger 2DEG concentration and better carrier confinement interest has been grown from single heterojunction devices to double heterojunction high electron mobility transistors. DH-HEMT also exhibits higher value of transconductance with less modification over an extensive range of gate-source voltage as compared to a single heterostructure HEMT [8-13].

Modification in the conventional HEMT structure such as a double-heterostructure HEMT has emerged as a possible solution to obtain further improvement in the high-power, high frequency performance beyond the limit of device miniaturization [8-10]. DH-HEMT offers numerous advantages over conventional single-heterostructure HEMT (SH-HEMT), such as larger sheet carrier concentration, larger current, larger transconductance and higher cut-off frequency over SH-HEMT which leads to better RF performance of the device and shows better charge control in DH-HEMT over SH-HEMT [14-16].

Authors in their previous work [14-16] proposed an analytical approach for the evaluation of threshold voltage, sheet carrier concentration, drain current, transconductance and cut-off frequency of AlGa<sub>0.75</sub>N/GaN/AlGa<sub>0.75</sub>N DH-HEMT. A comparative analysis of the dependence of sheet carrier concentration and threshold voltage on donor-layer doping density and donor layer thickness of 100 nm gate-length AlGa<sub>0.75</sub>N/GaN SH-HEMT with AlGa<sub>0.75</sub>N/GaN/AlGa<sub>0.75</sub>N DH-HEMT was also presented [14-15]. In this paper, extensive analysis has been carried out using ATLAS 2D device simulation [17], in order to study the effect of variation of donor layer thickness  $d_n$ , doping density  $N_D$ , temperature  $T$  and gate-length ( $L_g$ ) on the channel potential and electron concentration of DH-HEMT as compared to SH-HEMT.

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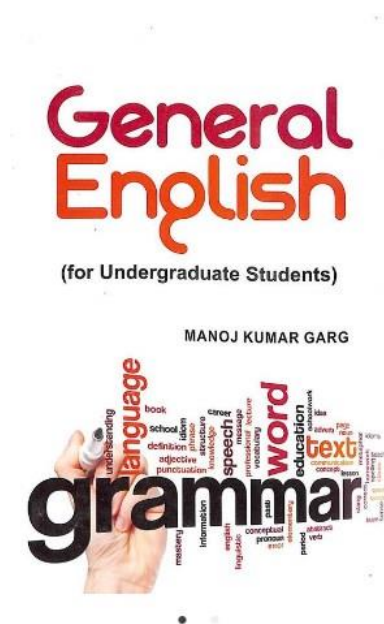
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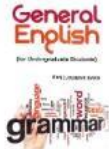
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WRITTEN BY

Rakesh Kumar Sonker, Saroj Radheshyam Shabaleet, Rahul Johari and Balchandra Yedav

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## Abstract

Nowadays innovations in synthetic methods for metal oxide-based nanomaterials such as nanostructured and both physical and chemical route techniques have been adopted by various researchers around the world. The investigation has been focusing on various deposition parameters for fabricating nanostructured metal oxide. Gas sensors that use metal oxide materials are broadly utilized in industry to monitor combustion processes. While they are economical to powerful in high temperature environments, many of these instruments are not selective towards the species of interest when placed in a stream composed of multiple gases. Research on nanostructured metal oxide materials has generated great interest in scientific community. Metal oxide is a chemically stable, harmless, biocompatible, inexpensive material with very high dielectric constant and interesting photocatalytic activities. It is a wide-gap semiconductor and depending on its chemical composition, it shows a large range of electrical conductivity. Synthetic strategies regarding nanocomposites of metal oxide with other inorganic and organic materials sensing activities has been reviewed. The measure response of metal oxide film-based sensor highest low concentration of LPG.

## Keywords

metal oxide thin film deposition technique LPG sensor

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## 1. Introduction

Liquefied petroleum gas (LPG) is the composition of hydrocarbons mainly propane and butane. The lower explosive limit (LEL) as specified by National Institute for Occupational Safety and Health (NIOSH) and Occupational Safety and Health Administration (OSHA) standards for chemical hazards is 21,000 ppm (2.1% by volume in air) for propane and 10,000 ppm (1.0% by volume in air) for butane. The permissible exposure limit (PEL) for LPG as specified by NIOSH and OSHA standards is 1000 ppm [1]. LPG is mostly used as fuel for vehicles and as cooking gas for household applications. Exact observing of leakages of LPG even at low concentrations can be useful to avoid accidental explosions [2, 3]. Sensors have turned into an indispensable piece of the cutting-edge human progress attributable to its significance, where metal oxides have played a major role as reliable sensor materials. Nanoparticle do research presents broad scope for the growth of novel solutions

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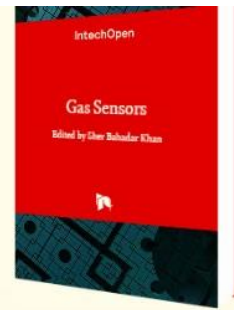
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*Rakesh Kumar Sonker, Saroj Radheyshyam Shabajeet,  
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## Abstract

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**Keywords:** metal oxide, thin film, deposition technique, LPG sensor

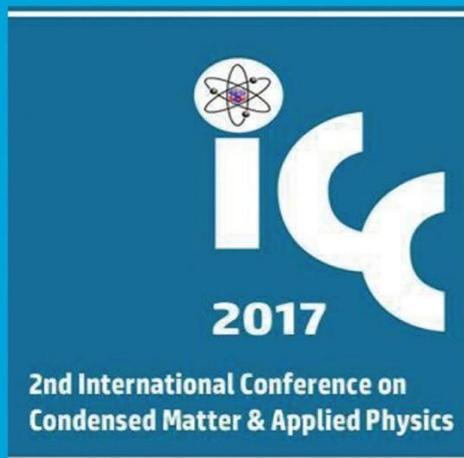
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### ABSTRACT

Graphene oxide, sister material of Graphene has generated tremendous research interest in fields of energy storage, catalyst material, adsorbent material for heavy metals and dyes, green energy production, drug delivery agent, a gas sensing material as well as in membrane based water purification and desalination systems<sup>1-3</sup> etc. In this paper, we are reporting the effect of concentration variation in GO membranes on water flux. GO has been synthesized by Hummer's method with related characterizations like XRD, Raman, SEM and FTIR carried out. GO membranes have been developed using pressure assisted filtration assembly (Water Vac-100) over Cellulose Acetate membrane support (47 mm dia. and 0.45  $\mu\text{m}$  pore size), Millipore.

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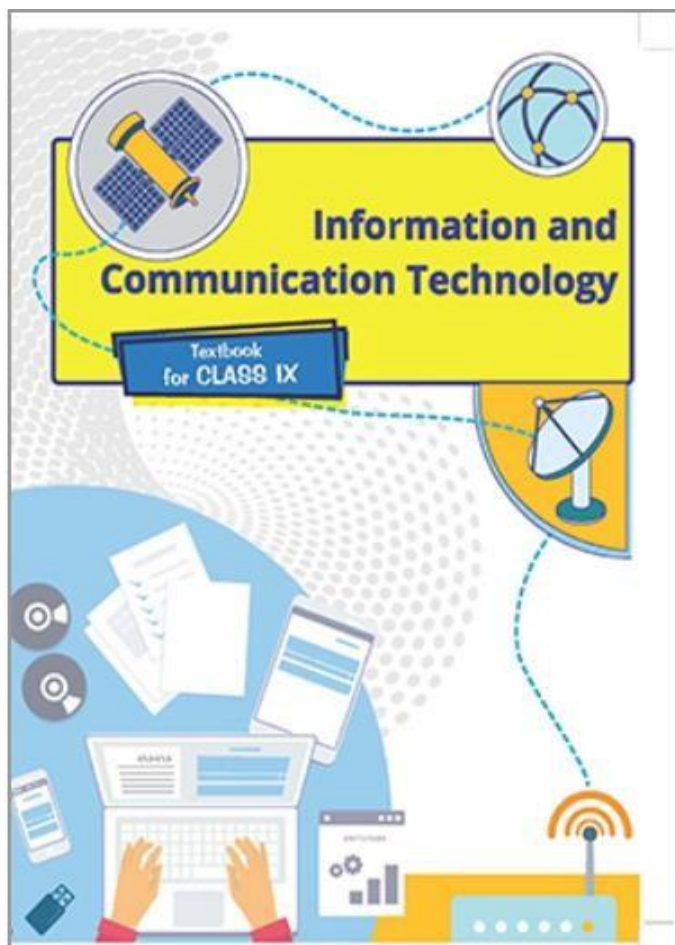
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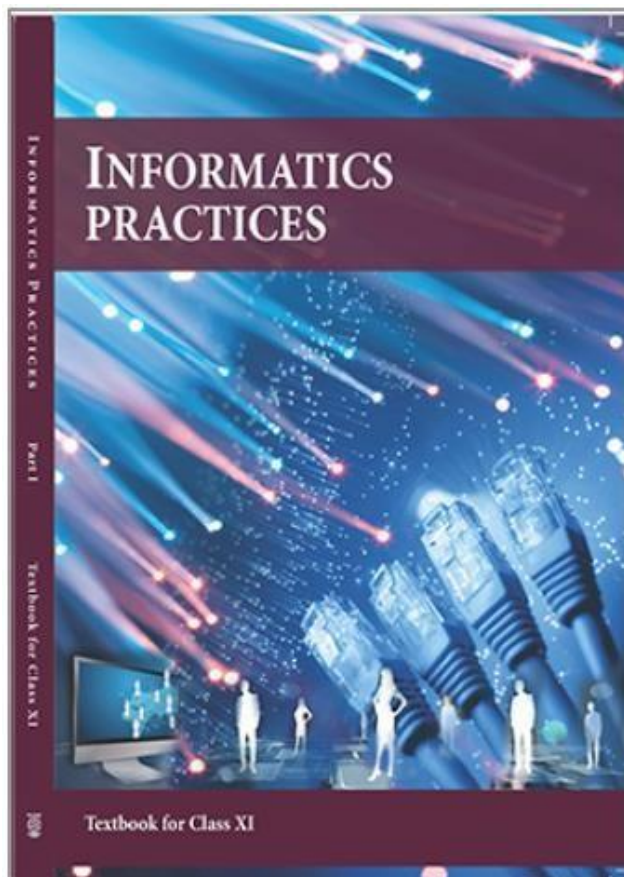
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# 3rd International Conference on Condensed Matter and Applied Physics (ICC-2019)

Bikaner, India • 14–15 October 2019

Editors • Manoj Singh Shekhawat, Sudhir Bhardwaj  
and Bhuvneshwer Suthar

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### 3RD INTERNATIONAL CONFERENCE ON CONDENSED MATTER AND APPLIED PHYSICS (ICC-2019)



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#### PRELIMINARY

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### Preface: 3rd International Conference on Condensed Matter & Applied Physics (ICC-2019)

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#### NANO MATERIALS, NANO OPTICS & ELECTRONICS

### Impact of Fabrication of Pyramidal Structure on Silicon Wafer Surface in ZnO/Si Heterojunction

Manju Rani<sup>1,a)</sup>, Jyoti Kashyap<sup>2</sup>, Udaibir Singh<sup>3</sup> and Avinashi Kapoor<sup>2</sup>

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**Abstract.** We have demonstrated the impact of fabrication of pyramidal structure on Silicon (Si) wafer substrate in ZnO/Si heterojunction on its structural and optical properties. The texture on Si substrate is obtained using wet etching method for different time durations. Patterns of photoresist have been used to get desired size of the structure. Scanning electron microscopy (SEM) of the samples shows a pyramidal structure on the surface of Si substrate. The thin film of ZnO material on p-type planar silicon (100) and textured Si (100) substrate has been deposited by using RF magnetron sputtering technique. ZnO thin films produce an anti reflection (AR) effect when deposited on silicon substrate. The structural and optical properties of ZnO/Si (TS) heterojunction were studied by x-ray diffraction (XRD) and UV-Vis spectrophotometer respectively. XRD patterns of the ZnO/Si and ZnO/Si (TS) heterojunctions show the orientation of the ZnO film fabricated on silicon substrate. Their reflectance spectra show reduction in reflectance proportional to increase in time duration of texturization. This study indicates that ZnO/Si (TS) heterojunction may be utilized in various heterojunction and photovoltaic devices for reduction in reflection of incident light.

#### INTRODUCTION

Silicon is the first choice for manufacturing solar cells in present scenario due to the facts that it has the potential for high efficiency, reliability, easily availability in the earth's crust, most widely studied literature. In silicon based solar cells one of the prominent issues is high reflection of the solar radiation by the silicon surface. Due to this optical loss, a limited efficiency of the solar cell is achieved. To reduce the reflectance, an anti-reflection coating is used on the silicon surface. ZnO (Zinc Oxide) thin films have got an important place in ZnO/Si heterojunction solar cells as anti-reflection (AR) coating [1,2]. The reason for using ZnO as an anti-reflecting coating is that there is much difference in the refractive indices of Si and ZnO [4,5,6]. ZnO has a large optical bandgap in the range of 3.3 to 3.7 eV, which are transparent in the visible region. Also ZnO has good adhesion properties and hardness. ZnO thin films have got multiple applications ranging from UV light emitters, varistors, transparent high power electronics, surface acoustic wave devices, piezo-electric transducers, chemical and gas sensing devices etc. ZnO has a direct band gap (3.37 eV), a high excitation binding energy (60 meV) at room temperature and a wurtzite crystal structure. ZnO thin films have been proved to be a good choice as anti-reflection coating (ARC) in solar cells.

Texturization of the silicon surface (TS) can further enhance the light trapping in the ZnO/Si (TS) heterojunction. Texturization provides better absorption of incident light by means of second reflection. Fig. 1 shows an indicating diagram of light getting reflected from a texturized surface [17]. Also bigger surface area becomes available for absorption of light which in turn reduces the level of reflectance by the silicon surface [3].

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### Impact of fabrication of pyramidal structure on silicon wafer surface in ZnO/Si heterojunction

Manju Rani, Jyoti Kashyap, Udaibir Singh and Avinashi Kapoor

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### Characterization of 100 keV silicon negative ion implanted SiO<sub>2</sub> thin films

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### Absorption enhancement by surface texturing in ZnO/Si heterojunction

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### Structural and electrical properties of chitosan - Spinel MnFe<sub>2</sub>O<sub>4</sub> biocomposites

Kiran, Sanjeev Kumar and Nagesh Thakur

AIP Conference Proceedings 2220, 020182 (2020); <https://doi.org/10.1063/1.50002383>

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### Absorption Enhancement by Surface Texturing in ZnO/Si Heterojunction

Jyoti Kashyap<sup>1,a)</sup>, Poonam Shokeen<sup>2</sup>, Manju Rani<sup>3</sup>, Udaibir Singh<sup>4</sup>, and Avinashi Kapoor<sup>1</sup>

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**Abstract.** In this paper, thin film of ZnO nanoparticles deposited on a planar Si (100) and a textured Si (100) substrate are investigated. Chemical etching is used to prepare textured Si substrate and RF magnetron sputtering is used to deposit ZnO thin films. The surface morphology and reflectance are studied with SEM and UV-VIS Spectroscopy, respectively. Structural morphology of the etched wafer indicate random pyramidal structures. Optical study indicates a significant reduction in reflectance for textured silicon (TS) heterojunction in comparison to planar Si (PS) heterojunction. This study promotes the study of heterojunction devices and surface texturing for light management in various optoelectronic devices.

#### INTRODUCTION

Silicon is widely used in optoelectronic devices under various structural morphologies [1]. Surface reflections contribute to major optical losses in the system. It has motivated a group of scientists to tackle this problem [2]. One of the popular methods to reduce the reflection is Surface Texturing. The texturization of the silicon surface leads to an increase in its topographic irregularities which results in an increased effective surface area. Anisotropic etching is one of the most accepted for texturization of industrial silicon solar cells to reduce reflection losses from the front surface [3-6]. Alkaline solutions are the main anisotropic etchants, where the main component can be either an organic or an inorganic compound [7]. Sodium Hydroxides (NaOH) or Potassium Hydroxide (KOH) are the popular inorganic solutes which are mixed with isopropyl alcohol (IPA) and water. In this study, texturization based on alkaline anisotropic etching was investigated using KOH as alkaline etchant and IPA as a surfactant [8]. Adding IPA can improve the wettability of silicon surface and control the etching rate. It prevents an explosive reaction between the silicon surface and the OH-ions [9-10]. Etching of silicon in KOH solution has the advantages of simplicity, ease of handling, low-cost and homogeneous etching rate of the (100) crystal phase [11].

Zinc oxide (ZnO) is a low-cost, non-toxic material. It has high optical transparency and low resistivity. It can be deposited at low temperatures. As a result, it finds applications in a wide range of semiconductor devices [12-15]. ZnO films can be deposited by a variety of techniques like spray pyrolysis, molecular beam epitaxy, thermal evaporation, RF magnetron sputtering, sol-gel and others [16]. It acts as a n-type semiconductor when deposited on top of p-Si. ZnO/Si heterojunction shows an excellent response in optical spectrum and relatively simple to fabricate.

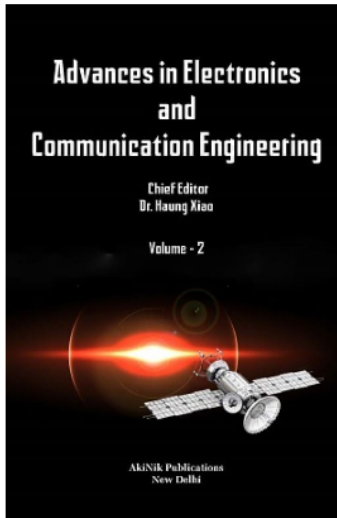
In the present work, we optimize the process of surface texturization to reduce reflections from the top surface of solar cell. We have also fabricated ZnO/Si heterojunction solar cells with textured and plane Si wafer. A thin film of

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**Semiconductor Materials in Electronic Devices**

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**Chapter - 3**

**Semiconductor Materials in Electronic Devices**

Dr. Neelakshi Niti Kachari Borah, Jyotsna Sharma and Dr. Siddhartha

**Abstract**

The three semiconductor materials used most frequently in the construction of electronic devices are Ge, Si and GaAs. The construction of every discrete solid-state electronic device or integrated circuits begins with a semiconductor material. Use of semiconductor has brought an incredible change in the design, operation and application techniques of the devices.

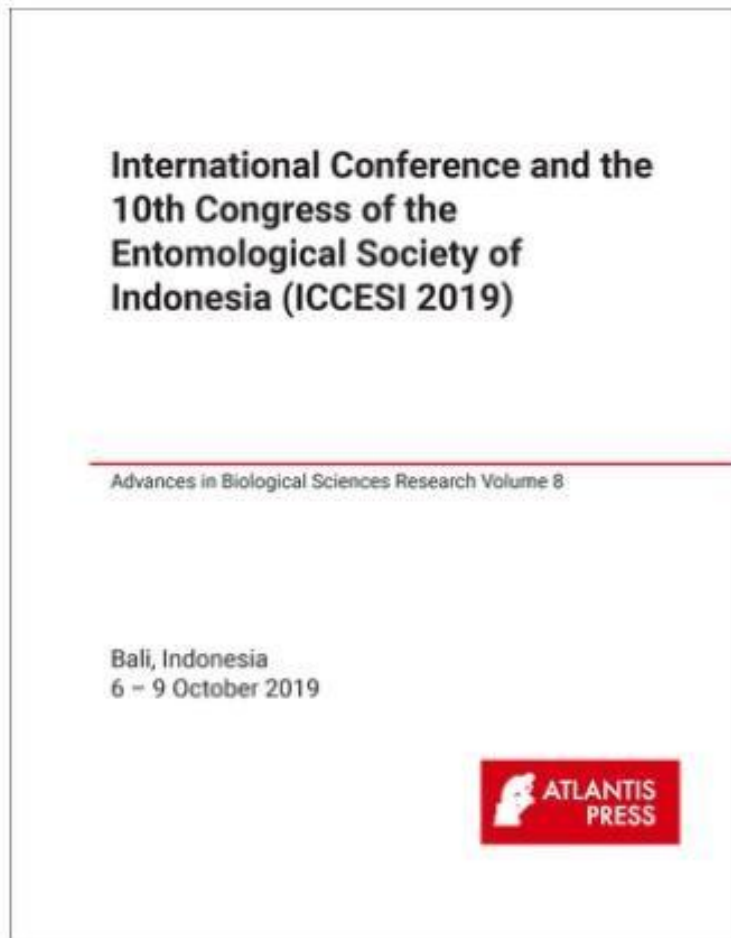
**Keyword:** semiconducting materials, semiconductor technology

**Introduction to semiconductor materials in electronic devices**

The history of electronic devices technology has taken a big leap after the discovery of semiconducting elements. The devices which control the flow of electrons are called electronic devices. These devices are the main building blocks of electronic circuits. Such devices have established wide applications because of their reliability, compactness and low cost. These are discrete components which are used in power devices, optical sensors, and light emitters, including solid-state lasers etc. Though the basic fundamental principles have changed very little over the time, the devices are now incredibly smaller, operation speeds are truly excellent and new gadgets are coming to the surface every alternate day. Altogether the discovery of semiconducting materials has brought major changes in the construction techniques, general characteristics and application techniques of the decade old electronic devices. It has lead us to the miniaturization era of these devices and the recent developments have left us wondering about its limits.

The study of semiconductor materials began in the early 19th century. Over the years, many semiconductor materials have been investigated. The electronic properties of the semiconductor materials have allowed us to easily manipulate their behaviour by the addition of impurities known as doping. The conductivity of a semiconductor is generally sensitive to temperature, illumination, magnetic fields and minute amounts of impurity atoms. Current conduction in a semiconductor occurs due to free electrons

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# 10th Congress of the Entomological Society of Indonesia (ICESI 2019)

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## Biochemical Characterization of Acetamiprid Resistance in Laboratory-Bred Population of *Aedes aegypti* L. Larvae

### Authors

Roopa Rani Samal, Kungreiliu Panmei, P Lanbiliu, Sarita Kumar

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Roopa Rani Samal

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### Keywords

*Aedes aegypti*, acetamiprid, esterases, glutathione-S-transferase, acetylcholinesterases

### Abstract

The constant rise in cases of Zika, Dengue and Chikungunya worldwide has made control of *Aedes aegypti* a principal concern. The most recommended plan to control mosquito-borne diseases primarily lies on vector management and disturbing their disease-transmission cycle. Wide-ranging use of different classes of organic insecticides for mosquito control has led to the development of high levels of resistance making them less operative at safe dosages imposing us to explore novel insecticides. Present study investigates the bio-efficacy of a neonicotinoid, acetamiprid on the *Ae. aegypti* larvae, development of resistance after subjecting acetamiprid selection pressure for 10 successive generations and biochemical characterization of the resistance developed. Acetamiprid exposure of the parent population of *Ae. aegypti* early fourth instars resulted in respective LC<sub>50</sub> and LC<sub>90</sub> values of 0.188 ppm and 1.315 ppm. Selection with acetamiprid for 10 successive generations (ACSF-10) reduced its efficacy by 20-fold. Involvement of four enzymes; alpha-esterases, beta-esterases, glutathione-S-transferases and acetylcholinesterases in development of acetamiprid resistance was investigated to uncover mode of action of acetamiprid. An elevation of 1.4-fold and 2.1-fold was observed in alpha-esterases and beta-esterases activity in ACSF-10 as compared to ACSF-5. However, activity of glutathione-S-transferases decreased in ACSF-5 which rose to 12-fold in ACSF-10. Similarly, the activity of acetylcholinesterases was found to be much higher in resistant generations as compared to the parental strains. The results indicated individual/synergistic contribution of different enzymes leading to acetamiprid detoxification. Further research is being conducted to identify the role of target site mutations in resistance development.

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## Lufenuron: A Potential Chitin Synthesis Inhibitor Against *Aedes aegypti* L.

### Authors

Kungreiliu Panmei, P Lanbiliu, Roopa Rani Samal, Sarita Kumar

### Corresponding Author

Kungreiliu Panmei

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### Keywords

*Aedes aegypti*, growth inhibition, intermediates, Lufenuron, hormone-mimetic

### Abstract

Chemical control of dengue vector, *Aedes aegypti* is impaired due to development of resistance to conventional insecticides. Insect Growth Regulators (IGRs) are considered more suitable and effective vector control agents as they specifically inhibit chitin biosynthesis, a process absent in vertebrates, and impose less adverse effects on beneficial insects and the environment. Present study investigates Lufenuron, a Chitin Synthesis Inhibitor (CSI), as a control agent of *Ae. aegypti*. Different instars of *Ae. aegypti* were exposed to a range of concentrations of Lufenuron as per WHO protocol. The investigations showed the effective hormone-mimetic effect of Lufenuron resulting in the formation of a significant number of larval-pupal and pupal-adult intermediates with the maximum number observed on exposure to L3 (L-P=17%, P-A=21%). Approximately 20% of L2 instars either could not moult and remained trapped inside the new exuviae or possessed bulged abdomen while some showed ruptured exoskeleton. The results showed increase in IE30 from L1 (0.00010 ppm) to L4 stage (0.00013 ppm); the L2 stage exhibiting maximum IE30 (0.00025 ppm). The median emergence suppression (IE50) doses of the Lufenuron were found to be 0.00057 ppm for L1, 0.00047 ppm for L2, 0.00050 ppm for L3 and 0.00096 ppm for L4. The results also revealed increased duration of larval development and inability of pupae to develop into adults, as compared to the controls. The investigations indicate the potential use of Lufenuron as the control agent of *Ae. aegypti*. Further research is being conducted to understand its mode of action to develop effective control strategies.

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# Assessment of Toxicity and Growth Regulatory Effects of Beta-Cyfluthrin Against Red Cotton Bug, *Dysdercus koenigii* (Fabr.) (Hemiptera: Pyrrhocoridae): An Emerging Cotton Pest

P Lanbilu<sup>1\*</sup>, Roopa Rani Samal<sup>1</sup>, Kungreiliu Panmei<sup>1</sup>, Sarita Kumar<sup>1</sup>

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## ABSTRACT

Red Cotton Bug, *Dysdercus koenigii* (Fabr.) (Hemiptera:Pyrrhocoridae), commonly called cotton stainer, is a damaging pest of cotton and other economical crops in Asia. Nymphs as well as adult of this pest suck the sap from the green bolls and leaves of cotton causing shedding of young bolls, rotting of green bolls, stained cotton fibers and loss of seed viability. The present study evaluates the toxic and growth regulatory effects of a pyrethroid, beta-cyfluthrin against *D. koenigii*. The newly emerged fifth instars nymphs were exposed to beta-cyfluthrin at concentration ranging from 0.00008% to 0.00128%. A volume of 1µL of beta-cyfluthrin was topically applied on the dorsal anterior thoracic region of nymphs (in 3 replicates, each replicate containing batch of 25 insects) and were observed for mortality after 24 hr. The nymphs were further reared till adults to observe delayed toxicity effects and developmental abnormalities, if any. The result revealed significant lethal effects of beta-cyfluthrin on *D. koenigii* nymphs with LD<sub>50</sub> and LD<sub>70</sub> values as 0.00051% and 0.00076%, respectively. A positive correlation was observed between percent nymphal mortality of *D. koenigii* and the dose of insecticide. The survived nymphal instars developed several development malformations; partial moulting, shrunk abdomen, abnormal adults with deformed wing, adultoids and adults with attached exuviae. Further studies are being conducted to assess the development of beta-cyfluthrin resistance in *D. koenigii* and strategies to counter resistance. These results can provide an important base for developing effective and desired strategies to control and monitor insecticides resistance in *D. koenigii*.

**Keywords:** *Dysdercus koenigii*, mortality, beta-cyfluthrin, adultoids, developmental abnormalities

## 1. INTRODUCTION

Cotton is one of the major fibres and cash crops grown not only in India but also throughout the world. It plays an important role in the economic growth of industries and agriculture sector of the country. India with approximately 12 million hectares land under cotton production is one of the largest producers of cotton in the world [1] which accounts for 27% of the world cotton production. Around 10 million farmers are engaged in the production of cotton; while about 30 million individuals are employed in cotton industry, its processing and final production [2]. However, the cotton cultivation faces severe pest attacked resulting in low production and major losses. Although worldwide, 1326 species of insect pests have been reported on this crop, it is known to be susceptible to about 162 species [3]. Among these pests leading to the low cotton produce, the enormous attack of sucking insect pests plays the significant role [4]. In addition, the large-scale introduction of *Bt*-transgenic cotton to reduce the usage of insecticides against other cotton pests; *Helicoverpa armigera*, *Earias*

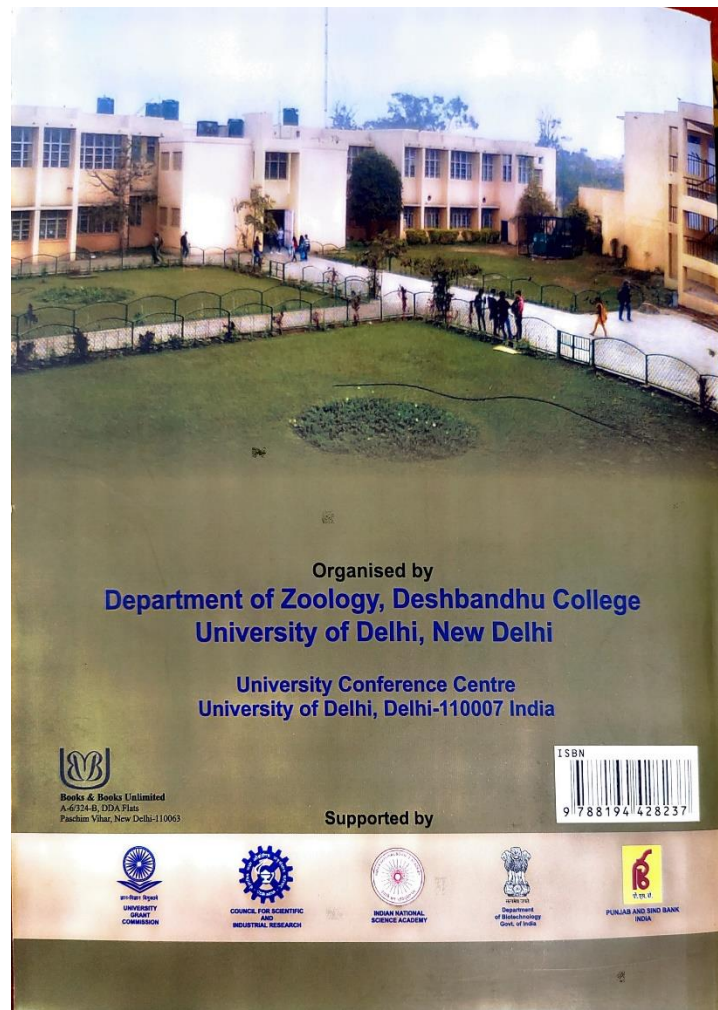
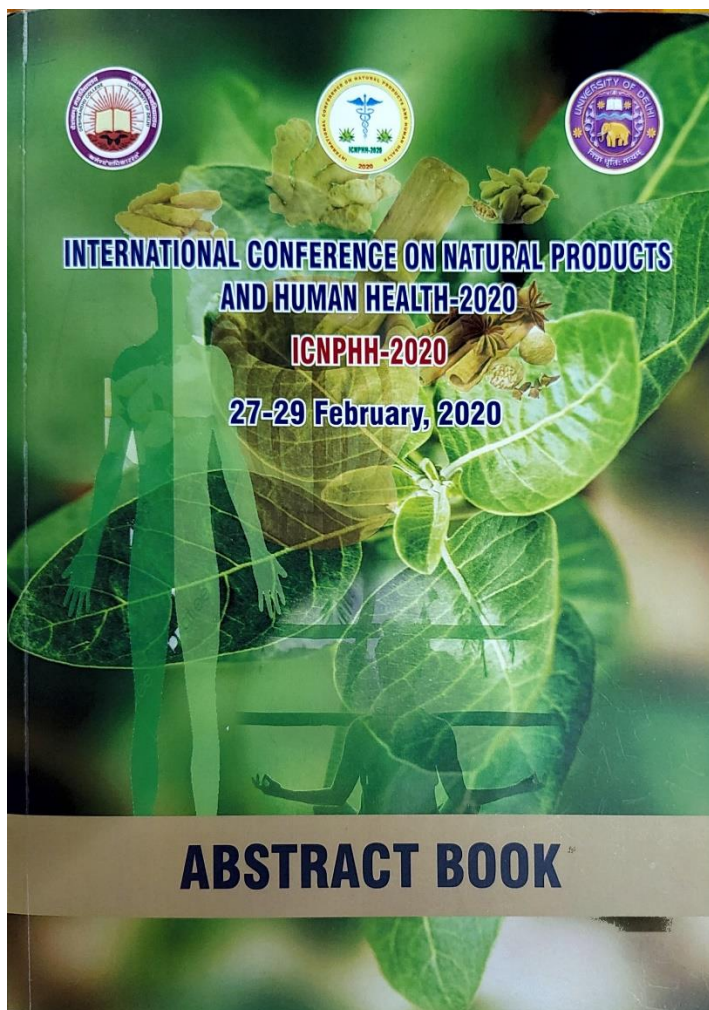
*sp.*, and *Pectinophora gossypiella* [5]; has led to the emergence of sucking pest; *Dysdercus koenigii* [6].

*D. koenigii* is one of the most notorious bugs of cotton. Also known as red cotton stainer, it belongs to order Hemiptera, family Pyrrhocoridae, and is a disastrous cotton pest in several parts of Asia [7, 8]. Both nymph and adults feed on developing cotton bolls and seeds within them resulting in diminished oil quantity and viability of the seeds [9]. Furthermore, adult excreta stain the cotton yellow that adversely affects the colour of cotton lint. The infested cotton bolls become prone to fungal and bacterial infections, which make their way into the bolls through the punctures made by insects while feeding [10]. The rapid multiplication of the pest in the fields due to short life cycle in comparison to lepidopteran pests aggravates its seriousness [11].

Currently, chemical insecticides are the key tools to manage insect pests in almost all cropping systems around the world [12]. Thus, like other pests, *D. koenigii* has also been controlled by using various chemical globally. Since last few decades, pyrethroids, an important group of

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**Keywords:** Larvicides, GC-MS, *An. culicoides*

VBD0018

**Knockdown and irritability response to deltamethrin in the susceptible and deltamethrin-resistant adults of *Culex quinquefasciatus***

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**Introduction:** Pyrethroids are the most widely used insecticides against mosquitoes because of their toxic properties, rapid action and safety to humans and non-target organisms. However, extensive usage of pyrethroids as residual domestic sprays, and active ingredient in mosquito mats, coils and bed nets, etc. mosquitoes are developing resistance against it. Today, pyrethroid resistance is envisioned to be a major problem for the vector control program since, at present there are no suitable chemical substitutes for pyrethroids.

**Aim and Objectives:** To assess speed of resistance development to deltamethrin in *Culex quinquefasciatus*; and assess the impact of deltamethrin resistance on the behavioural responses of adults.

**Methods:** The parent susceptible adults of *Cx. quinquefasciatus* (PS) were selected with 0.05% deltamethrin (diagnostic dosage) for 40 successive generations (DAS<sub>40</sub>). Knockdown and irritability tests were carried on freshly blood-fed 3day old adult females of PS as well as DAS<sub>40</sub> strain using 0.05% deltamethrin-impregnated papers. Parallel negative control tests were run with siliconoil-impregnated papers and positive control tests were conducted with 4% DDT-impregnated papers. The effect of deltamethrin resistance was estimated on the knockdown response and the irritability behaviour of adults by computing KT<sub>50</sub>, knockdown resistance, relative irritability and irritability ratio.

**Results:** Forty generations of selections with deltamethrin resulted in 6.1-fold deltamethrin resistance in *Cx. quinquefasciatus* adults. The adults of DAS<sub>40</sub> strain developed just 0.8-fold cross-resistance to DDT despite of similar mode of action. The knockdown studies resulted in KT<sub>50</sub> of 22.7 min in PS adults with no signs of recovery even after 24 h, whereas DAS strains showed 2.5-fold knockdown resistance (KDR). Knockdown response of *Cx. quinquefasciatus* to 4% DDT was 3 times slower than that to deltamethrin. Both the PS and DAS strains exhibit significant irritability response towards deltamethrin, though DAS strain was more irritant to deltamethrin as well as DDT as compared with PS strain.

**Conclusions:** Results suggest that deltamethrin can be used as a promising adulticide against *Cx. quinquefasciatus*, as adults are unable to develop significant resistance to deltamethrin. A strong irritability and knockdown response, and insignificant knockdown resistance towards deltamethrin even after 40 generations of deltamethrin selection also indicate the potential use of deltamethrin in fields.

**Keywords:** *Culex quinquefasciatus*, Deltamethrin, DDT, Knockdown, Irritability, Resistance

**Bio-efficacy of *Achyranthes aspera*-derived silver nanocomposites against early fourth instars of *Aedes aegypti* L.**

**Sharma A.<sup>1</sup>, Kumar, S.<sup>2</sup> and Tripathi, P.<sup>1</sup>**

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**Introduction:** *Aedes aegypti* (*Ae. aegypti*)-borne diseases, such as dengue, Chikungunya and Zika, are on the rise at the global level since the past few years. Present study attempts to design an eco-friendly approach; alternative to chemical insecticides; for control of dengue vector.

**Aim and Objectives:** To formulate silver nanocomposites (AgNCs) from the leaf extract of *Achyranthes aspera* and estimate their efficacy against *Ae. aegypti* larvae and non-target organisms.

**Methods:** The aqueous leaf extract of *A. aspera* was assayed against *Ae. Aegypti* larvae, alone or in combination with silver nitrate added in different concentrations (1mM- 5mM). Bioassays were carried out at different time intervals; 24h, 48h and 72h. Bioreduction of AgNCs was characterized by UV-Vis spectroscopy, Dynamic light scattering (DLS), Scanning Electron Microscopy (SEM), Energy dispersive X-ray (EDX) spectroscopy, Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD) and Fourier Transform Infrared Spectroscopy (FTIR).

**Results:** The aqueous extract of *A. aspera* leaves (AALE) demonstrated insignificant larvicidal effects. However, the synergism of extract with silver nitrate in form of AgNCs increased the larvicidal effects significantly displaying LC<sub>50</sub> values of 37.570, 6.262 and 1.041 µg/mL; 5.819, 1.412 and 0.489 µg/mL; and 5.519, 1.302 and 0.267 µg/mL after 24, 48 and 72 h of exposure. Biophysical characterization of the synthesized AgNCs confirmed the uniform distribution of spherical nanocomposites with an average size ranging from 1-25 nm. The XRD analysis established their crystalline and face-centred-cubic structure, the EDX pattern showed the presence of Ag, O and C in their order of weight%, while the FTIR displayed the intricacy of silver nanocomposites. The NCs were also found non-toxic to non-target organisms; *Gambusia affinis*, *Daphniamagna* and *Moinamacrocopa*; indicating their safe use in fields.

**Conclusion:** The synthesized AgNCs from *A. aspera* were highly potent against *Ae. Aegypti* larvae in comparison to the extract alone suggesting the probable synergism for toxicity or more efficient delivery of toxicants. These NCs can be potential, cheap and promising bioresource against dengue vector larvae.

**Keywords:** *Aedes aegypti*, EDX, FTIR, Larvicidal, SEM, Silver nanocomposites (AgNCs), TEM, XRD

**Effect of emamectin benzoate-induced dietary stress on the nutritional performance of American bollworm,  
*Helicoverpa armigera***

**Dagar VS**, Mishra M, Kumar S

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**Aim and Objectives:** *Helicoverpa armigera*, an agricultural pest, is known to attack a wide variety of crops across the globe. As overuse of conventional insecticides has led to the development of insecticide resistance in *H. armigera* leading to more severe attacks on crops and loss of yield; researchers have diverted their interest to explore alternatives as control agents. Present study evaluated the effects of emamectin benzoate (EMB) on the survival, growth and nutritive fitness of *Helicoverpa armigera*.

**Methods:** The systemic toxicity and feeding (Choice and No Choice) assays were carried out against starved (4h) early fourth instars of *H. armigera*. The experimental diet was provided to the larvae for 24 h and mortality was scored to assess the systemic toxicity of EMB. The consumption of the diet was measured by recording the diet remaining after 24 h of feeding. Various nutritional parameters, such as gain in larval weight, dried frass, etc. were measured to estimate the nutritional indices.

**Results:** Emamectin benzoate-induced dietary stress caused a significant systemic toxicity in *H. armigera* larvae resulting in  $LC_{50}$  and  $LC_{90}$  values of 0.092  $\mu\text{g/mL}$  and 0.156  $\mu\text{g/mL}$ , respectively. Dietary 0.1  $\mu\text{g/mL}$ -1.6  $\mu\text{g/mL}$  EMB deterred larval feeding significantly with 10-100% larval mortality at 0.05  $\mu\text{g/mL}$ -0.2  $\mu\text{g/mL}$  EMB. Nutritive performance assessment with dietary 0.05  $\mu\text{g/mL}$ -0.01  $\mu\text{g/mL}$  EMB also revealed a pronounced post-ingestive toxicity impairing ingestion as well as digestion. The larvae displayed reduced Relative Growth Rate (RGR) and Relative Consumption Rate (RCR) in the range of 0.385-0.978 and 1.653-3.985, respectively, which may also be attributed to incompetence in food utilization and assimilation, as evident by 10-24% and 02-52% diminished Efficiency of Conversion of Ingested Food (ECI) and Efficiency of Conversion of Digested Food (ECD); and 09-63% diminished Approximate Digestibility (AD).

**Conclusion:** These results advocate the effective utilization of Emamectin benzoate in Integrated pest management program of *H. armigera*. Sub-lethal doses of dietary EMB impaired gut biochemical machinery of *H. armigera* larvae impacting their nutritive fitness and thus, growth and development. Additional investigations are being conducted to comprehend the specific mode of action of EMB causing biochemical and genomic-altering effects in *H. armigera*.

**Keywords:** *Helicoverpa armigera*, Emamectin Benzoate, Growth-inhibitory, Nutritive Performance, Post-ingestive toxicity

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A. A. Mohamed Hatha  
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Editors



# A Closer Look at Actinomycetes

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# A Closer Look at Actinomycetes

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A. A. Mohamed Hatha (Editor)

Professor, Fulbright Scholar, Dept. of Marine Biology, Microbiology & Biochemistry, School of Marine Sciences, Cochin University of Science and Technology, Cochin, Kerala, India

P. Lakshmanaperumalsamy (Editor)

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Actinomycetes are a versatile group of Gram positive bacteria widely distributed in the terrestrial and aquatic environments. The specialty of the actinomycetes is that they have a mycelial appearance unlike most bacteria. This group of bacteria is well known for their ability to produce a range of bioactive molecules, including antibiotics and various kinds of enzymes. As they are known for their ability to produce various antibiotics, the actinomycetes are widely explored by various research groups in search of novel drug molecules. Since the cultivation and maintenance of actinobacteria are not that easy as in the case of other bacteria, they are rather underexplored.

With the frequent emergence of multidrug resistant bacteria, which are outpacing the discovery of new antibiotics, there is a renewed interest in actinomycetes from special habitats such as extreme habitats in the marine environment, salt pans, geothermal springs, permanently frozen polar environments etc. Endophytic actinomycetes are also attracting the attention of current researchers in this field. This book titled "A Closer Look at Actinomycetes" is a compilation of articles which deals with interesting topics such as "actinomycetes as microbial drug factories", endophytic fungi from special habitats of Pakistan as well as strategies for exploration of actinomycetes diversity and the taxonomy of actinomycetes should be of great interest to those who are interested in Actinomycetes research. People with interest in general microbiology will also find it an interesting read.  
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Chapter 7

**METABOLIC PROFILING OF *STREPTOMYCES*  
SP. STRAIN 51 FOR DETECTION  
OF BIOACTIVE COMPOUNDS**

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**ABSTRACT**

Actinomycetes are Gram- positive bacteria having high GC content in their genome. They are crucial from industrial perspective as they have great ability for production of bioactive secondary metabolites. Compounds produced by them possess diverse biological activities such as

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Chapter

## Chapter 7: Metabolic profiling of *Streptomyces* sp. strain 51 for detection of bioactive compounds

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### Abstract

Actinomycetes are Gram-positive bacteria having high GC content in their genome. They are crucial from industrial perspective as they have great ability for production of bioactive secondary metabolites. Compounds produced by them possess diverse biological activities such as anticancer, antifungal, antibacterial, antiviral and belong to distinct chemical classes. Members of genus *Streptomyces* are well known producers of bioactive compounds. Due to emergence of drug resistant pathogens, there is a dire need for the discovery of new compounds having unique modes of action. During isolation and screening programme of actinomycetes carried out in our laboratory, a biologically active strain was isolated from agricultural soil, Dhanaura, Uttar Pradesh, India and designated as Strain 51. Morphological and biochemical studies revealed that Strain 51 belongs to genus *Streptomyces* and it showed 100% 16S rRNA gene sequence homology with *Streptomyces griseochromogenes*. Present investigation was undertaken as an effort to extract and characterize potent compounds from Strain 51 which are responsible for higher bioactivity. Extraction of bioactive metabolites was performed using cold extraction method taking ethyl acetate as solvent. Minimum inhibitory concentration (MIC) of compounds against *Bacillus cereus* was determined by microdilution method taking industrial antibiotic- chloramphenicol as positive control. Crude extract of Strain 51 showed inhibition of *Bacillus cereus* growth at 0.0050 mg/ml while chloramphenicol suppressed growth at 0.0075 mg/ml. Metabolomic studies were carried out for identification and structural elucidation of bioactive molecules using gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS/MS) techniques. GC-MS analysis of strain 51 extract showed the presence of thirty three volatile organic constituents, out of which some are reported in literature to have diverse biological activities. Extract of Strain 51 was also subjected to LC-MS analysis which gave several sharp peaks in the spectrum. Metabolites identified in LC-MS data showed molecular ion peaks at *m/z* 228, 758, 548, 784 and 803. The structure was elucidated and confirmed for each peak through their mass fragmentation patterns; as a result structure of compounds were confirmed as thiolutin, streptothricin D, antimycin A, rifaximin and fujimycin. PCR was performed for detection of biosynthetic gene clusters responsible for production of bioactive compounds in Strain 51. Amplification of polyketide synthase-I (PKS-I) and non-ribosomal peptide synthetases (NRPS) was observed, the amplicons were purified and sequenced. The gene sequences were submitted in NCBI-GenBank database under accession numbers MK355718 and MK355717. In future studies, our aim is to produce a novel compound by introducing genetic manipulations in these genes.

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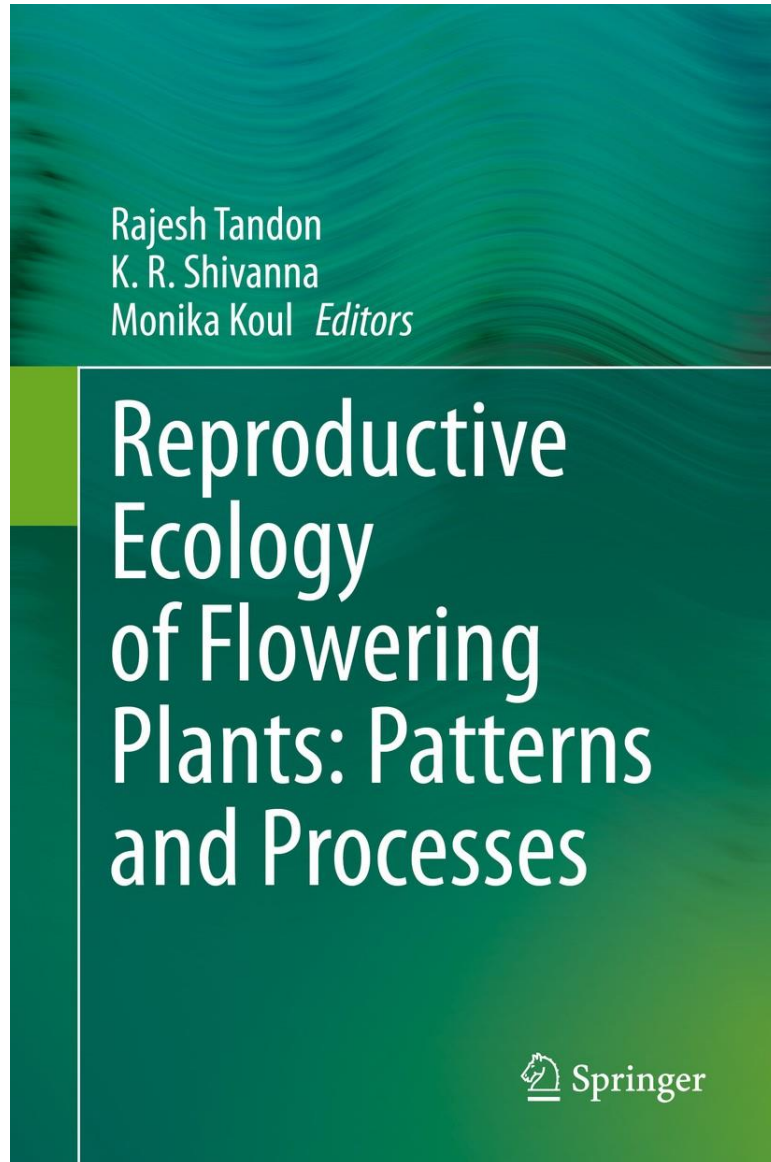
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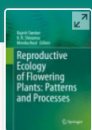
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### Abstract

Evolution of dioecy among plants is a distinct phenomenon, debated extensively among biologists. It has now been realized that besides the underlying gender determination mechanisms, it is equally important to understand the contextual framework of eco-evolutionary forces that are instrumental in shaping dioecy in general. The theoretical framework of evolution of dioecy is well-argued in literature. Several empirical studies have indicated ecological factors like habitat, floral features, wind pollination, and clonality to be advantageous for establishing dioecy. Further, resource partitioning among genders is known to modulate the sex ratios, which is crucial for its evolutionary maintenance. How these factors influence evolutionary pathways and evolution of dioecy, has not been sufficiently investigated. Available phylogenetic analyses indicate that the factors are interlinked, and that they serve as usual correlates of dioecy. Although, such associations are not clearly elucidated in literature due to paucity of information about the prevailing sexual systems, further obscured by low species richness in existing dioecious clades. In this chapter, we present a conspectus of present understanding of ecological correlates of evolution and maintenance of dioecy, especially among the flowering plants. The information which has emerged so far indicates the involvement of multivariable eco-evolutionary suites. However, in order to appropriately characterize them, there is need to extend empirical studies on the complete range of sexual variation.

### Keywords

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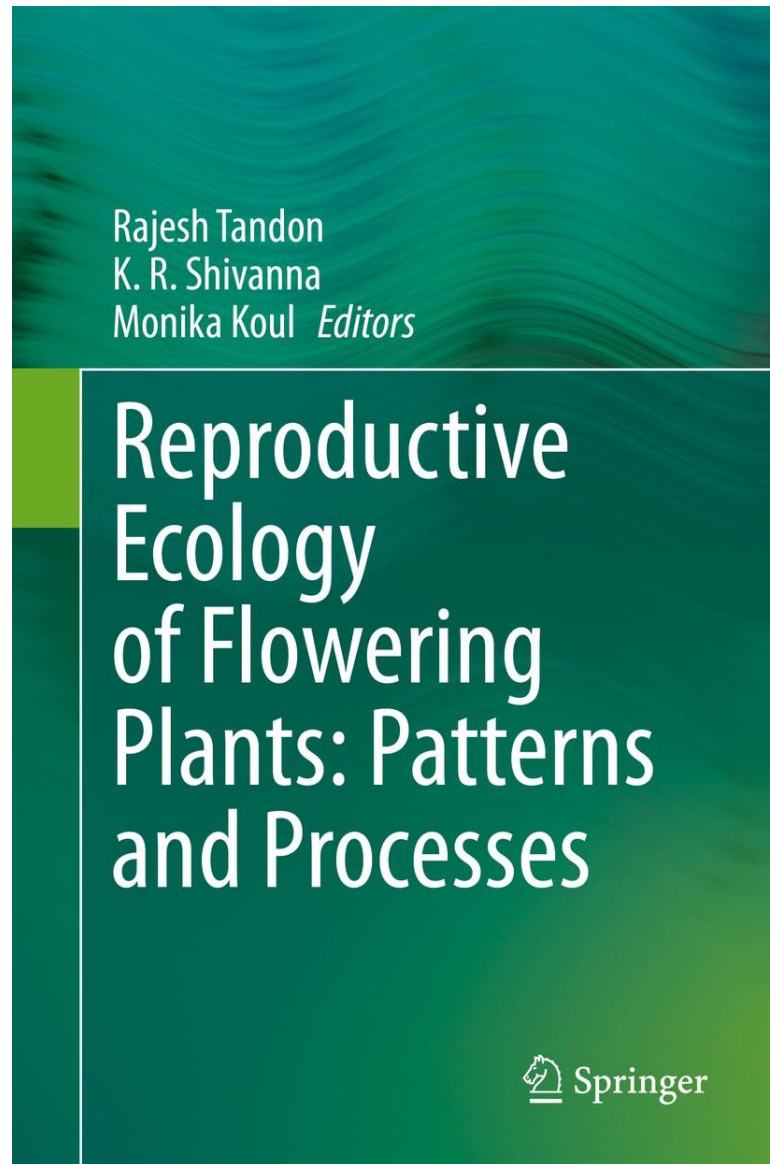
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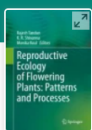
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## Secondary Pollen Presentation in Flowering Plants

Chandan Barman, Vineet Kumar Singh & Mrinalini Kakkar

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### Abstract

Successful pollen transfer among the compatible conspecifics is an essential attribute of sexual reproduction among flowering plants. The plants maximize their male fitness by improving the efficiency of pollen dispersal to as many conspecifics as possible. The precision with which pollen is carried by biotic vectors is also influenced by the manner in which the pollen is presented by the flowers. The method of presenting the pollen to the vectors can be either from the anthers directly (primary presentation) or that from the other floral organs (secondary presentation). The significance of these methods mainly lies in the targeted deposition of pollen for successful mating. Here, we focus on the structural and mechanistic diversity of secondary pollen presentation among angiosperms. The knowledge of these floral attributes is important to understand the intricacy of reproductive mechanisms that are integral to the selection for establishing successful plant-pollinator interaction and maximizing plant fitness.

### Keywords

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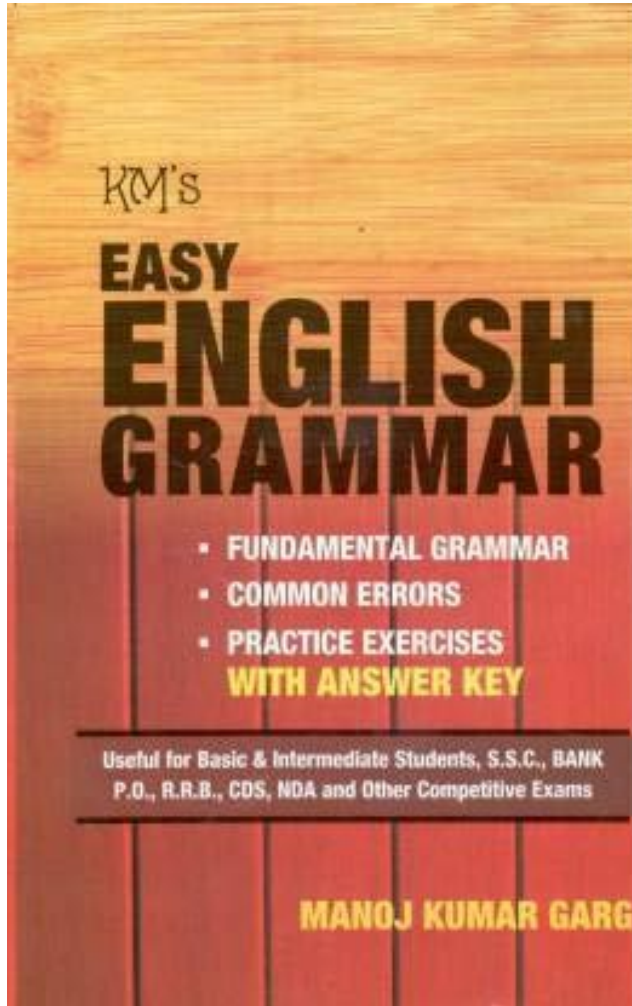
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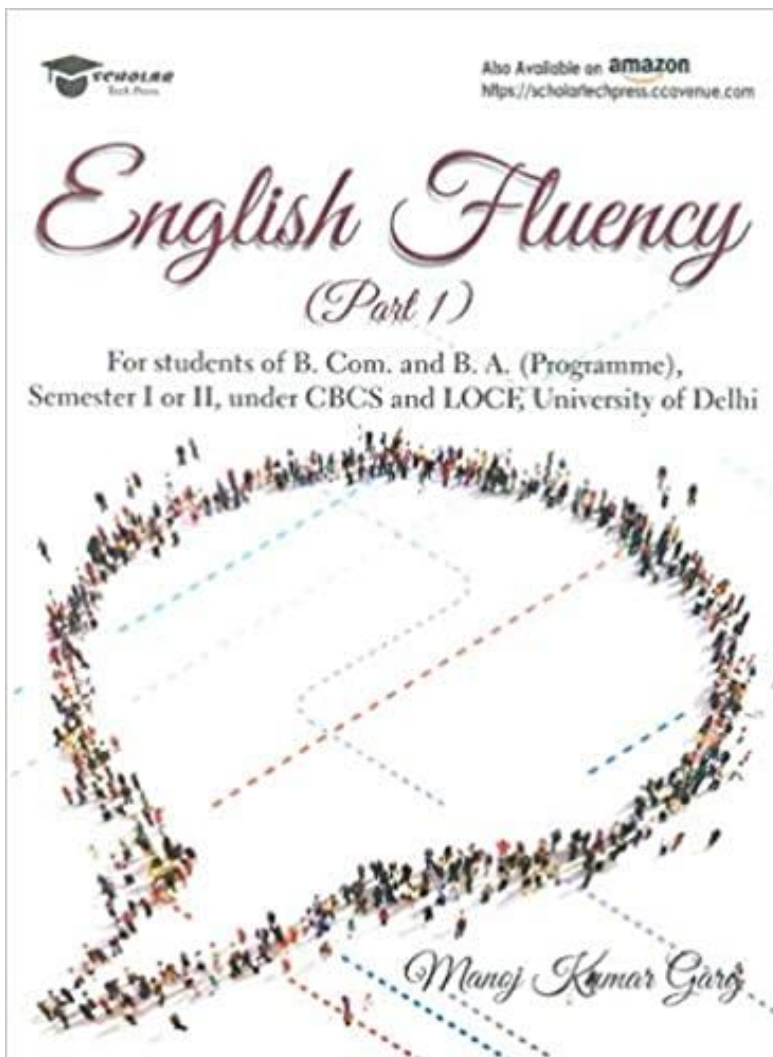
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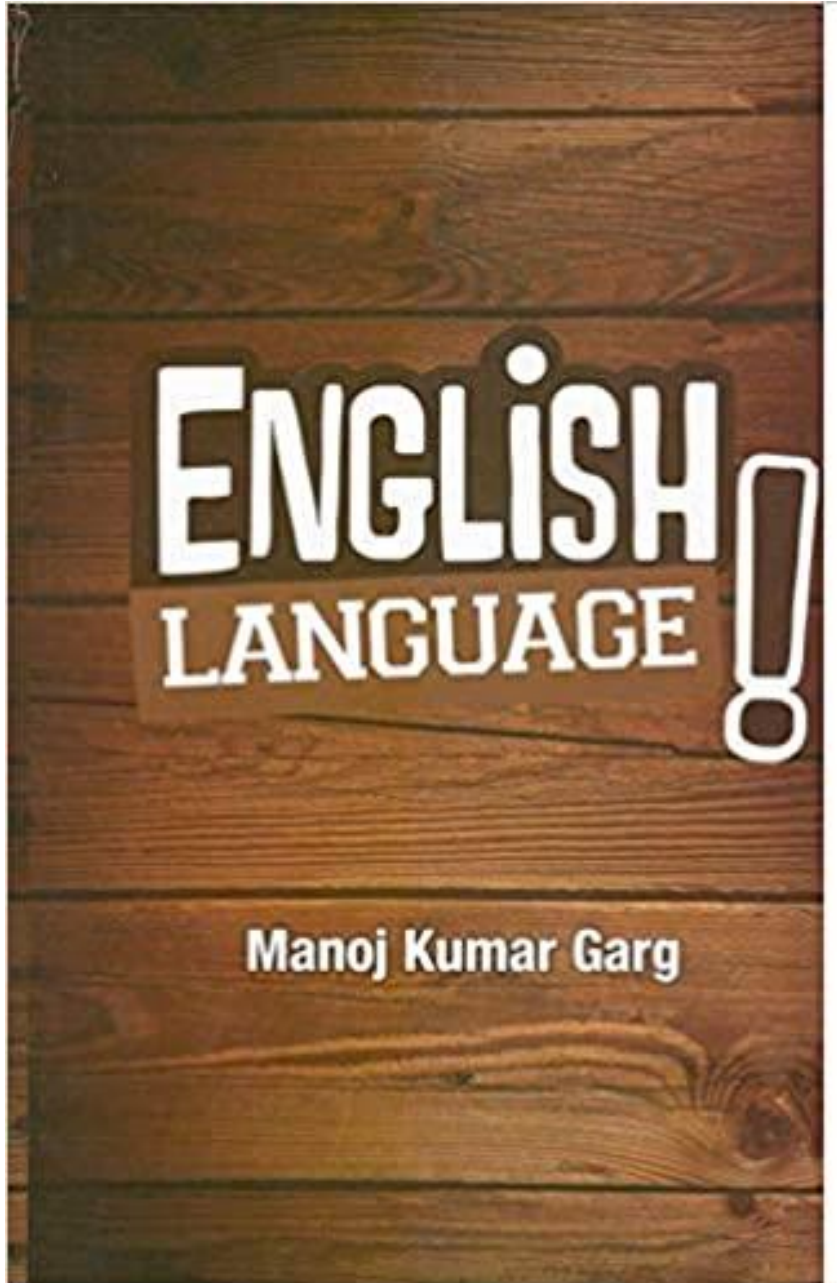
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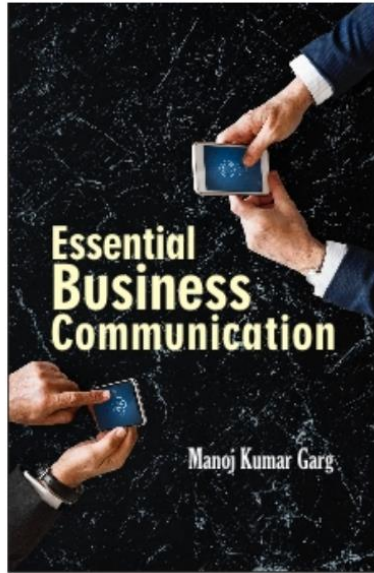
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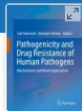
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### Abstract

Nanobiotechnology is the bridge between biology and chemistry interface, with disparate biomedical as well as microbiological applications. Nanomaterials, nanoconjugates and nanowires have extensively been used for the detection of diverse pathological conditions as well as in the chemotherapy of the diagnosed disorders. Targeted drug and gene delivery has been shown to produce encouraging results. In current scenario, nosocomial infections have been affecting developing countries with a high frequency. Eradication of these infections may be achieved by introduction of novel nanodrugs effective for longer duration of time as well as with fewer side effects. Some peculiar properties of nanostructures such as cost-effectiveness, biocompatibility, mammalian cell compatibility and less toxicity to the environment make these nanoparticles as major candidates for various therapeutic purposes. In agriculture too, nanoparticles synthesized from marine sources or several bacteria, fungi, algae, actinomycetes and biofungicides have been shown to possess the potential to prevent the crops from pests. Nanobiotechnology provides a platform for designing and developing nanomaterials with promising effects that can be delivered at specific target sites. Combining nanoscience with biotechnology provides a broad term for exploring the design and synthesis of novel molecules which can further be inculcated in various studies. At present, microbial infections are playing a major havoc due to improper use of antibiotics in hospitals, improper use of pesticides in fields, poor sanitation as well as lack of awareness among population. In this chapter, we mainly focus on the areas affected by nanobiotechnology, such as how microbial population can be affected, current trends in microbial infection inflation rate, various nanomaterials used to combat microbial infections as well as their future aspects.

### Keywords


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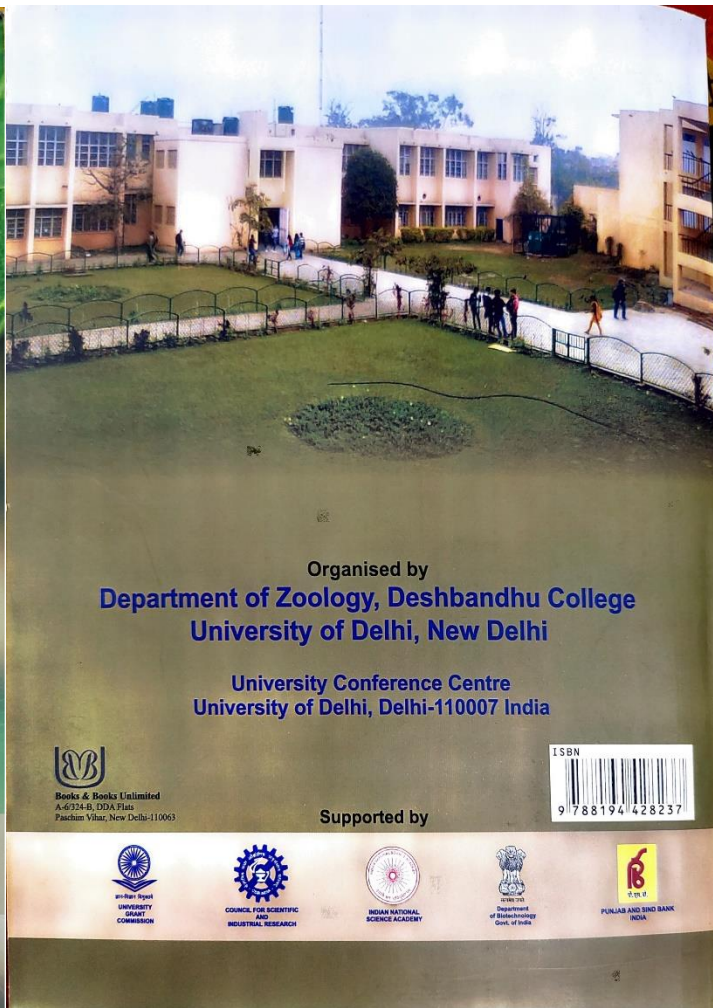
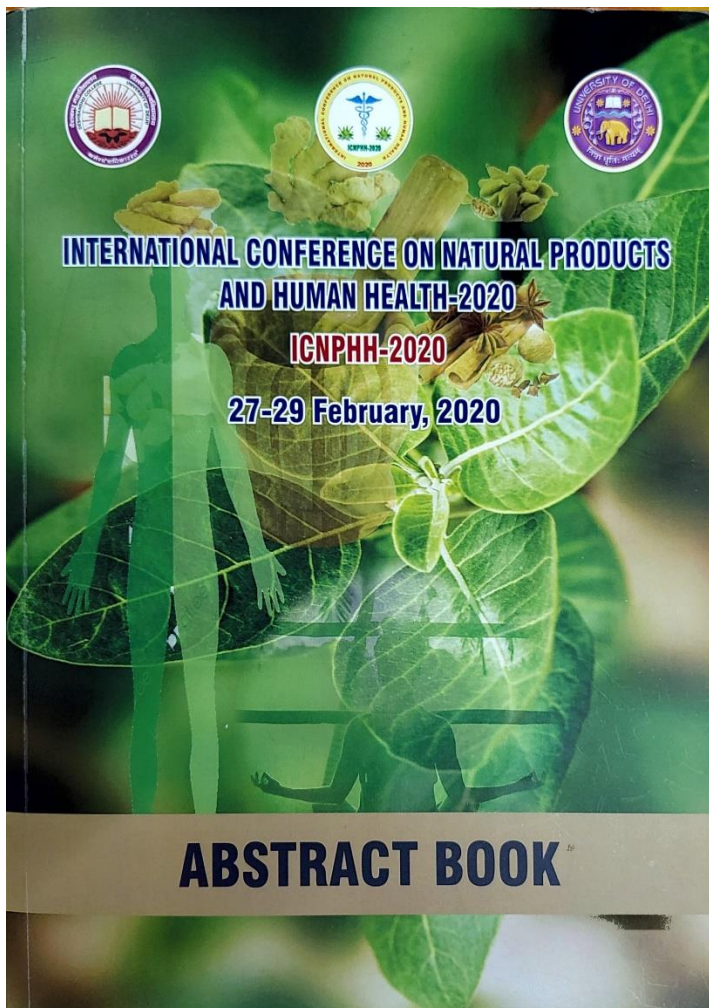
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# Acetamiprid resistance in *Aedes aegypti*: Evaluation of metabolic detoxification and target site mutations as defense mechanisms

**Kumar S, Samal RR**

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**Introduction:** Mosquito-borne diseases are a major public health problem in the tropical and subtropical regions of the world; especially in the developing as well as resource-poor countries. Mosquito vectors, *Aedes*, *Culex* and *Anopheles* are responsible for transmitting a range of disease pathogens causing dengue, Chikungunya, malaria, filariasis and Zika, etc. Global preponderance of these cases has increased the need of mosquito management at a large scale. Till today, the most endorsed strategy to tackle and control mosquito-borne diseases principally lies on interrupting the disease transmission cycle. Majority of the control programs are reliant on chemical insecticide-based interventions. Use of these insecticides and those with similar or different modes of action has increased the problem of environmental pollution and bioaccumulation of insecticides undermining their effectiveness. In addition, prowess of development of resistance amongst mosquitoes has risen sharply over the last decade and the relationship between current indicators of resistance and the impact of vector control interventions is still uncertain due to the diverse mechanisms of resistance. Consequently, novel and safe strategies employing natural products are necessitated for mosquito control.

**Aim:** Present study explores the bio-efficacy of acetamiprid, a neonicotinoid, against *Aedes aegypti* larvae and development of larval resistance after subjecting to acetamiprid selection pressure for 10 successive generations. The variations in the levels of three metabolic detoxifying enzymes - Non-Specific esterases, Glutathione-S-transferases and acetylcholine esterases and insensitivity in target protein were determined in the resistant population.

**Results:** Exposure of the susceptible population (PS) of *Ae. aegypti* early fourth instars to acetamiprid resulted in LC<sub>50</sub> and LC<sub>90</sub> values of 0.18799 ppm and 1.31547 ppm, respectively. Acetamiprid selection with 10 successive generations (ACSF-10), however, reduced its efficacy by 19.7-fold. The activity of alpha-esterases and beta-esterases elevated by 1.12-fold and 1.38-fold in ACSF-10 as compared to the PS. In addition, a rise of 1.5-fold was observed in the activity of glutathione-s-transferases in ACSF-10 as compared to PS exhibiting an increase in activity by 0.91 nanomoles/min/mL. Similarly, the activity of acetylcholine esterases was found to be higher in resistant generations as compared to the parental strains. The resistance resulting from insensitive acetylcholinesterase was also indicated by point mutations in ace-1 gene, at V456C codon (Tyrosine to Cysteine) and at R495M (Arginine to Methionine).

**Conclusion:** The results indicate that larvae of *Ae. aegypti* were highly susceptible to acetamiprid, though, they developed 19.7-fold resistance after subjection to selection pressure for 10 generations. Individual/synergistic contribution of different enzymes leading to acetamiprid detoxification in *Ae. aegypti* was observed. Mutations in ace-1 gene leading to insensitivity in the target protein further added to the development of acetamiprid resistance. The rotational use of toxicants with different modes of action and use of synergists, etc. are recommended for mosquito management in fields.

**Keywords:** *Aedes aegypti*, Acetamiprid, Acetylcholine esterases, Ace-1, Esterases, Glutathione-s-transferase, Mutation, Resistance

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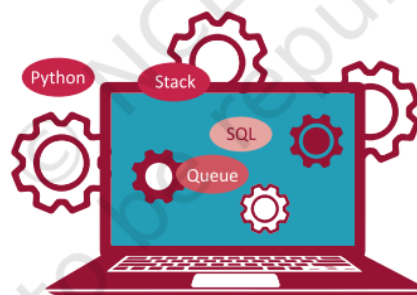
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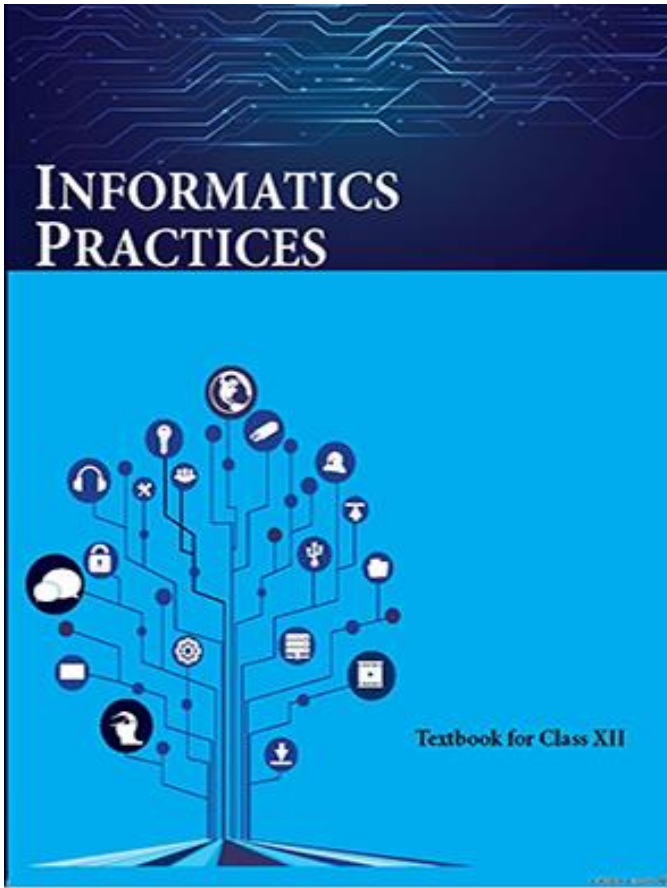
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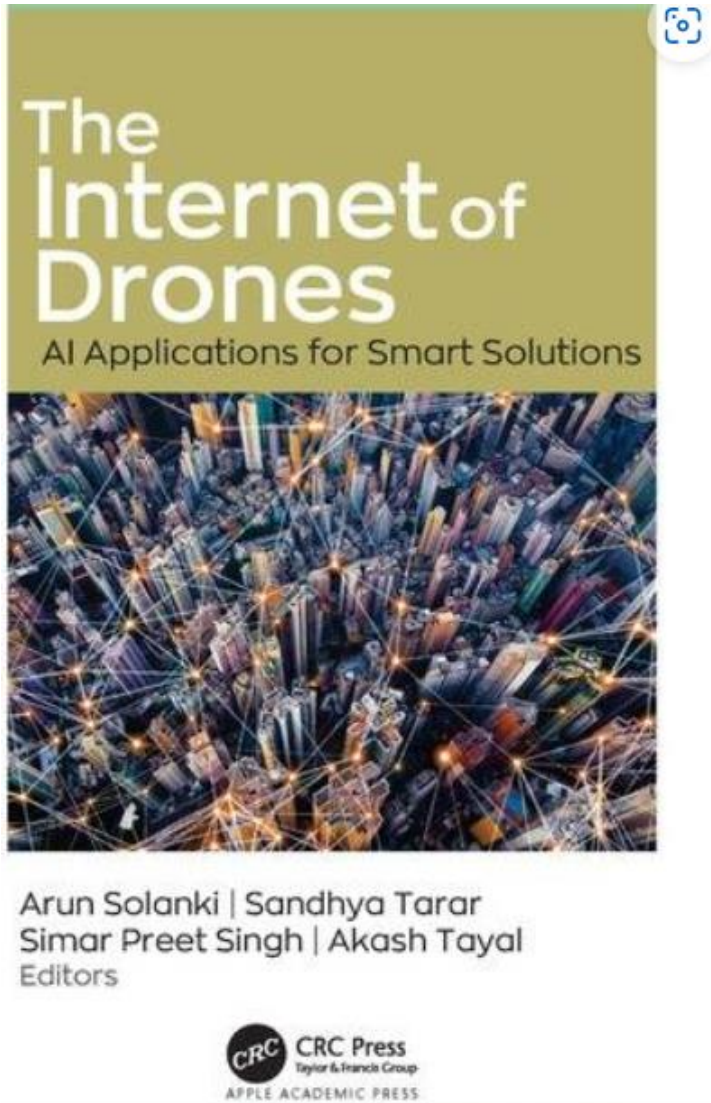
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## Programmable Joint Computing Filter for Low-Power and High-Performance Applications

Abhineet Bawa<sup>1</sup>, Rama Kanta Choudhury<sup>1</sup>,  
Chandra Kanta Samal<sup>2</sup>, and Navneet Yadav<sup>1</sup>

<sup>1</sup> MAIT, GGSIPU, Delhi, India  
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**Abstract.** A high-performance programmable joint computing for low power and high-performance filter (PJA) is presented in this paper. It emphasizes on low power and high efficiency, which is reliable for filter operation. The architecture is designed based on CSHM which can be implemented effectively in vector-scalar products at the circuit level. The products of the pre-multiplier are shared with all A&As, which assist significantly in the performance of the system. A programmable digital 10-tap PJA filter, which accepts the input signal and values of coefficients of up to 17 bits (signed), is designed using VHDL and implemented on the Xilinx Spartan-7 XC7S100FPGA676FPGA. It contains a total of 64000 LUT (Look-Up Table) elements and is based on 28 nm HKMG (High K metal Gate) transistor. The implementation was done using Xilinx Vivado 2019.2, and the power is measured using Xilinx Power Analyzer.

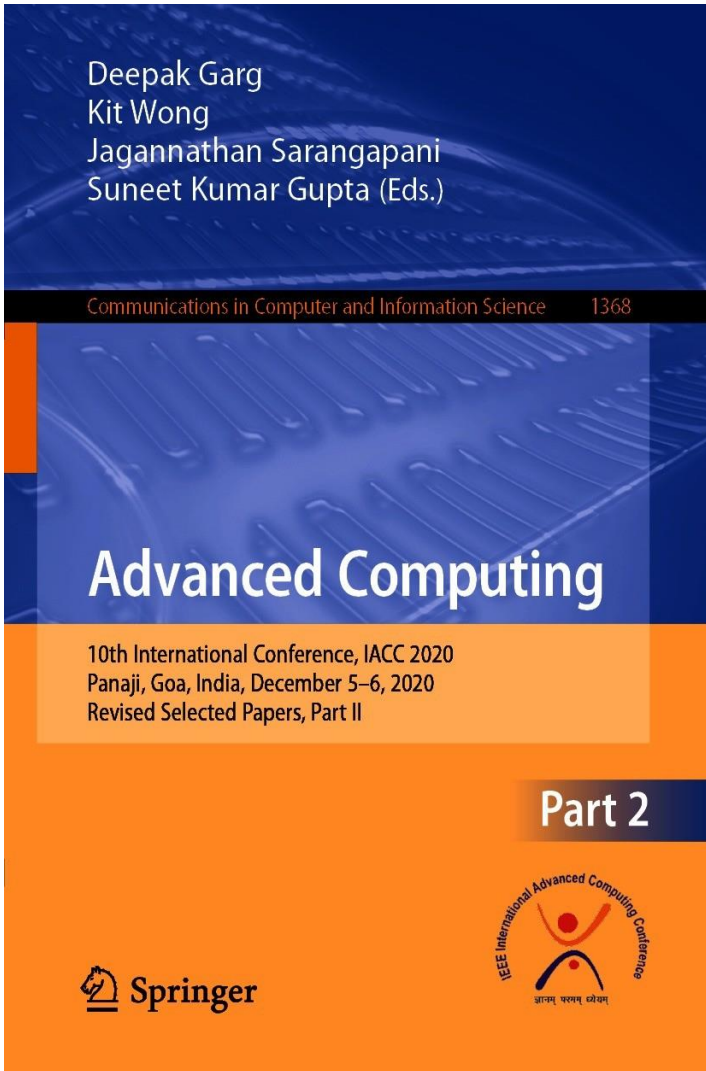
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## 1 Introduction

Presently, digital media and multimedia with various computational applications demand various high performance, and low power consuming filters. The use of filters in VLSI design with help of FPGA is predominantly applicable in various DSP applications. The computationally intensive operation used in DSP can be obtained by a convolution operation. It can be visualized by the help of moving weighted mean, i.e. the weighted mean of every input stream over a suitable number of inputs. Here 10-taps or 10 inputs are considered for the weighted mean. Specific weights are assigned to the past and current values of the input signal, which determines the frequency band to be handled. Taking 1/10 weights for every input for a 10-tap filter it gives an arithmetic average of the inputs, thus implementing a low pass filter by smoothening out the sudden high bursts or high-frequency element in the signal. A large amount of multiplication and accumulation processes increase power consumption by an increase in the hardware requirements for these operations, i.e. due to demand of high-order PJA filters with high sampling rate. The Fig. 1 shows the structure of transposed direct form

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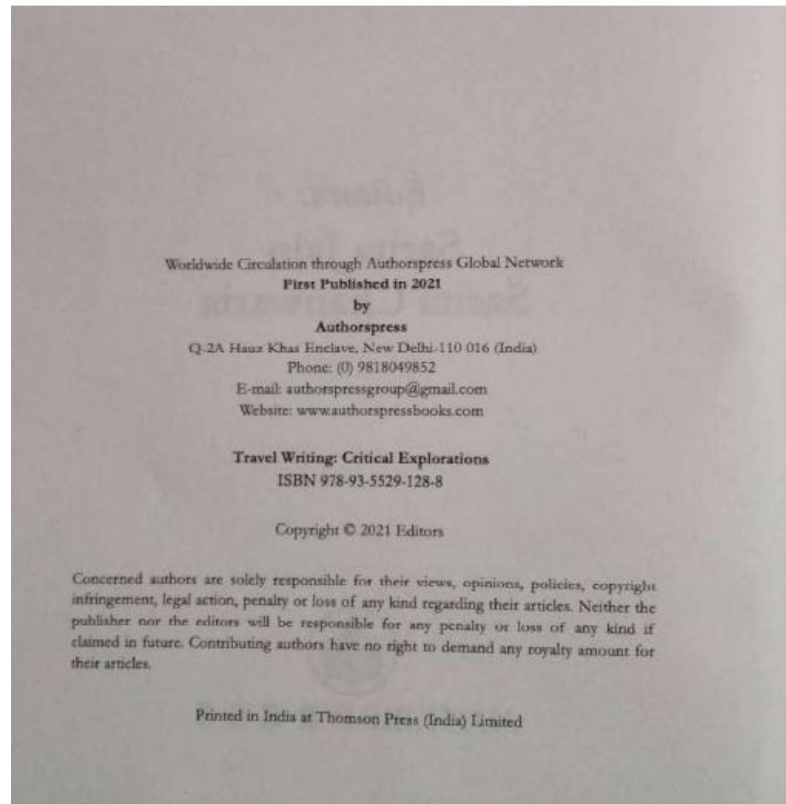
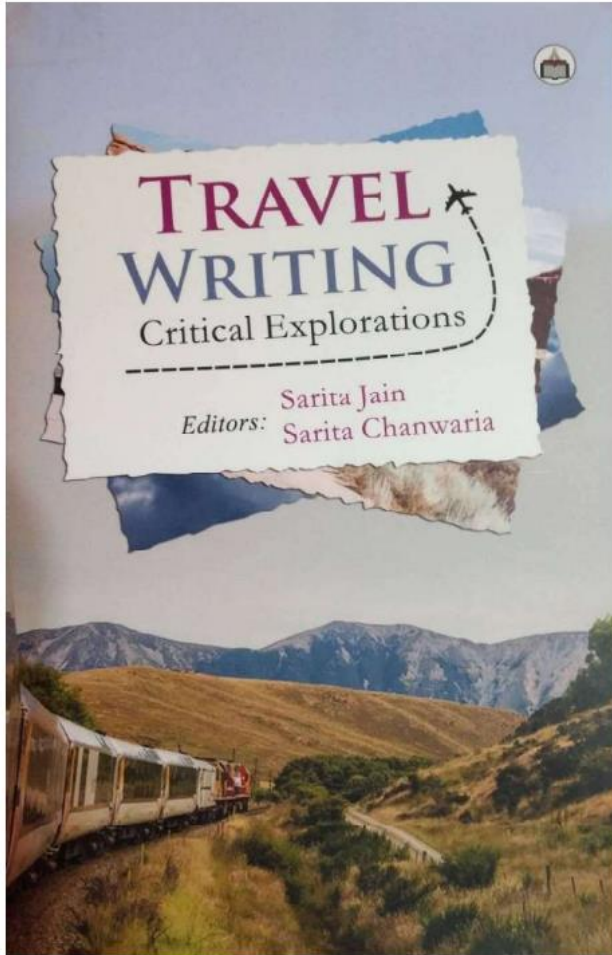
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## ABSTRACT

Efficient and enhanced gas sensing especially at room temperature is the demand for contemporary industrial applications. This has been made possible due to a paradigm shift from semiconducting metal oxides to 2D materials including Graphene Oxide (GO) and reduced GO (RGO). GO and its derivatives have ushered in a revolution mainly because of their high surface to volume ratio and presence of various oxygen groups. Literature reports since 2010 indicate existence of investigations by many research groups wherein multiple approaches have been employed to enhance the gas sensing capabilities of GO and RGO. Some of the more radical approaches have been fabrication of free standing GO films, adoption of green fabrication techniques, thermal reduction and even implantation of nitrogen ions. However, quantitative augmentation of favourable oxygen species on the GO films envisaged to act as active sites for the target gas molecules ( $H_2$  and  $SO_2$  in the current investigation) is yet to be carried out. The present study reports enhancement in detection of gaseous species due to twin mechanisms of a) advantageous tailoring of surface morphology and b) presence of favourable oxygen species. Both the processes are shown to occur due to intentional incorporation of variations induced in the sonication process during synthesis of GO films.

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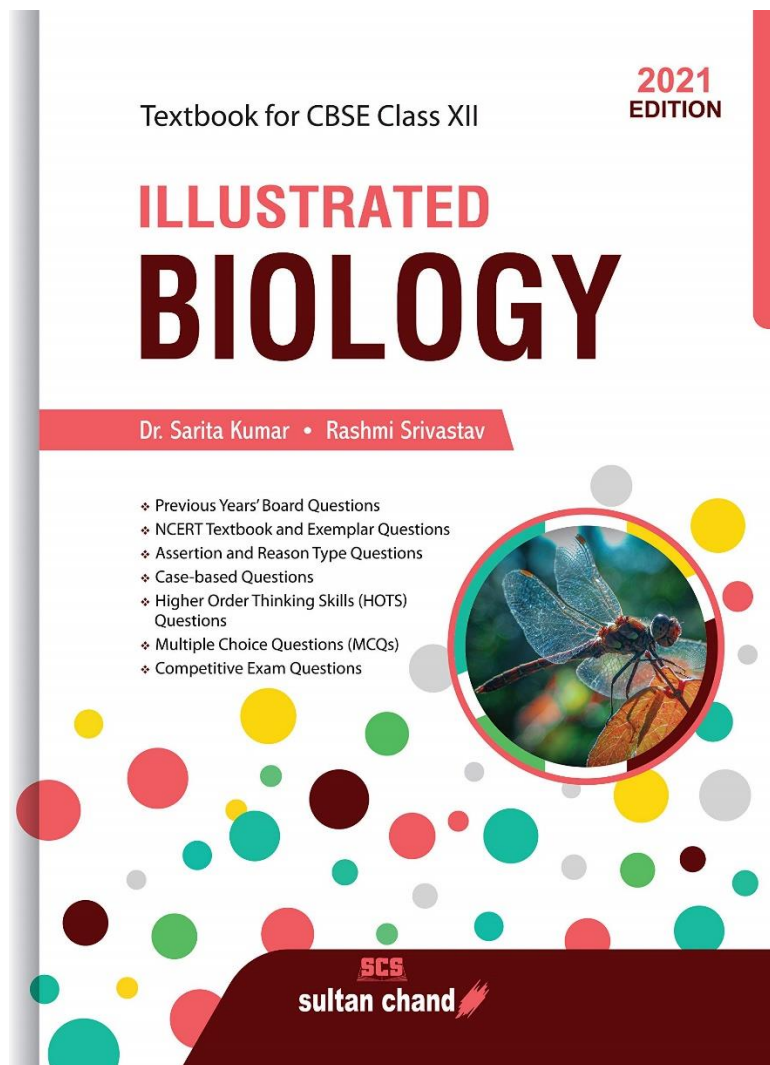
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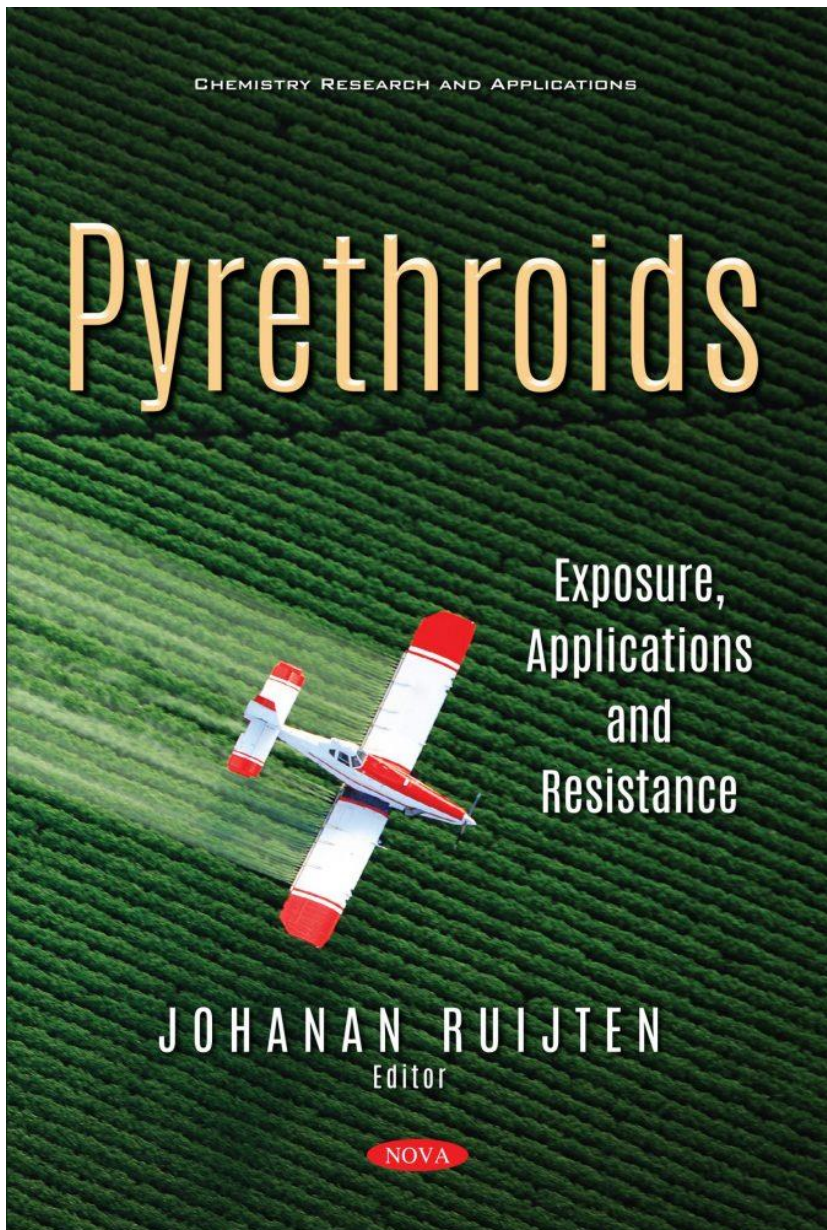
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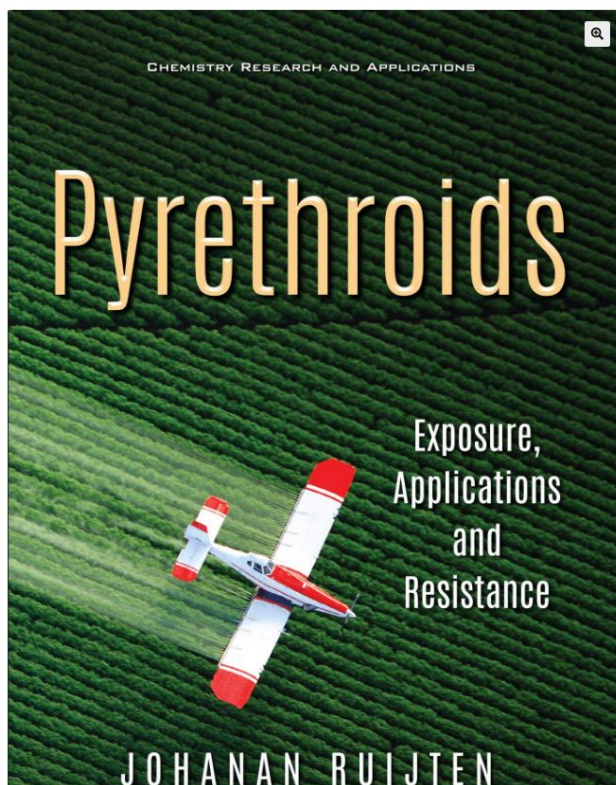
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Pyrethroids have been employed in crop fields all over the world. However, the use of this chemical class of insecticides raised concerns about environmental contamination and toxic effects on non-target species, including health issues on human population.

Therefore, *Pyrethroids: Exposure, Applications and Resistance* presents recent literature about the biodegradation of pyrethroids with emphasis on studies performed in soil at fields and in controlled environments.

The authors chapter briefly discuss pyrethroid exposure, toxicity, effects and their applications in different fields. A detailed insight on microbial mediated transformation of pyrethroids is also provided.

In closing, the current status of pyrethroid resistance in the dengue vector is reviewed, and the underlying biochemical and molecular mechanisms that may potentially play a role in the resistance are characterized. This knowledge may aid in understanding challenges in mosquito control.

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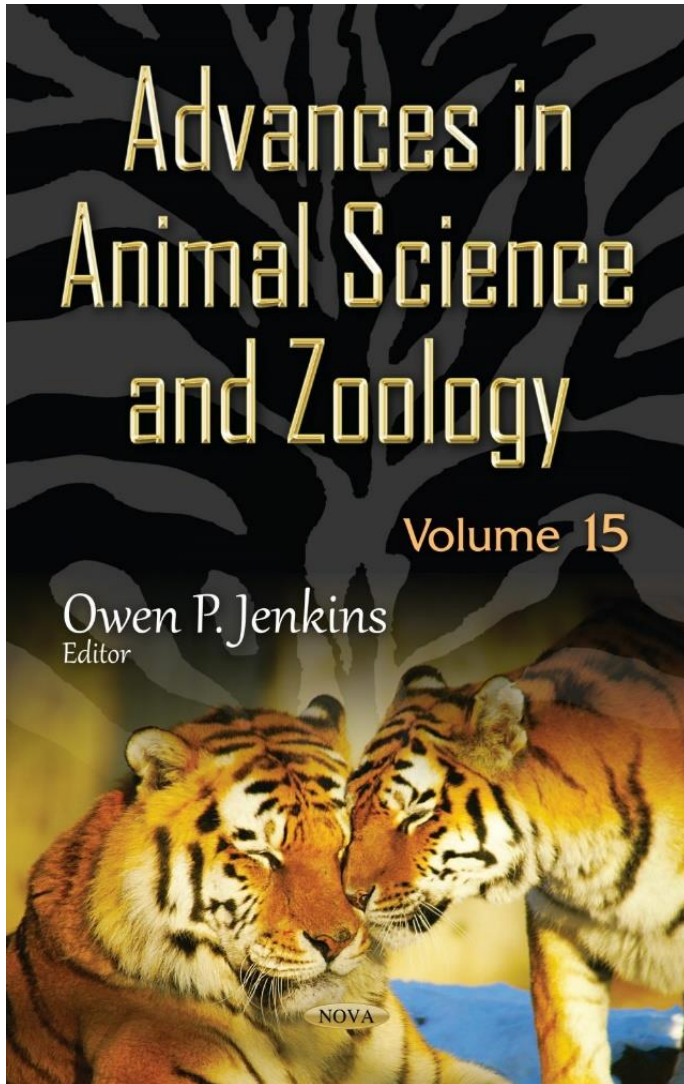
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Chapter

Multiple Insecticide Resistance in *Culex quinquefasciatus*: Impact and Associated Mechanisms

August 2020

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Abstract

*Culex quinquefasciatus* Say is a widespread mosquito vector responsible for transmitting several diseases of great concern; such as Japanese encephalitis (JE), Filariasis, West Nile fever, Rift valley fever, etc. A strongly anthropophilic mosquito, it is the most predominant species in sub-tropical and tropical regions; irrespective of urban, semi-urban and rural areas. Since last few decades, Japanese encephalitis (JE) has emerged as a prime health concern at the global level. Currently, about 3 billion people residing in 24 countries are at the risk of JE virus, among which 378 million reside in India. The fatality rate of the JE-infected individuals; primarily children; is about 30%, while approximately 30%–50% of survivors have long-term neurologic ramifications. In addition, 893 million people in 49 countries worldwide are threatened by *Culex*-borne lymphatic filariasis which has raised alarm for its management. Till date, several conventional methods; such as mosquito repellents, indoor residual sprays (IRS), insecticide-impregnated nets (ITNs), net screens, etc.; have been used as mosquito management interventions. Among these, chemical-based interventions have been the most successful because of easy application and rapid action. Several compounds of different chemical nature have been discovered and attempted for the *Culex* management. These include inorganic insecticides (oils, sulphur, etc.), organic insecticides (organochlorines, organophosphates, carbamates, etc.), botanicals (pyrethroids, nicotinoids, etc.), chitin synthesis inhibitors and growth regulators (penfluron, dimilin, etc.), avermectins, etc. Use of these compounds has not only aggravated the problem of environmental contamination but has also affected human health and non-target organisms. Though, novel measures have been explored and used for the *Culex* management; including biological agents, microbial pesticides and genetic manipulations; yet chemical interventions have been favourite despite of associated problems. This has arisen the need for management of insecticide resistance and developing strategies that could delay or prevent the development of resistance and ensure long-term efficacy of toxicants. A few such strategies include the use of synergists and rotational use of insecticide with different modes of action, etc. Exploration of new stratagems necessitates the knowledge of insecticide resistance mechanism in *Culex* mosquito which could help to formulate new management policies. The mechanism responsible for insecticide resistance in *Culex* is manifold and intricate based on the chemical nature of insecticide, and its mode of entry and action approach. A few mechanisms; such as increased metabolic detoxification of insecticides, altered biochemical machinery, decreased target sensitivity (protein/genes), target overexpression by amplification or mutations in protein coding-gene regions; have frequently been reported and implicated as well. The complexity of mechanism has failed to establish a major criterion and regulation in *Culex*. This Chapter provides current knowledge of the influence of insecticide resistance in *Culex quinquefasciatus* in India and the governing molecular mechanisms including gene interactions, and gene regulation. The Chapter also discusses the potential impact of the latest research findings on the basic and practical aspects of research in the field, associated issues and probable solutions. Key words: *Culex quinquefasciatus*, insecticide, resistance, detoxification, synergist, biochemical machinery

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(Fábio Morotti, Marcela Bortoletto Cerezetti, Elis Lorenzetti, Denis Vinicius Bonato and Marcelo Marcondes Seneda, Laboratório de Reprodução Animal [REPROA], DCV-CCA-Uel, Londrina, Parana, Brazil, and others)

Chapter 2. Multiple Insecticide Resistance in *Culex quinquefasciatus*: Impact and Associated Mechanisms

(Roopa Rani Samal, Aarti Sharma and Sarita Kumar, Department of Zoology, Acharya Narendra Dev College, University of Delhi, New Delhi, India)

Chapter 3. Factors That Affect Reproductive States in Female Eusocial Hymenoptera

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Chapter 4. *Mycoplasma synoviae*

(Muhammad Akbar Shahid, Somayeh Kordafshari, Ling Zhu, Mian Muhammad Awais,

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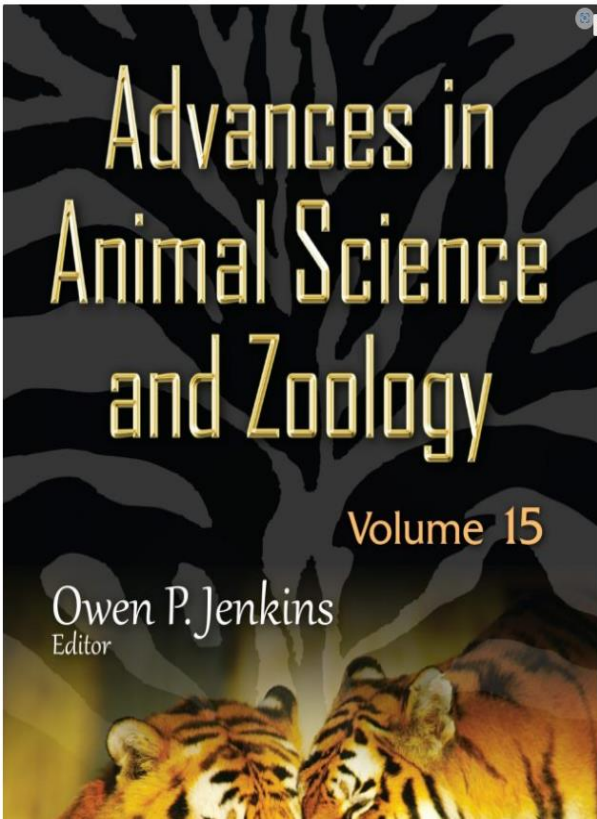
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Advances in Animal Science and Zoology, Volume 15 begins by presenting the main advances of artificial insemination and timed artificial insemination, highlighting the technical parameters, advantages, and influencing factors in an effort to discuss practical and current strategies for the improvement of the herd via artificial insemination programs.

Following this, the authors provide current knowledge on the influence of insecticide resistance in *Culex quinquefasciatus* in India, as well as the governing molecular mechanisms including gene interactions and gene regulation. The potential impact of the latest findings on aspects of research in the field, associated issues and probable solutions is also addressed.

A study on eusocial Hymenoptera, a large order of insect, is included. The factors that determine castes are addressed, and the varying methods of initiation of reproduction by workers in primitive and advanced eusocial species are outlined.

This compilation goes on to discuss *Mycoplasma synoviae*, an important poultry pathogen that causes airsacculitis, synovitis, and eggshell apex abnormalities. *M. synoviae* infections cause significant economic losses to the poultry industry due to the culling of birds, increased carcass condemnation and decreased egg production.

The authors review the most relevant scientific contributions to the understanding of brain mechanisms related to working memory using macaques as a study model. The neurophysiological mechanisms of working memory in the macaque have been thoroughly explored, which has given rise to unprecedented advances in the understanding of the neurophysiological mechanisms that underlie this type of memory in other mammals, including humans.

The conclusion centers on the utmost task of a biologist: knowing the taxonomic status of the organism on which the study is focused. A taxonomist fulfills this task by distinguishing the salient characteristics of the organism concerned, giving it an appropriate name and placing it to taxonomic hierarchies.

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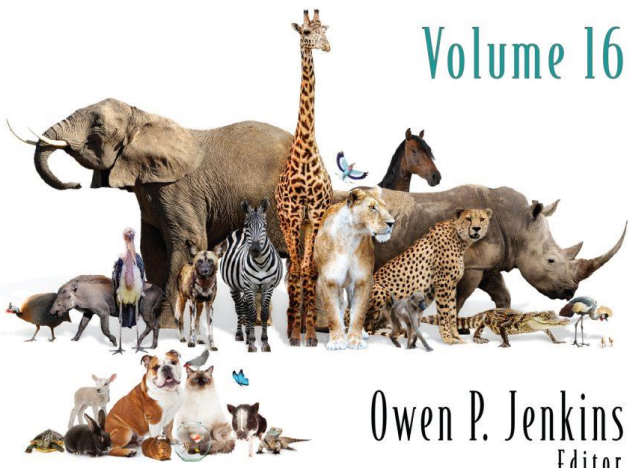
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*Advances in Animal Science and Zoology, Volume 16* begins with a focus on entomopathogenic nematodes of the families Steinernematidae and Heterorhabditidae, which can be used successfully to control a wide range of agricultural insect pests.

Following this, the authors discuss the potential use of silver nanoparticles for the control of mosquito vectors and other coinhabiting species. The green synthesis of these nanoparticles, along with spectroscopic and microscopic techniques employed for primary and secondary phase measurements, is considered at length.

The meathoracic flight apparatus of the honey bee *Apis mellifera* is discussed, representing a highly specialized system for turning manoeuvres which is capable of generating unilateral modifications of the aerodynamic effect of the whole double-wing.

Novel advancements in regenerative engineering utilizing various biomaterials and engineering techniques are discussed, offering a hopeful outlook for patients with severe urologic dysfunction or damage with limited options.

The authors explore how gases produced through the fermentation of feedstuffs may be screened and analyzed to assess the production and emission of greenhouse gases related to their consumption and degradation. The concluding study aims to identify the debilitating fall armyworm of the genus *Spodoptera* and assess the severity of damage they cause to maize plants in the municipality of Djougou in northern Benin.

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Hiran Mayookh Lal  
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Nanoparticles, ranging in the size from 1 to 100 nm possess novel or enhanced properties compared with larger particles of bulk materials, based on their specific characteristics such as size, distribution and morphology. Noble metal nanoparticles are widely used in the nano-medicinal application; especially silver nanoparticles, which exhibit antifungal, antibacterial, anti-plasmodial and anti-mosquito properties due to the unique properties such as chemical stability, good conductivity and catalytic activity. Nanoparticles are largely synthesized by a variety of chemical and physical approaches. These techniques being expensive and potentially hazardous to the environment, can pose various biological risks. This has necessitated for the alternate eco-friendly and innocuous approaches. In recent years, the convergence between the two fields; nanotechnology and biology; has evolved a new field of nanobiotechnology that encompasses a number of biochemical and biophysical processes employing biological entities such as algae, bacteria, fungi, viruses, yeasts, and plants. Focus on green synthesis of nanoparticles without employing toxic and expensive chemicals frequently used in conventional chemical and physical processes, has augmented their applications and safe usage. This chapter describes the different methods to synthesize silver nanoparticles with a major focus on synthesizing nanoparticles via green route i.e., by utilizing biological entities

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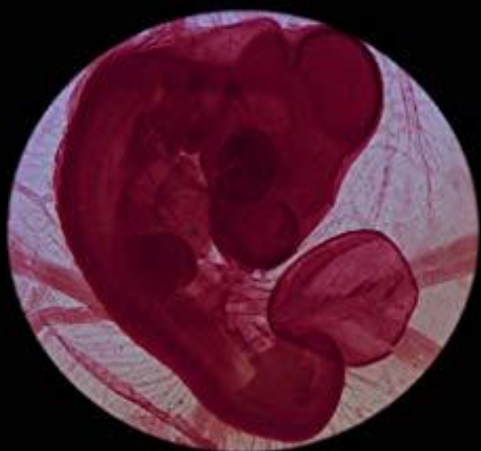
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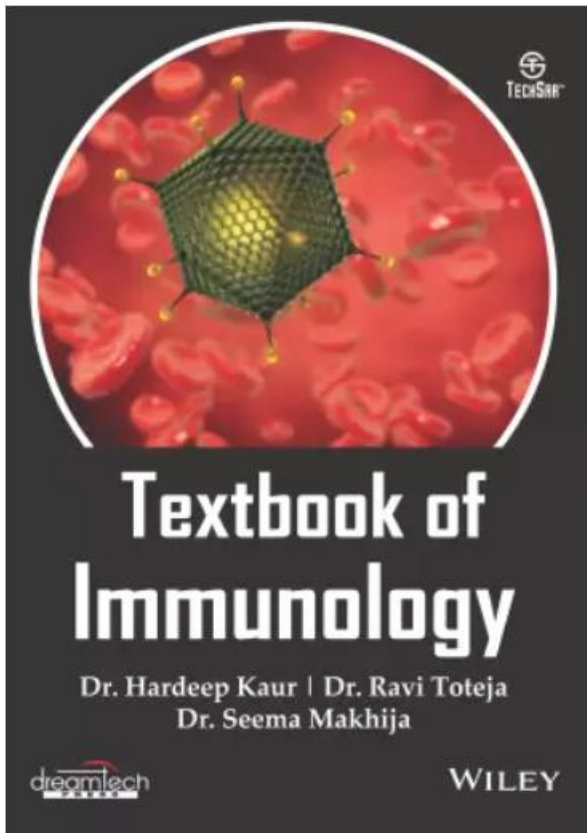


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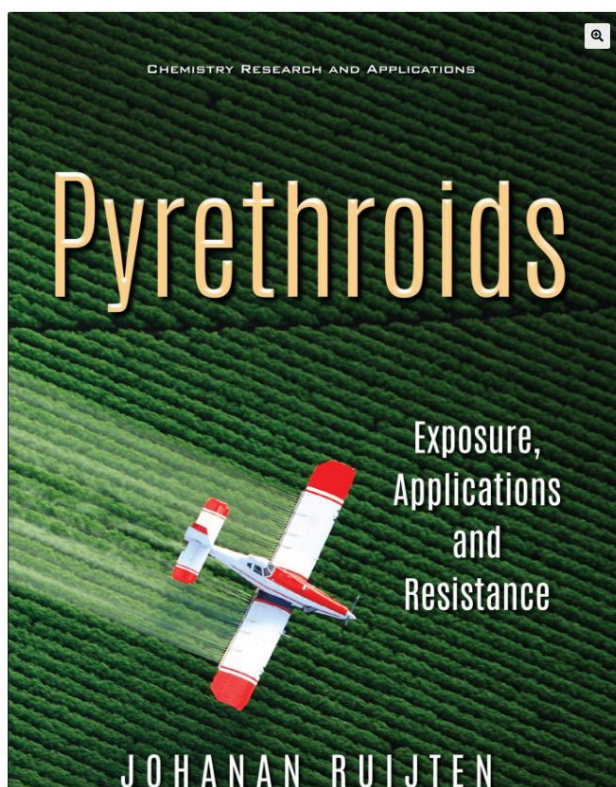
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Pyrethroids have been employed in crop fields all over the world. However, the use of this chemical class of insecticides raised concerns about environmental contamination and toxic effects on non-target species, including health issues on human population.

Therefore, *Pyrethroids: Exposure, Applications and Resistance* presents recent literature about the biodegradation of pyrethroids with emphasis on studies performed in soil at fields and in controlled environments.

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In closing, the current status of pyrethroid resistance in the dengue vector is reviewed, and the underlying biochemical and molecular mechanisms that may potentially play a role in the resistance are characterized. This knowledge may aid in understanding challenges in mosquito control.

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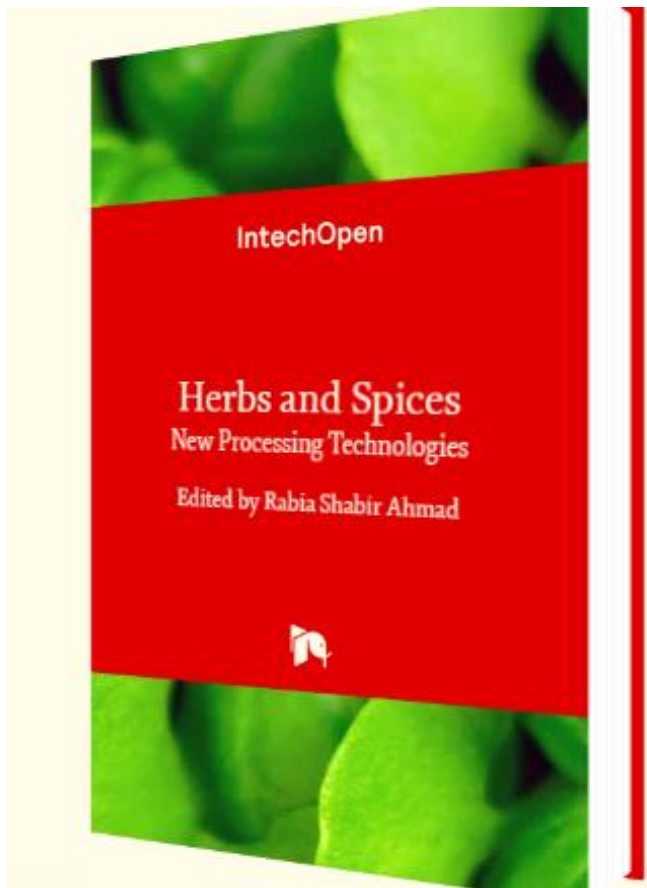


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## Herbs and Spices - New Processing Technologies

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*Herbs and Spices - New Processing Technologies* is a collection of research and review chapters offering a comprehensive overview of recent developments in the field of herbs and spices, with a focus on plants containing bioactive components and the utilization of novel processing technologies in the development of functional products. The book consists of four sections containing fourteen c...

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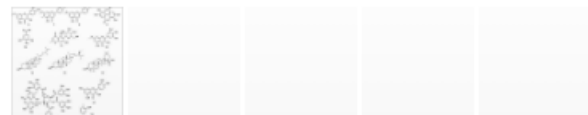
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## Abstract and Figures

All over the world, Plants have found to be a valuable source of herbs and spices for a long period of time to maintain the human health. Varieties of herbs and spices have been used to impart an aroma and taste to food for last few centuries. Several applications of plants species have been reported as antioxidative, anti-inflammatory, antidiabetic, antihypertensive and antimicrobial activities. Currently efforts are focused on their scientific merits, to provide science-based evidence for their traditional uses and to develop either functional foods or nutraceutical behavior. India is well recognized all over the world for their variety of herbs, spices and medicinal biodiversity. The WHO has listed more than 21000 plants, which are used for their medicinal purposes either in the form of essential oil or in the form of flavor. Among these, more than 2500 species and herbs are found in India, however; among them more than 150 species are used commercially on large scale. In India, the use of spices and herbs in the form of essential oil or in the form of flavor are traditionally used in routine treatment. For example, Curcumin which is found in turmeric are frequently used in medical facilities to wound healing, rheumatic disorders, and gastrointestinal symptoms etc.



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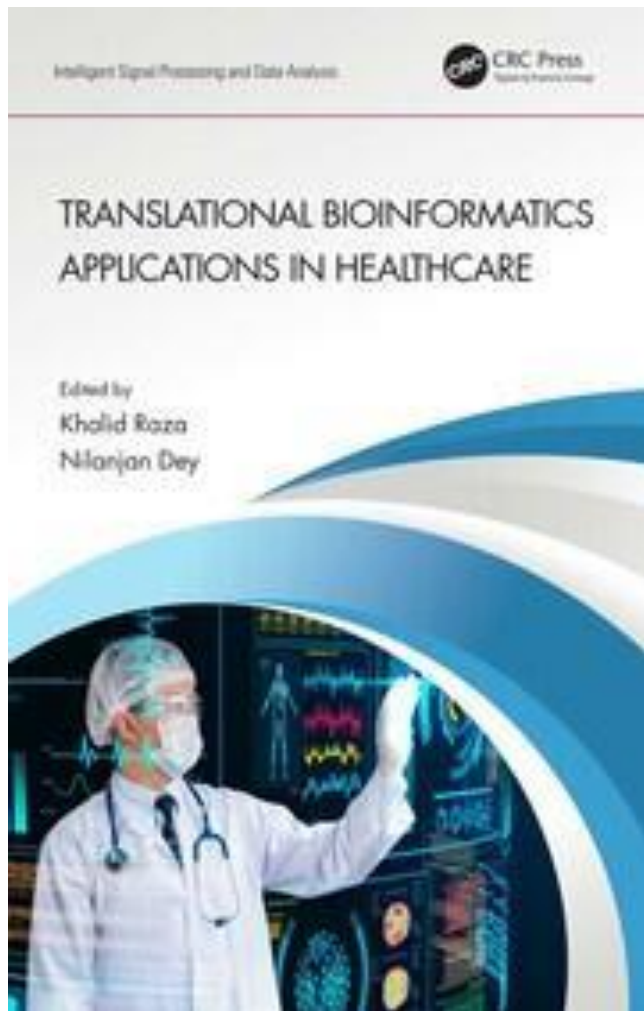
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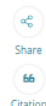


Book

## Translational Bioinformatics Applications in Healthcare

Edited By Khalid Raza, Nilanjan Dey

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### ABSTRACT

Translational bioinformatics (TBI) involves development of storage, analytics, and advanced computational methods to harvest knowledge from voluminous biomedical and genomic data into 4P healthcare (proactive, predictive, preventive, and participatory). *Translational Bioinformatics Applications in Healthcare* offers a detailed overview on concepts of TBI, biological and clinical databases, clinical informatics, and pertinent real-case applications. It further illustrates recent advancements, tools, techniques, and applications of TBI in healthcare, including Internet of Things (IoT) potential, toxin databases, medical image analysis and telemedicine applications, analytics of COVID-19 CT images, viroinformatics and viral diseases, and COVID-19-related research.

- Covers recent technologies such as Blockchain, IoT, and Big data analytics in bioinformatics
- Presents the role of translational bioinformatic methods in the field of viroinformatics, as well as in drug development and repurposing
- Includes translational healthcare and NGS for clinical applications
- Illustrates translational medicine systems and their applications in better healthcare
- Explores medical image analysis with focus on CT images and novel coronavirus disease detection

Aimed at researchers and graduate students in computational biology, data mining and knowledge discovery, algorithms and complexity, and interdisciplinary fields of studies, including bioinformatics, health-informatics, biostatistics, biomedical engineering, and viroinformatics.

**Khalid Raza** is an Assistant Professor, the Department of Computer Science, Jamia Millia Islamia (Central University), New Delhi. His research interests include translational bioinformatics, computational intelligence methods and its applications in bioinformatics, viroinformatics, and health informatics.

**Nilanjan Dey** is an Associate Professor, the Department of Computer Science and Engineering, JIS University, Kolkata, India. His research interests include medical imaging, machine learning, computer-aided diagnosis, and data mining.

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## Translational Bioinformatics Methods for Drug Repurposing

By Jyoti Rani, Urmi Bajpai, Srinivasan Ramachandran

Book [Translational Bioinformatics Applications in Healthcare](#)

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### ABSTRACT

The translation of research findings into new approved drugs takes a vast amount of time and effort and also costs so high. Due to these obstacles and delays in the development of novel drugs, drug repurposing (DR) has been inspired to transform the traditional process of drug discovery and also ameliorate the low possibility of success. To diminish the cost and durability, the insilico activities have received primary attention. The availability of the wealth of data on drugs makes DR a fastest and low-cost process to find new therapeutic indications. DR is the procedure to find new indications of existing drugs. The drugs approved for other diseases are already tested in humans, which provide detailed information on their formulation, pharmacology, and toxicity. Several computational tools are also available for the integration, analysis, and visualization of experimental information derived from various sources. Tools such as asrepoDB, RE: fine Drugs, RepurposeDB, DrugSig, and deep DR are well known for DR. In this chapter, we will discuss all the well-recognized bioinformatics approaches for DR.

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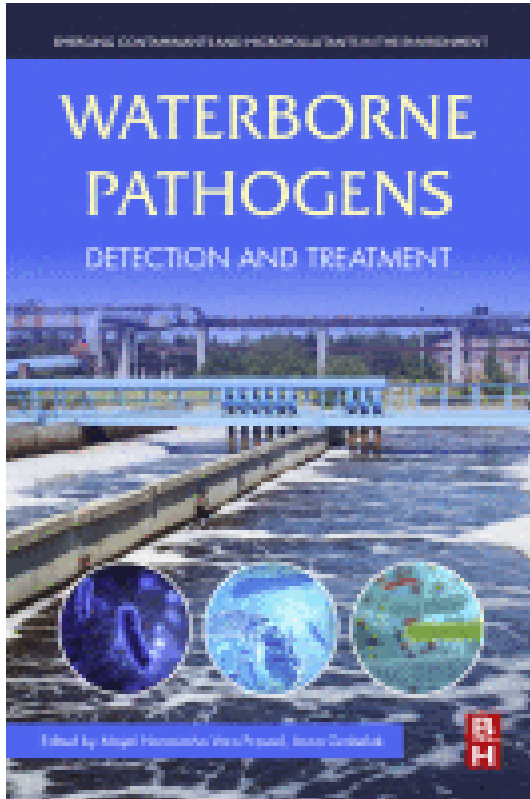
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

























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# Chapter 7 - Biofiltration technique for removal of waterborne pathogens

Anurag Maurya<sup>1</sup>, Manoj Kumar Singh<sup>2</sup>, Sushil Kumar<sup>3</sup>

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## Abstract

Pathogenic agents such as protozoa, bacteria, virus, and helminths disseminate among human community via ingestion of contaminated water and pose a serious concern to public health. Biological filtration method of disinfection is the key step in centralized multistep and decentralized point-of-use water treatment system. A biofilm of indigenous microorganisms fixed on solid surface, called biofilter, is an eco-friendly and economic technique for removal of pollutants and pathogens. Stone, gravel, sand, soil, compost, mesoporous mineral stone, wood chips, etc., exemplify solid bed medium which provide enhanced surface area for microbial adherence and water retention. Slow sand filter (SSF) characterized by slow flow rate (0.1–0.2 m<sup>3</sup>/h) and a biological layer over filter bed called schmutzdecke is fairly efficient in removal of coliform microorganisms such as *Giardia*, *Cryptosporidium*, *Salmonella*, *Escherichia coli*, total coliform and fecal coliform, fecal streptococci, bacteriophage, and MS2 virus from wastewater. Rapid sand filter characterized by coarser sand and higher flow rate than SSF removes indicator microorganisms efficiently. Stormwater biofilter is popular and effective method for removal of pathogen and involves biological activity and physical retention of pathogen on filter media. Microbial diversity, inoculum size, pH and moisture of medium, temperature, and nutrient content are key parameters governing optimum performance of biofilter system. Therefore, biofiltration can be an efficient bioremediation technology for pathogen removal.

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### Abstract

**Bioaugmentation** is an eco-friendly and economically viable approach for enhanced degradation of pollutants and pathogens by addition of pregrown **microbe** or microbial **cocultures** in the medium. Microorganisms from different ecological conditions and engineered microbes capable to produce versatile enzymes and bioproducts are added to native microbial population for insitu treatment of wastewater. Bacterial pathogen borne in wastewater is an important concern for public health because they are not only associated with environmental damage, morbidity, and mortality but also cause economic loss connected with physical and chemical methods in **wastewater treatment**. Bacteriophages are natural killer of bacteria; they can be used as an alternative, cost-effective, biological method for waterborne bacterial pathogen control. *Legionella pneumophila* is the most tracked waterborne pathogen requiring specific treatment conditions because despite of biocides use, they are able to persist in water supplies with the help of multispecies biofilms and phagocytic **protists**. This type of pathogens can be biologically controlled through native complex communities fight for nutrients by means of antagonistic molecules as war weapons. Bioinoculation of heterotrophic bacterial strains in different wastewater treatment systems improves the process of pathogenic bacteria removal. The antagonist substances produced by the inoculated strains are responsible for bacterial pathogen inactivation.

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### Abstract

Water is the most crucial commodity for life support process in organism. There are various natural and anthropogenic factors that affect the basic physical, chemical, and biological properties of natural water. Among them waterborne pathogens and chemical contaminants are major concerns for public health on local, regional, and global scale, not only with respect to morbidity and mortality but by the high cost of their prevention and treatment. The contamination of water through bacteria, virus, protozoa, and some chemical species are major concerns for waterborne pathogen. This chapter provides a brief overview on conventional chemical treatment technique for wastewater treatment. In accordance with this method, some of the conventional treatment processes are based on coagulation-flocculation, chemical precipitation technique, ion exchange, adsorption, membrane filtration, and electrochemical treatment followed by disinfection used in wastewater treatment, as well as advanced chemical oxidation process such as ozonation, ultraviolet radiation, and chlorination for waterborne pathogen treatment.

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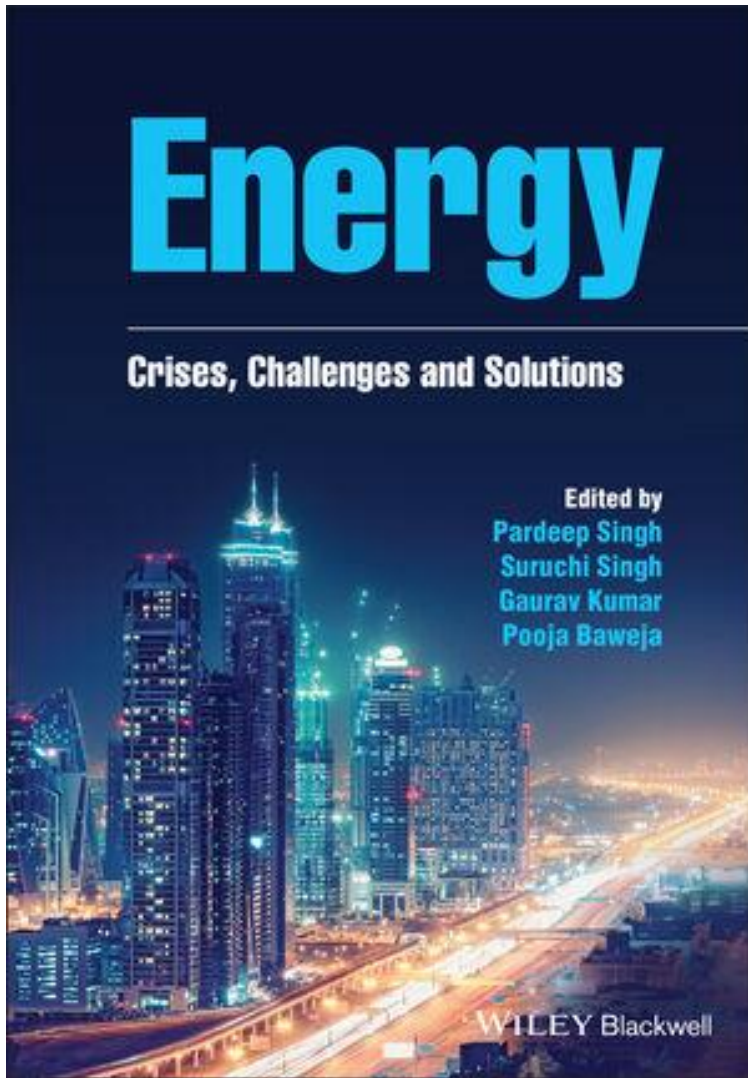
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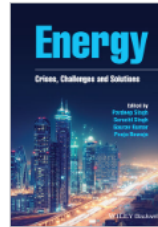
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### Energy: Crises, Challenges and Solutions

Pardeep Singh (Editor), Suruchi Singh (Editor), Gaurav Kumar (Editor), Pooja Baweja (Editor)  
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Global energy demand has more than doubled since 1970. The use of energy is strongly related to almost every conceivable aspect of development: wealth, health, nutrition, water, infrastructure, education and even life expectancy itself are strongly and significantly related to the consumption of energy per capita. Many development indicators are strongly related to per-capita energy consumption. Fossil fuel is the most conventional source of energy but also increases greenhouse gas emissions. The economic development of many countries has come at the cost of the environment. However, it should not be presumed that a reconciliation of the two is not possible.

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## Sustainable Solution for Future Energy Challenges Through Microbes

Sumit Sahni, Manoj Kumar Singh, Anita Narang

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### Summary

Shrinking reserves, volatile prices and environmental concerns associated with use of non-renewable energy pose challenges not only to the global economy but also to environmental sustainability. Furthermore, the location of world's oil reserves, which is politically unstable, puts a question mark on the future of global energy security. High chemical similarity, carbon neutrality and comparable energy content made biofuels (bio-alcohol, biogas, biodiesel) as a sustainable energy source, and microbes played a pivotal role in their production. Biofuels have been classified into first, second, third and fourth generation depending on the evolutionary hierarchy of raw material and technology used for its production. With each generation, the production of biofuels is moving towards attaining sustainability and profitability in energy production. They are evolving to solve the problems of energy crisis, pollution, global warming and waste management in most efficient manner. Advancements in biotechnology, gene editing technology and synthetic biology converted the role of microbes from just decomposer of biomass to producers of biofuels, as bio-refineries, bioelectric cell to solar biofuels. This chapter elucidates the mechanisms and technologies through which microorganisms can pave the way towards a clean and alternative source of energy, which is viable too.

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### Summary

Due to rapid industrialization and population growth, the demand for existing non-renewable energy resource, especially fossil fuels, has been increasing in spite of their shrinking resources. Moreover, excessive use of fossil fuels poses environmental risks such as air pollution and global warming. The development of alternative energy resources is of utmost significance among ways to cope with these challenges. Lignocellulosic biomass (LCB), an agriculture and food industry by-product, is an important source for the production of different categories of liquid transport fuels. The most extensively used biofuel in today's world is bioethanol. Bioconversion of lignocellulose to ethanol usually requires multi-step processes, which include: selection of suitable biomass, effective pretreatment method, suitable enzyme cocktail for saccharification, fermentation of mixed sugars and ethanol purification. Due to multiple and complicated steps in conversion of bioethanol, production of liquid hydrocarbons (such as alkanes and aromatic hydrocarbons) from LCB is attracting more research interest. Therefore this article also reviews the recent advancements in catalytic conversion of LCB components (cellulose, hemicelluloses and lignin) into hydrocarbons. LCB can be considered as an effective bio-resource to satisfy the global energy crisis in a sustainable way. However, integrated studies are required for the commercial production of liquid transport fuels from LCB resources.

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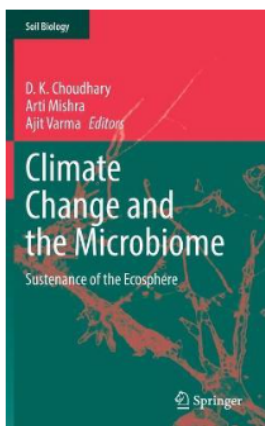
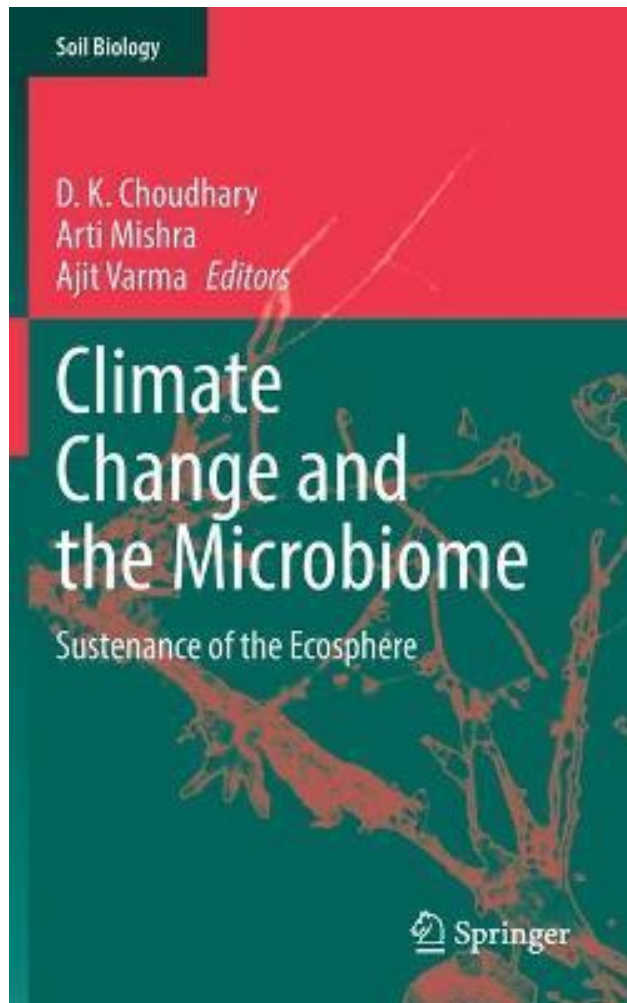
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This book highlights the impact of climate change on the soil microbiome and its subsequent effects on plant health, soil-plant dynamics, and the ecosphere. It also discusses emerging ideas to counteract these effects, e.g., through agricultural applications of functional microbes, to ensure a sustainable ecosystem.

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### Abstract

In the study of global changes and ecosystem impacts, it is very important to consider mycorrhiza, because they hold a critical position at the plant-soil interface. Human-induced environmental changes on earth depend on number of factors such as increasing atmospheric CO<sub>2</sub>, nutrient enrichment by atmospheric deposition (N<sub>2</sub>), altered precipitation and temperature. All these changes taking place in present and will surely increase in the future can impact the association of fungi with plant roots in a positive or negative direction. These factors are classified on the basis of their impact on colonization of mycorrhiza viz. factors affecting arbuscular mycorrhiza (AM) fungi indirectly by altered allocation of carbon from the host and factors that directly affect AM fungi i.e. altered precipitation, temperature and nitrogen deposition. For the study of global climate change and its impact on AM fungi, this distinction in responses to different factors is very important. These global change factors always occur in association, since experimental examination of a large number of scenarios would not be possible in-situ. Therefore for the study of global changes on AM fungi, large spatial and temporal scale assessments have been considered. The majority of experiments only permit to extract short-term responses, though long-term responses are more appropriate. For example, CO<sub>2</sub> springs, global distribution of plant communities and regional extinction because of climate change. AM fungal community may also be impacted according to host biodiversity at local scales. Further, changes in AM fungal community that are not affected by the changes in plant community should be studied to find precise response of mycorrhizas to global change.

### Keywords

AM fungal community

Elevated CO<sub>2</sub>

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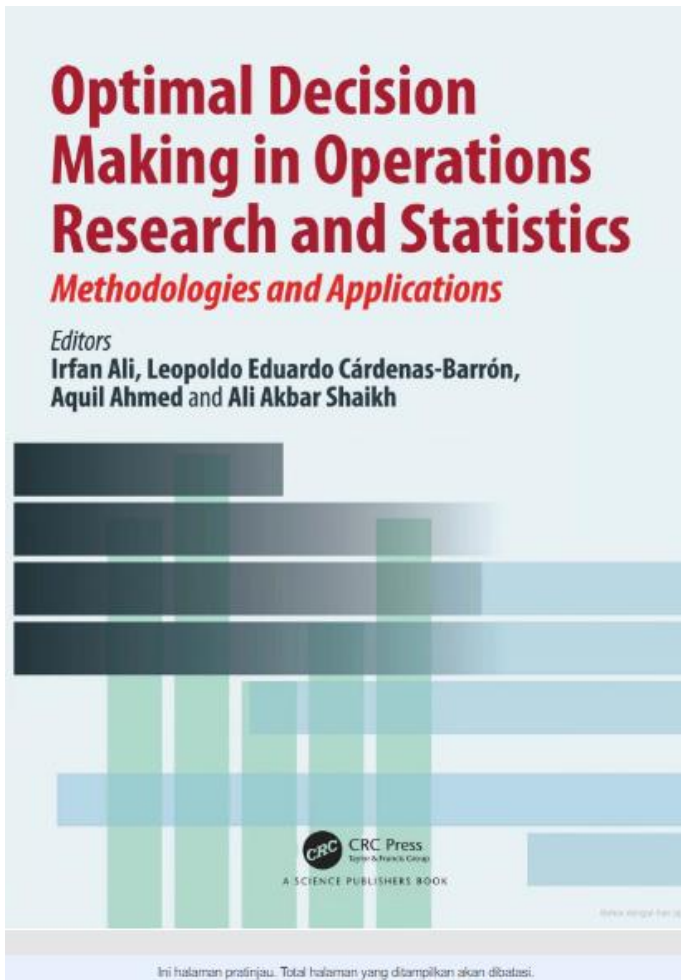
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## CHAPTER 22

### Adjusted Bias and Risk for Estimating Treatment Effect after Selection with an Application in Idiopathic Osteoporosis

*Omer Abdalghani, Mohd. Arshad, K R Meena\* and A K Pathak\**

#### 1. Introduction

In clinical researches, when comparing the effects of different treatments (therapies or drugs), usually a physician would like to select the most effective treatment among  $k$  ( $k \geq 2$ ) active treatments. The classical statistical approach to such a problem are the statistical significance tests (such as the test of homogeneity), where we examine the hypothesis of equality of treatment effects. If this hypothesis is rejected, we have the information that the effects are not equal, but we do not have the information about the best (most effective) treatment. Therefore, statistical tests (whether or not they yield statistically significant results) do not supply the information about the selection of the most effective treatment. To this end, one statistical inference problem concerned with the correct selection objective is the ranking and selection problem which concentrates on selecting the most effective treatment among the  $k$  available treatments, using some selection rules. The quality of a treatment is assessed in terms of the characteristic (or parametric function) associated with it. Often, a primary characteristic of interest is the mean effect of a treatment. Moreover, the treatment that corresponds to the largest mean effect will be selected using some selection rule. Further, the problem of interest is the estimation of treatment mean effect after selection. Some relevant selection problems in medicine are represented in finding the optimal dose of treatment or identifying subgroups of patients that respond better to specific therapies than to populations at large.

In clinical trials, most of the work carried out for evaluation of new treatments mainly based on designs that compare a single or number of experimental treatments with a standard therapy or a placebo, then one or two treatments will be selected, based on their observed data, for further investigations. Such a design is called 'select and test' design due to Tall et al., 1998; Stallard and Todd, 2003. Most randomized comparative clinical trials including well-designed trials can produce bias in conventional treatment estimation. For example, in the process of randomization, if the allocation of patients is not completely blinded, so that, experimenters or patients have a preconceived idea about their allocation, then the process would be a form of selection bias (intervention allocation bias). If a physician has prior knowledge of how a new treatment might work, then, their evaluation of the patient's responses could be a source of bias. However, they are often potential sources of bias that might not be so apparent, for example follow-up bias, measurement bias, and exclusion bias.

The bias of estimators may occur when the maximum mean effect of several treatments has to be determined, or the mean effect of the selected treatment has to be estimated. It is so because these estimators may contribute to the decision as to whether to continue a drug development program or to select a specific treatment. Bias is likely to be high if the experimental treatments have similar mean effects. The risk of overestimating mean effect after selection may present in these situations as well. Some theoretical results were constructed for adjusting the selection bias that may arise in these situations as discussed in Shen, 2001; Stallard and Todd, 2005. In some situations, the experimenter may wish to estimate the treatment mean effect after selection. In the literature, the problem of estimating mean effect after selection has been studied by many authors. Most discussions focused on obtaining estimators of the parameters associated with the treatment (population) after selection and deriving various results using different loss functions. For some recent contributions on these problems, the reader may refer to Szulcoviata and Samuel Cahn, 1986; Mize and Meulen, 2001;

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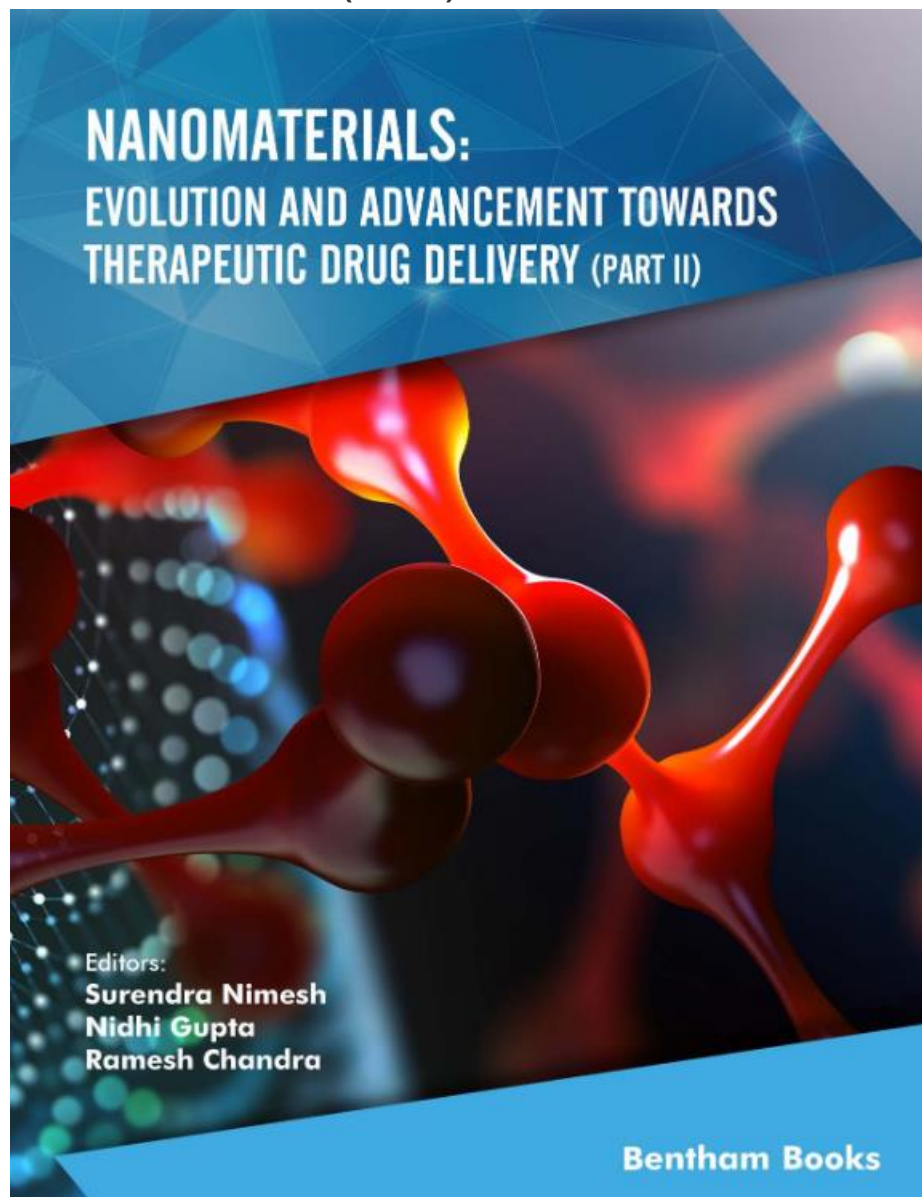
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## Chapter 3

# Hydrogels for Drug Delivery

*Reena Singh, Rahul Goel, Seema Gupta\* and Pradeep Kumar\**

### Abstract

The term 'Hydrogel' is self-defined, as a material composed of water (hydro) and matrix (gel). The hydrogels do not dissolve in water; rather, absorb water and swell into a volumetric mass due to their smart 3-dimensional network. Over the past few years, hydrogels have served as a multifunctional platform and gained the interest of the scientific community. The unique properties of hydrogels, including flexibility, biocompatibility, and mechanical stability, have made them quite an important research area in different fields like disease treatment, targeted drug delivery, and many others. The current applications of hydrogels include the manufacturing of contact lenses, drug delivery systems, hemostats, wound dressings, biosensors, etc. Here, the role of polymer and peptide-based hydrogels, their multi-functionality, unique properties, and major uses have been elaborated, which can serve as a major tool for human welfare in the future.

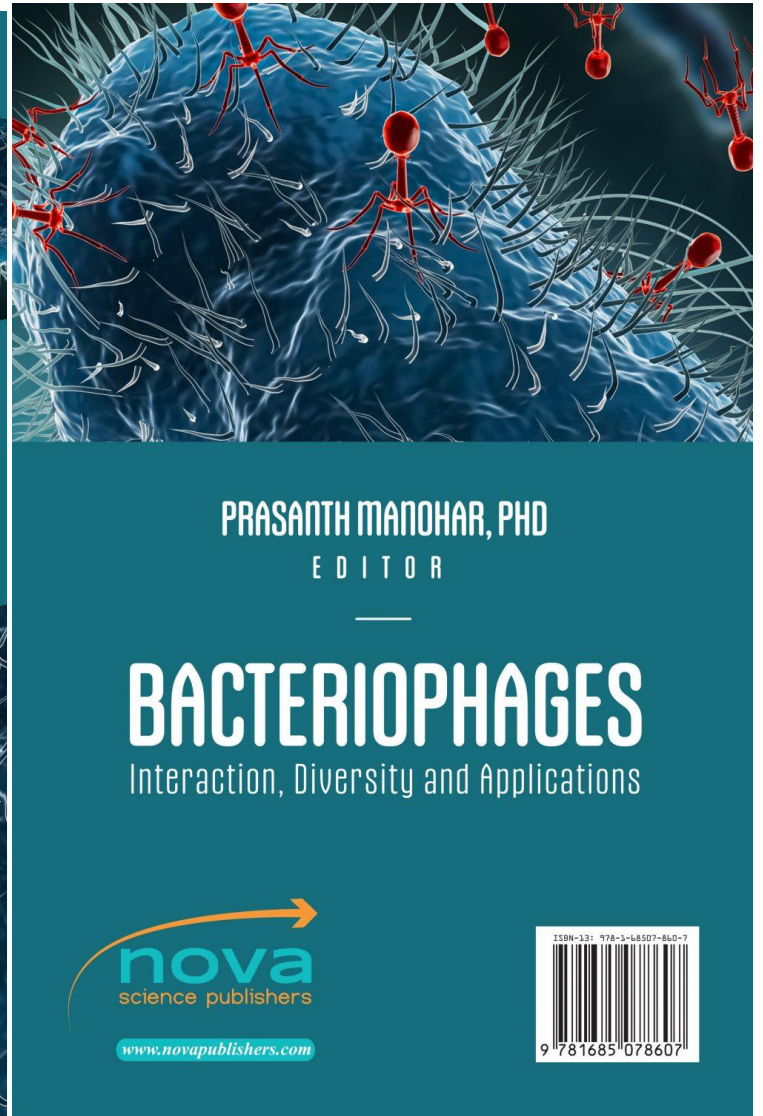
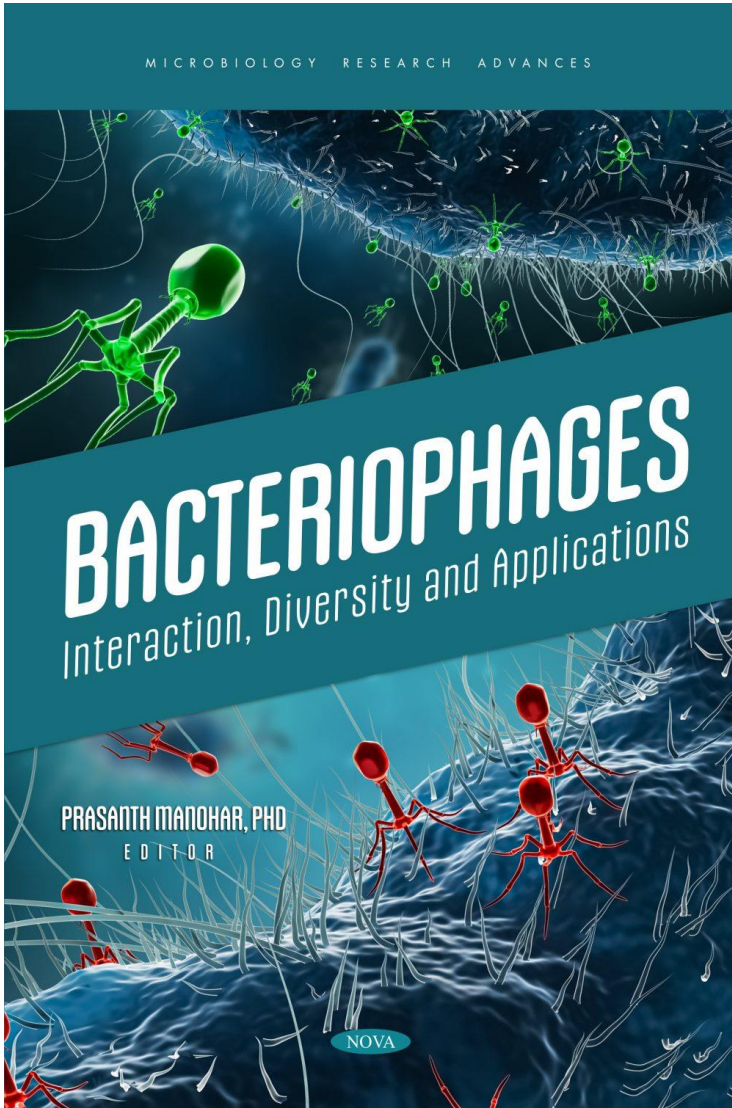
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
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## About the Editor



## Saroj and Urmi Bajpai<sup>\*</sup>

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### Abstract

Antimicrobial resistance (AMR) is a growing crisis and only a few new antibiotics at various stages of development are in the pipeline. To fight AMR, discovery and development of novel antibacterial agents is urgently required and mining of novel antimicrobial leads from nature is fast emerging as a viable and promising option. Among the many variables that contribute to AMR, biofilm formation during bacterial growth has been identified as a critical contributor which protects sensitive bacteria from antibiotics. Biofilms are constituted of an assembled microbial population adhering to each other and to the solid surfaces, enveloped in an extracellular matrix that consists largely of polysaccharides, nucleic acids and proteins. Biofilms can be found on living tissue, wounds, and on the surfaces of medical and prosthetic devices. Given their refractory response to available antibiotic treatment, the potential of bacteriophages and their derived proteins as biofilm inhibitors/disruptors is reviewed in this chapter. Bacteriophages and the encoded enzymes such as endolysins, EPS depolymerase can be harnessed effectively to treat topical biofilms in wounds or those found internally such as in the infected lungs. Though phage therapy has been practised in Eastern Europe for about a century now, it is yet to be established through the rigours of western clinical medicine. In a few case studies in recent years, the Food and Drug Administration (FDA) approved phage therapy in the United States and in the United Kingdom as an Emergency Investigational New Drug (eNID). Several phages and phage products are currently in the pre-clinical stage or different phases of clinical trials. This chapter summarizes the current status and prospects of clinical uses of phage and phage-derived products alone or in combination with antibiotics.

**Keywords:** bacteriophage, antimicrobial resistance, biofilm, lysin, therapeutics

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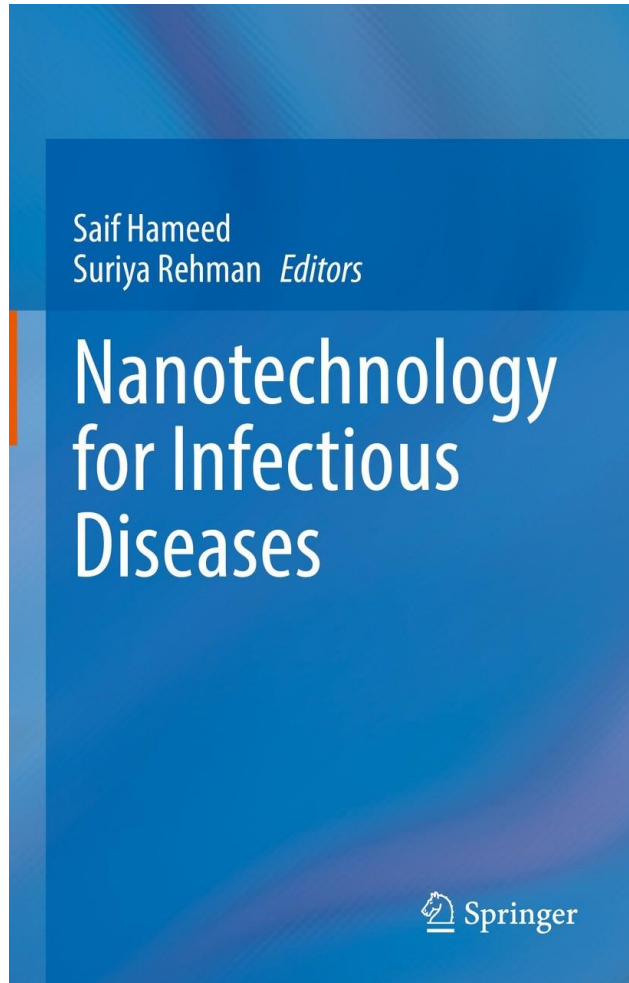
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Nishtha Agrawal, Indu Singh, Madhu Khanna, Gagan Dhawan, Pradeep Kumar & Uma Dhawan Chapter | [First Online: 14 April 2022](#)

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Infectious diseases are caused by living microorganisms such as bacteria, virus, parasite, and fungi that infect millions of people around the globe. These infectious diseases have been responsible for frequent outbreaks, sometimes culminating into epidemic or pandemic, the most recent one being the on-going COVID-19 pandemic caused by SARS-CoV-2. The major challenge posed by these infectious agents is the increasing cases of drug resistance and mutations (mainly in viruses). Another issue is the non-targeted approach of the conventional therapeutic agents which may lead to cytotoxic side-effects, low bioavailability, and the development of drug resistance. Hence, to overcome these shortcomings a target-based approach has been adopted in drug designing that would target the specific gene or protein involved in pathogenesis of above-mentioned microorganisms. In recent years, nanotechnology has gained great momentum in designing a targeted drug delivery system, wherein the targeted drug molecule is encapsulated in the nano-carrier which can be programmed for sustained drug release and has higher efficacy against the pathogens. Some of the nanoparticle platforms like liposome, dendrimers, hydrogels, metal-based nanoparticles have recently proved their efficacy at the molecular site (like as reticuloendothelial system, macrophages) where native conventional drugs could not penetrate efficiently. The major advantages of using nano-formulations in drug delivery are low toxicity, sustained release of drugs, enhanced drug uptake, etc. The chapter is primarily focused on the use of nanomedicine in pharmacological intervention for improving treatment regimen and strategies against infectious organism and is concluded by discussing the alternative strategy of monoclonal antibody therapy.

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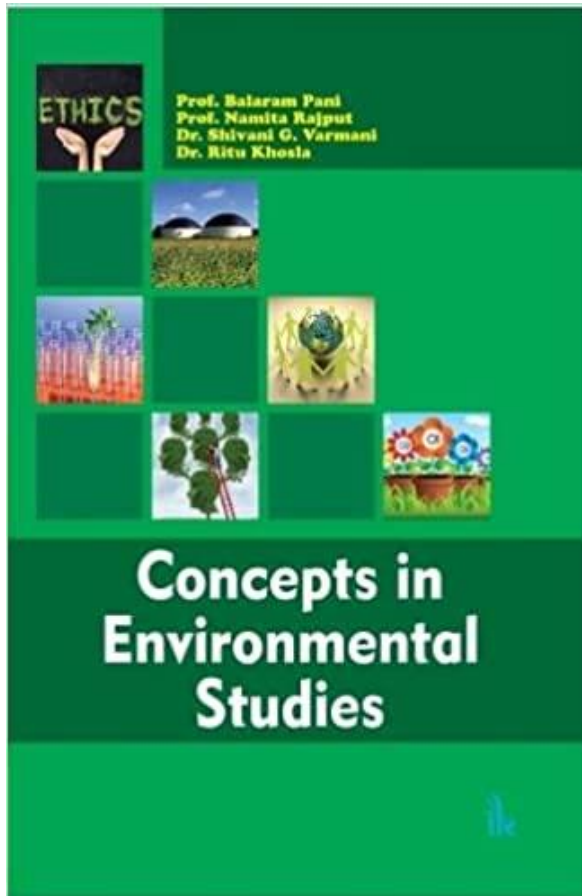
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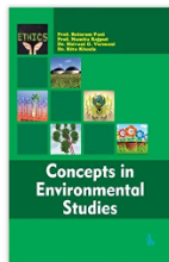
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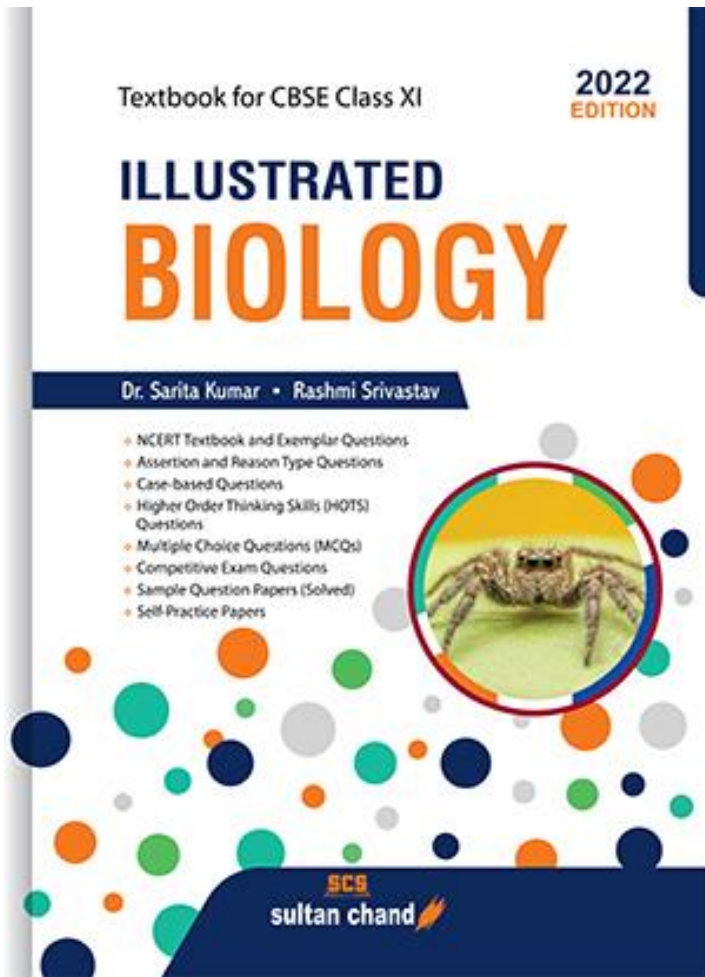
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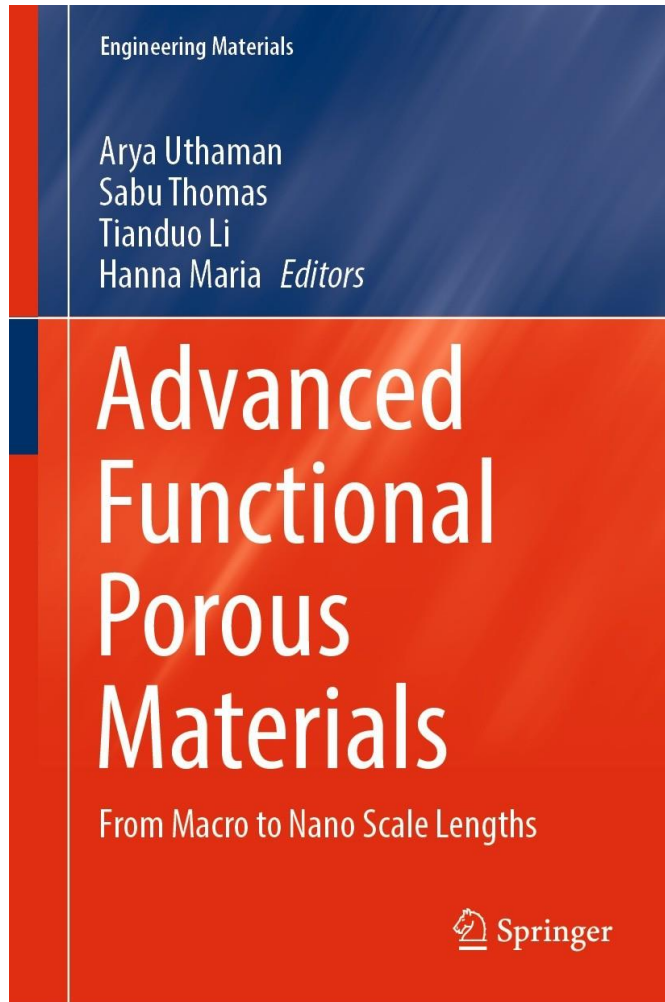
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### Abstract

Nanotechnology has emerged as an important and rapidly growing field in the area of instrumentation techniques for investigating and characterizing mesoporous materials in recent years. This chapter discusses the various instrumentation techniques that are used to investigate and characterize mesoporous materials in order to determine particle size, pore morphology, structure and surface information. The key biophysical techniques used to classify the most mesoporous materials are powder X-ray diffraction (XRD), transmission electron microscopy (TEM), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), Fourier transform infrared spectroscopy (FTIR), nitrogen adsorption-desorption and solid-state nuclear magnetic resonance (NMR), thermal gravimetric analysis (TGA) and differential scanning calorimetry (DSC). Direct approaches to obtain data from electron micrographs of mesoporous materials include microscopy-based techniques such as SEM and TEM. The diffraction technique and TEM can reveal structural order in mesoporous materials, while SEM can reveal particle size and morphology. The porosity and surface area of the formulated materials are determined by N<sub>2</sub> adsorption analysis, while the porous structure is determined by DSC. The NMR measurements provide information about material surfaces, while EDX provides qualitative and quantitative information about elemental-chemical composition. A brief description of the principle and graphical analysis for each technique has been discussed in detail.

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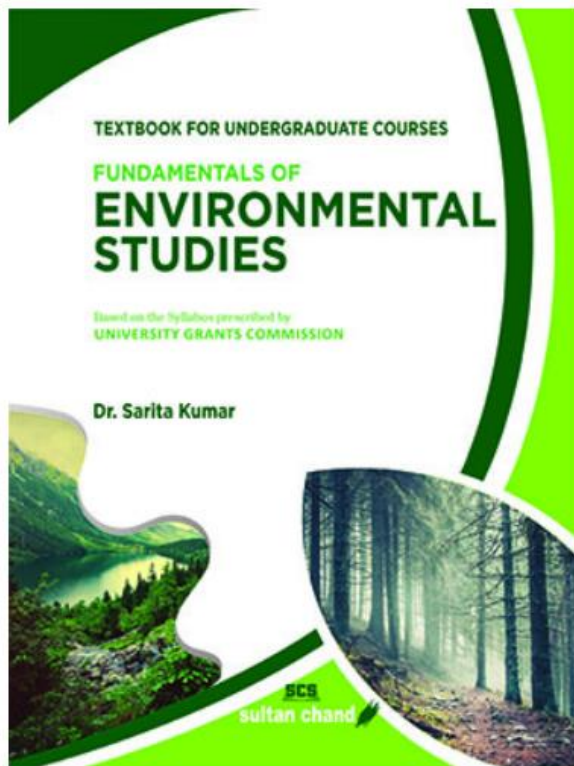
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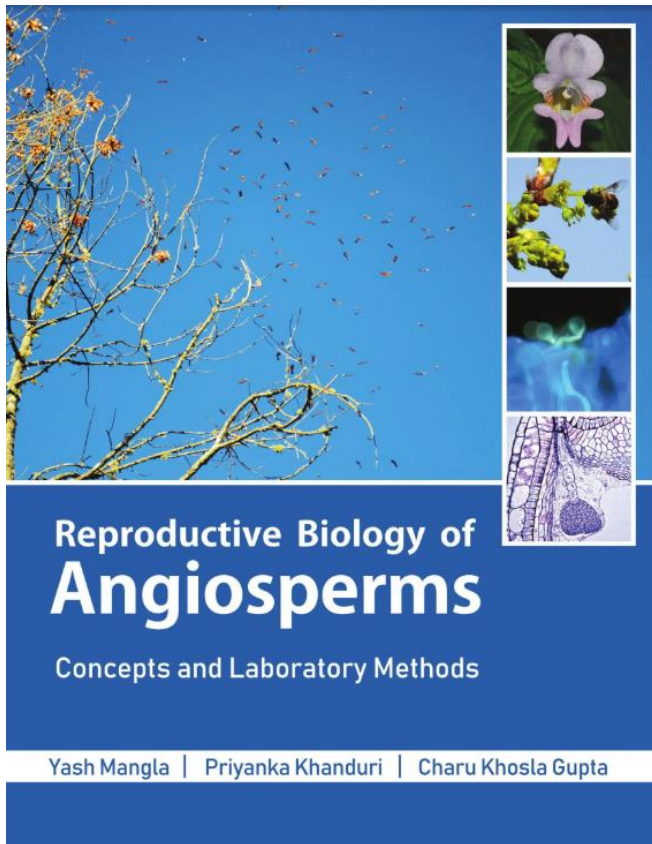
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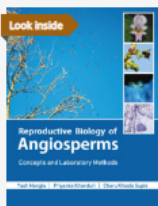
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### 1

## An Introduction to the Reproductive Biology of Flowering Plants



Reproduction is a very important stage in the life-history of a species, being essential for its survival and sustenance. Different organisms adopt different strategies as they attempt to maximize their reproductive success and produce a favourable number of new individuals. Reproduction in plants can be achieved by either vegetative or sexual means or a combination of both. The seeds and propagules produced by asexual and sexual modes of reproduction have differing implications on the perpetuation of the species. Asexual means (such as vegetative reproduction) in plants is a quicker reproductive strategy that leads to production of new individuals genetically identical to parents. However, there is a limitation of genetic variability in vegetative reproduction and this may affect the long-term survival of a species. On the other hand, reproduction by sexual means brings genetic heterogeneity in progeny resulting in their wider adaptability and better survival. Sexual reproduction in angiosperms is a complex process involving several sequential events which take place in different organs of a flower. Thus, flower is a unit of sexual reproduction in angiosperms.

Plant reproductive biology is the study of the mechanisms of both sexual and asexual reproduction in plants. It involves the study of interactions of plants with biotic factors (such as pollinators, seed dispersal agents) and abiotic components (such as soil, space, climate) in the environment. With the integration of the many aspects of ecology, reproductive biology of flowering plants is now also known as *Reproductive Ecology of Flowering Plants*.

### 1.1 Different aspects of Reproductive Biology of Flowering Plants

Study of reproductive biology of plants broadly includes observations on phenology, structural and functional floral biology, sexual system, pollination biology, mating system, pollen-pistil interactions, fertilization, embryo-endosperm development, seed formation,

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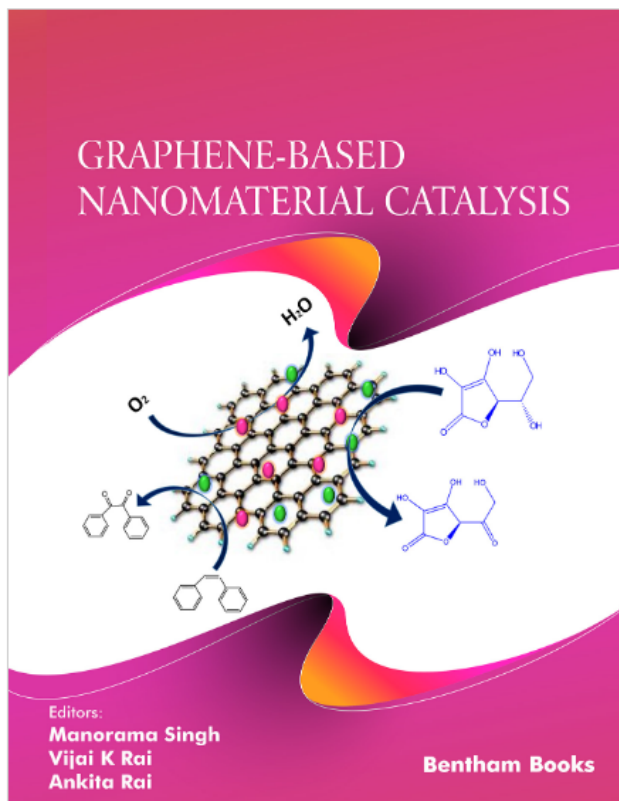
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**Graphene-Based Nanomaterial Catalysis** compiles knowledge about catalytic graphene-based nanomaterials in a single easy-to-read volume. The text serves to familiarize scholars and professionals with the methods of fabrication of both functionalized and non-functionalized graphene nanomaterials suitable for use in a variety of applications such as electrochemical sensors, oxygen and hydrogen production, fuel cells and organic transformations.

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- Accessible information about the fabrication of graphene-based catalysts
- updated knowledge about catalytic applications of graphene-based nanomaterials in electro- and organic catalysis.

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## **Graphene Based Nanomaterials as Catalyst in Reduction Reactions**

**Leena Khanna<sup>1,\*</sup>, Mansi<sup>1</sup> and Pankaj Khanna<sup>2</sup>**

<sup>1</sup> *University School of Basic and Applied Sciences, Guru Gobind Singh Indraprastha University, Sector 16-C, Dwarka, New Delhi-110078, India*

<sup>2</sup> *Department of Chemistry, Acharya Narendra Dev College, University of Delhi, Kalkaji, New Delhi-110019, India*

**Abstract:** The exceptionally outstanding physical and chemical properties as well as unique morphology of graphene have led to the development of various graphene-based catalysts, which are highly effective and selective in the reduction and hydrogenation reactions of organic compounds. This chapter is dedicated to compilation of the versatile reactions of hydrogenation/reduction over graphene-based catalysts. The use of catalyst allows highly effective and selective reduction of substrates in an effortless, recyclable, constructible and environmentally benign system.

**Keywords:** Eco-friendly, Graphene, Hydrogenation, Nanocomposites, Reduction, Solid support.

### **INTRODUCTION**

The chemistry of graphene has recently been explored and become an important part of material science just after a breakthrough work done by Geim and Novoselov in 2004 [1 - 3]. It has a 2D-sheet structure having conjugated carbon atoms with sp<sup>2</sup>-hybridization and an extended honeycomb-like network structure. Various properties of graphene, like high surface area, fine size, chemical inertness, great mechanical strength, and conductivity make it an ideal material for catalysis, organic conversion energy storage, *etc.*

The 2-dimensional single-layer carbon sheet structure of graphene serves as a building unit for the synthesis of graphite, fullerenes and nanotubes with three-, one- and zero-dimensional structures, respectively. Graphene sheets with a large

---

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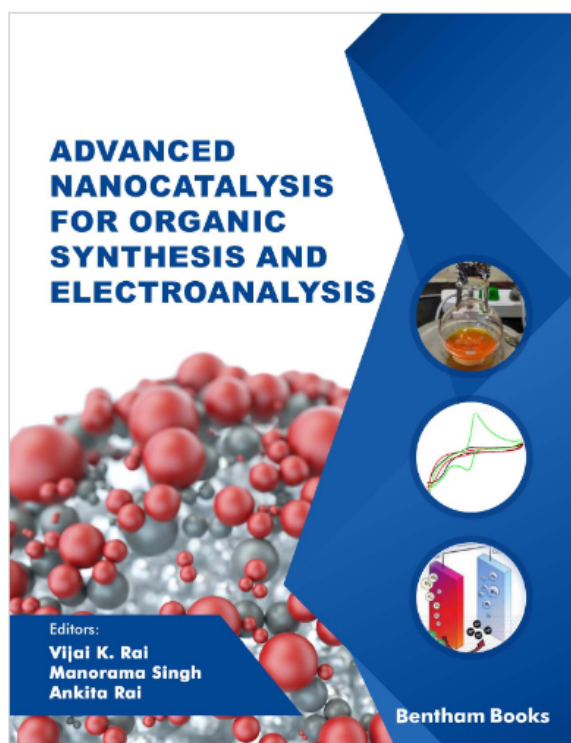
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This technical reference covers information about modern nanocatalysts and their applications in organic syntheses, electrochemistry and nanotechnology. The objective of this book is to present a review of the development of nanocatalysts in the fields of organic synthesis and electroanalysis over the last few decades. It provides readers comprehensive, systematic and updated information about the relevant topics. The reader is introduced to nanocatalysts, with the following chapters delving into the different chemical reactions in which they are involved. The topics covered include: carbon-carbon coupling reactions, aryl and organic carbon hetero atom coupling reactions, oxidation-reduction reactions, photocatalysis, heterocyclic reactions and multicomponent catalysis. The concluding chapters cover applications of nanocatalysts in electrochemical synthesis and sensing. The thirteen chapters demonstrate the value of a variety of catalysts that are important in

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## CHAPTER 6

## Nanocatalysis for Reduction/Hydrogenation Reactions

Leena Khanna<sup>1\*</sup>, Mansi<sup>1</sup> and Pankaj Khanna<sup>2</sup>

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<sup>2</sup> Department of Chemistry, Acharya Narendra Dev College, University of Delhi, Kalkaji, New Delhi-110019, India

**Abstract:** Heterogeneous nanocatalyst demonstrate excellent catalytic activity for the hydrogenation/reduction of nitro-aromatics, carbonyls, alkenes/alkynes in the presence of different reductants such as NaBH<sub>4</sub> and H<sub>2</sub>, using various solvents such as ethanol, methanol, dioxane, THF, and water, as green solvents. Earth-abundant coordinating elements such as Pd, Pt, Fe, Cu, Co, Ag, Au, and Ni, elementary synthesis, short time reactions, high selectivity, mild reaction conditions, and reusability of nanocatalyst for at least 4-5 cycles without any loss in catalytic activity, are some priorities for the hydrogenation reactions using nanocatalyst.

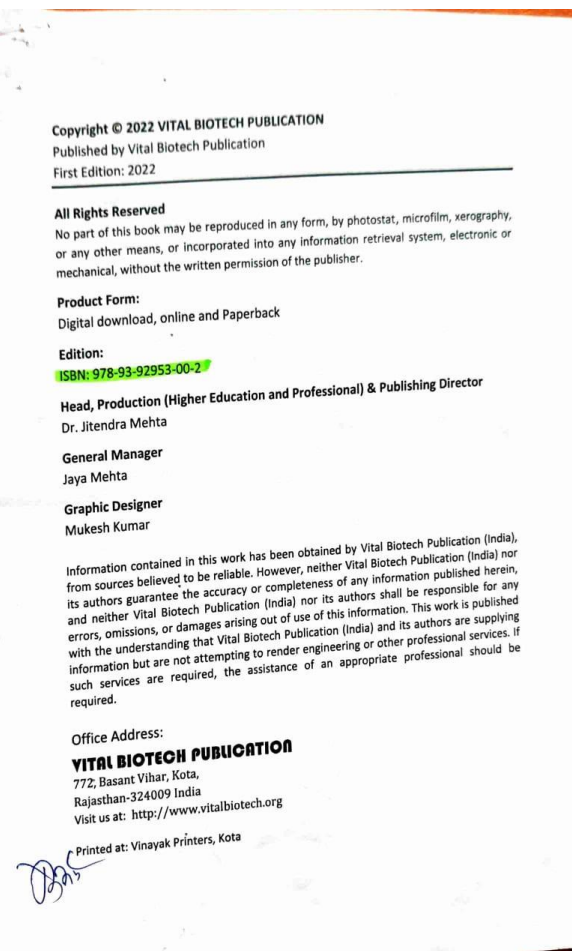
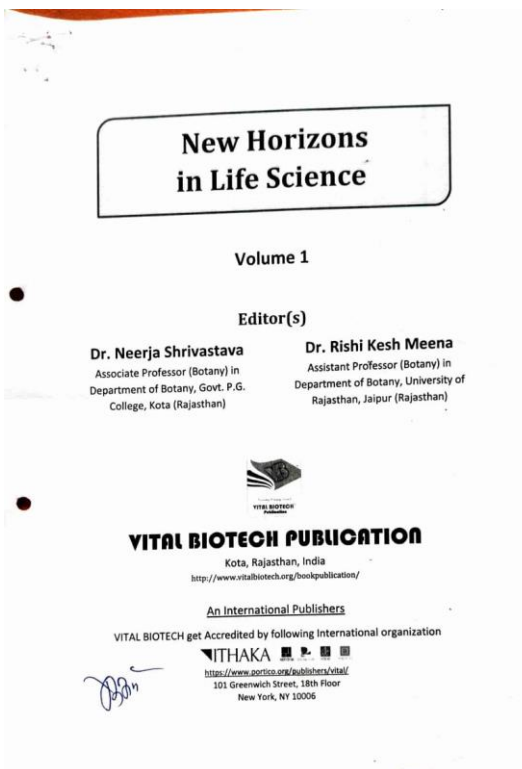
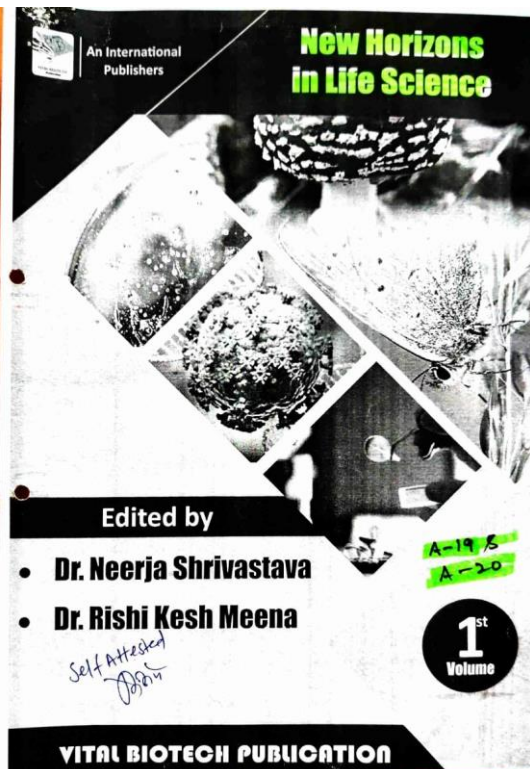
**Keywords:** Alkenes, Alkynes, Bimetallic, Carbonyls, Hydrogenation, Nanocatalyst, Nitro aromatics, Reducing agents, Reduction.

### INTRODUCTION

Hydrogenation and reduction of compounds are important chemical reactions in organic synthesis as well as industries. The use of heterogeneous metal catalysts has been the most versatile and dynamic process for these reactions. It was about 100 years ago when Paul Sabatier hydrogenated alkenes efficiently over Ni metal catalysts [1]. Since then, the use of these solid catalysts has multiplied thousand times. The heterogeneous metal catalysis owns a broad scope, besides Ni, Pd, and Pt, we now have several cheap metals to catalyse the hydrogen-ation/reduction reactions. A wide variety of multifunctional molecules are reduced by this method, and numerous value-added products can be obtained in high yield in a short time, with chemo and/or regioselective control.

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# 21 Chapter

## The Impact of Climate Change on Human Health in India: An Overview

Dinesh Kumar Arya<sup>1</sup>, Asha Verma<sup>2</sup> and Gobind Ji Rai<sup>3\*</sup>

<sup>1</sup>Department of Chemistry, Acharya Narendra Dev College,  
University of Delhi, Delhi, India

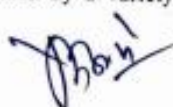
<sup>2</sup>Department of chemistry, University of Rajasthan, Jaipur, India

<sup>3</sup>Department of Chemistry, Swami Shradhdhanand College, University of Delhi, Delhi, India

### ■ Introduction:

Climate change occurs over decades, and still now-a-day climate change have occurred naturally, because of continental drift, numerous astronomical cycles, variations in solar energy output, and volcanic activity. Over the past few decades, it has become increasingly apparent that human actions changes atmospheric composition causing global climate change [1]. The Ministry of Earth Science (MoES), Government of India have published a report in 2020, under titled "Assessment of Climate Change over the Indian Region" considering that the impact of climate change as one of the most significant and concerning issues of the India that is the second largest country in the world by population and is rapidly catching up to China. The lack of adaptive capacity coupled with limited resources to help bolster health infrastructure have made it extremely challenging for the India to cope with the spread of illness and disease. Due to diverse array of temperature zones, climate change in India is now making things far worse. From the Himalayas in the far north, to coastal megacities, to deserts where the 50° Celsius mark is usually breached, the nation is persistently ranked as one of the most sensitive to climate change [2, 3].

The key question is, how will the climate change affect human health? Climate impacts numerous key determinants of health on which we depends that leads to extremes and violent weather events; resurgence of disease organisms and vectors, food and water, affects the quantity of air and the stability of the ecosystems. Climate changes have both direct and indirect impact on human health. Indirect impacts emanate from changes in temperature patterns that can disturb natural ecosystems, change the ecology of infectious diseases, exacerbate air pollution levels, harm agriculture and fresh water supplies, and cause large-scale reorganization of plant and animal communities [4]. Climate change is a significant and emerging threat to public health. The effects of climate change on human health are influenced by a variety of pathways and there may be long delays between





# 20 Chapter

## Biological and Physical Applications of Silver Nanoparticles

Rajesh Kumar Meena<sup>1</sup>, **Dinesh Kumar Arya**<sup>2</sup>, Aprajita Gaur<sup>1</sup>, Divya Verma<sup>1</sup>,  
Princi Singhal<sup>1</sup>, Yashika Aggarwal<sup>1</sup> and Anjali Saini<sup>1</sup>  
<sup>1</sup>Kalindi College, University of Delhi  
<sup>2</sup>Acharya Narendra Dev College, University of Delhi

### ■ Introduction:

A nanotechnology process involves designing, fabricating and applying nanostructures or nanomaterials, and analyzing the relationship between physical properties and the dimensions of those materials. Materials or structures that have nanometer-scale dimensions are known as nanotechnology, which includes substances and systems in the nanometer range.

$$1 \text{ nm} = 10^{-9} \text{ meter}$$

The nanotechnology field deals with developing and utilizing nanostructures or nanoscales with individual atoms arranged at intermediate scales, providing new properties as compared to bulk materials [1]. Figure 1 illustrates a variety of nanomaterials.

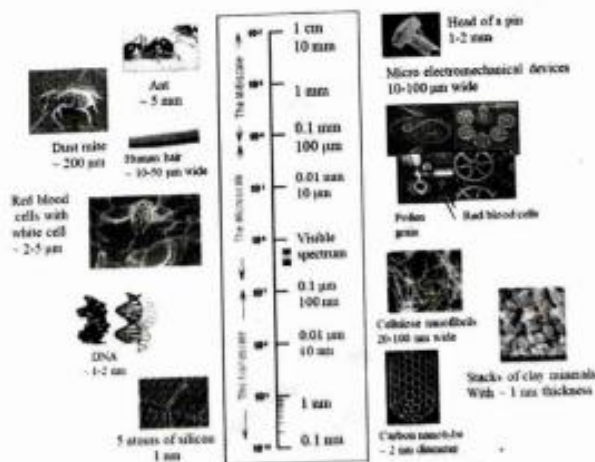


Figure 1 Visualization of Nanometer [2]

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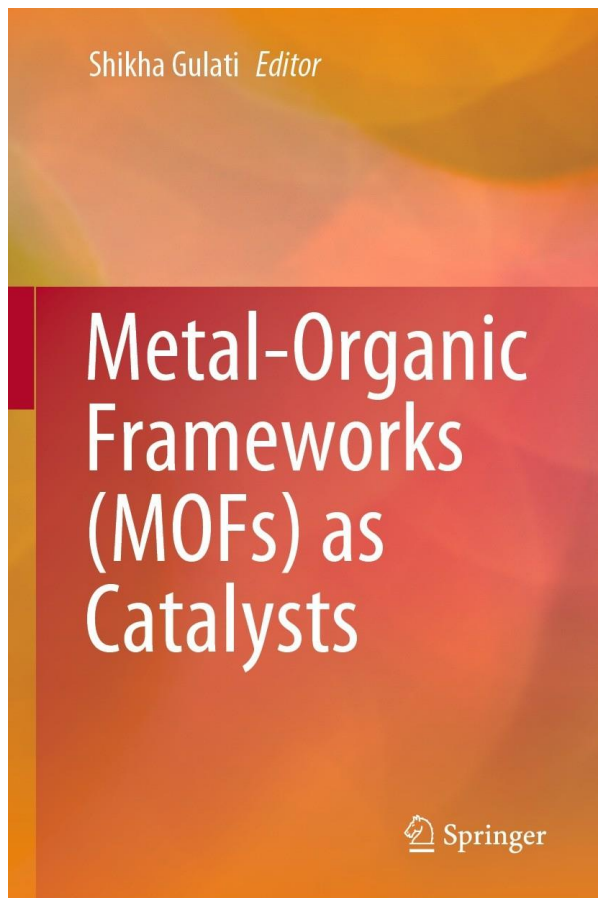


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## Metal-Organic Frameworks (MOFs) as Catalysts

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**Metal-Organic Frameworks (MOFs) as Versatile Detoxifiers for Chemical Warfare Agents (CWAs)**

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## Metal–Organic Frameworks (MOFs) as Versatile Detoxifiers for Chemical Warfare Agents (CWAs)

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### Abstract

Chemical warfare agents (CWAs) are considered as one of the most fatal weapons potentially strong to cause extreme toxicity and disastrous effects to a large population. They were used as weapons for the first time in 1915 during World War I (WWI) when Ypres, a Belgian city, was attacked by the German military. Sulfur mustard, a dreadful chemical warfare agent, which was used in the subsequent battles became the major cause of chemical casualties in WWI. These chemicals imposed harsh after-effects even years after they were deployed. Nerve agents and vesicants are particularly known to be extremely harmful, among the various classes of CWAs; even short-term exposure to these chemicals can lead to severe after-effects. Above all, CWAs also release various volatile organic compounds (VOCs), which comprise an important group of air pollutants, which can potentially cause serious health effects to mankind including mutagenesis and carcinogenesis. In view of these consequences, capture and subsequent degradation of these agents to less or completely non-toxic by-products are of paramount importance. Being highly toxic, degradation of hazardous CWAs through catalytic reactions such as hydrolysis, methanolysis, and oxidation has been proved to be one of the best methods that can eventually transform them into less-toxic products. Research communities throughout the globe have been making relentless attempts on developing novel catalytic materials in this field. Metal-organic frameworks (MOFs), being specifically designed making use of organic linkers and inorganic nodes, offer scope for fabrication of a versatile range of materials with great diversity in structural and chemical properties, characterized by their high stability, crystalline, and ordered nature with significantly large surface areas, high porosity, and free volume. The presence of freely available metal sites and/or numerous functional moieties on the surface of the MOFs allows adsorption or capture of certain toxic CWAs with high selectivity and efficiency via various interactions which may be either H-bonds, ionic or Coulombic interactions, coordination bonds,  $\pi$ - $\pi^*$  interactions, etc. or a combination of these. Moreover, further functionalization with coordinating or conjugating agents also imparts them good catalytic properties. The pore properties along with the specificity of the functional groups in the MOFs together ascribe to the subsequent catalytic degradation of highly toxic CWAs and their simulants.

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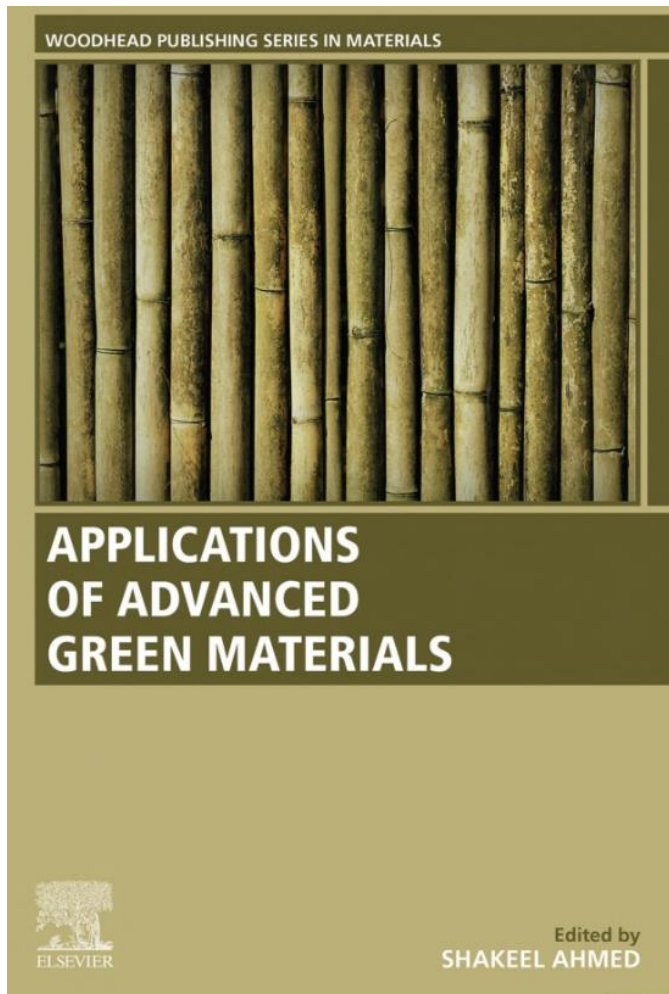
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## 6 - Nanostructured inorganic–organic silica as green material for sustainable development of catalysts

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### Abstract

Nanotechnological developments have paved new frontiers to develop solid materials with unique well-defined shapes and properties. These are employed to tailor the catalytic sites which are required for selective catalysis. In this regard, nanostructured inorganic–organic hybrid catalysts have been developed to address the shortcomings of homogeneous and heterogeneous catalysts. Silica nanoparticles have been employed as excellent support materials for fabrication of these hybrid nanocatalysts which possess outstanding features like high activity, selectivity, easy recoverability, and recyclability, which are key prerequisites to attain sustainable development. This chapter provides an overlay of recent advances in fabrication of nanostructured hybrid catalysts and its application for carrying out organic transformation reactions.

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


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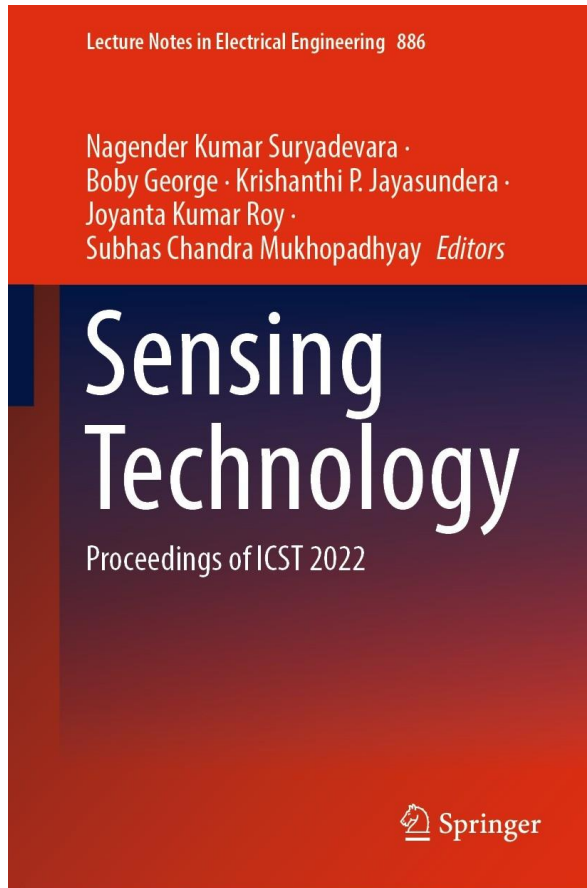
Efficient and enhanced gas sensing especially at room temperature is the demand for contemporary industrial applications. This has been made possible due to a paradigm shift from semiconducting metal oxides to 2D materials including Graphene Oxide (GO) and reduced GO (RGO). GO and its derivatives have ushered in a revolution mainly because of their high surface to volume ratio and presence of various oxygen groups. Literature reports since 2010 indicate existence of investigations by many research groups wherein multiple approaches have been employed to enhance the gas sensing capabilities of GO and RGO. Some of the more radical approaches have been fabrication of free standing GO films, adoption of green fabrication techniques, thermal reduction and even implantation of nitrogen ions. However, quantitative augmentation of favourable oxygen species on the GO films envisaged to act as active sites for the target gas molecules (H<sub>2</sub> and SO<sub>2</sub> in the current investigation) is yet to be carried out. The present study reports enhancement in detection of gaseous species due to twin mechanisms of a) advantageous tailoring of surface morphology and b) presence of favourable oxygen species. Both the processes are shown to occur due to intentional incorporation of variations induced in the sonication process during synthesis of GO films.



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### Abstract

In the present work, an effort has been made to fabricate conductometric gas sensors based on thin films of Cadmium Sulphide (CdS) doped Tin Oxide (SnO<sub>2</sub>), for detection of NO<sub>2</sub> gas at RT (room temperature) and the sensing response was studied at RT on 3% CdS nanoparticles doped SnO<sub>2</sub> thin film toward 10 ppm of NO<sub>2</sub> gas. The sensing response of CdS-SnO<sub>2</sub> nanocomposite was studied and compared with thin films of bare SnO<sub>2</sub>, bare CdS.


Incorporation of CdS in SnO<sub>2</sub> yielded the maximum sensing response of ~377 with faster response and recovery time of 8 s and 107 s respectively toward 10 ppm of NO<sub>2</sub> at RT. Bare SnO<sub>2</sub> and bare CdS thin films showed the sensing response of ~3.85 and ~89 respectively at RT.

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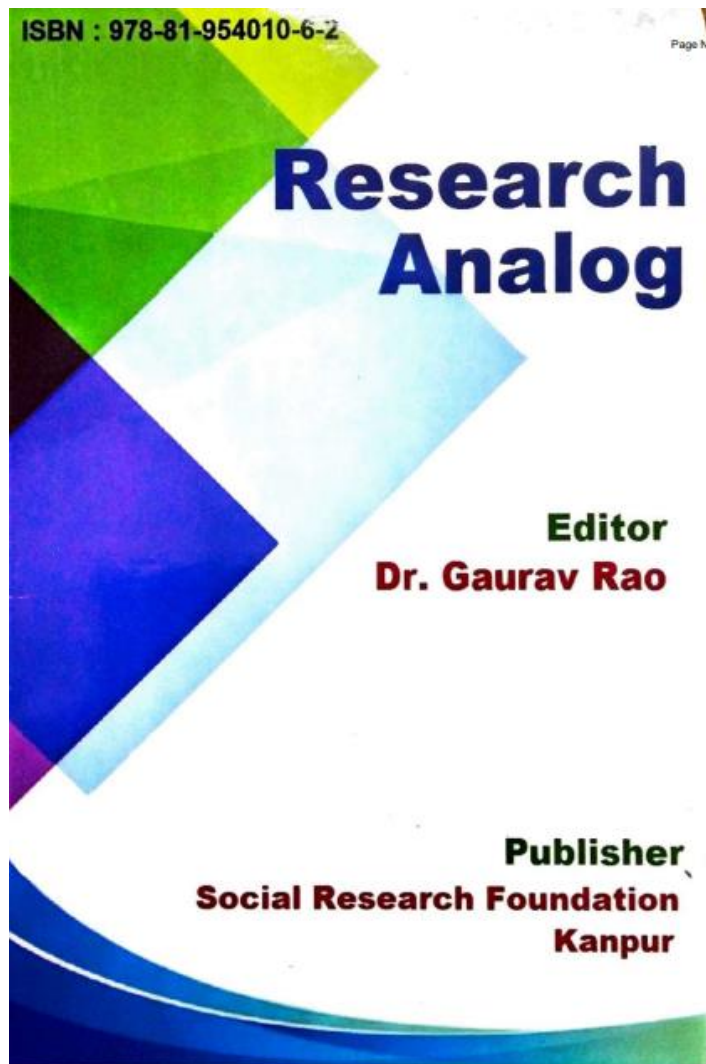
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### Introduction

In India social security system was available for all government employees by providing pension after retirement. But a large number of populations not being government employee are not covered with social security after the age of 60. There was need to introduce pension reforms in India. There was need to cover each and every citizen under pension scheme. To fulfill the object in 1998, Government of India set up an expert committee. The purpose of this committee to devise new pension system which can be implemented in India for the welfare of citizens as well as Government employees. Committee submitted its report

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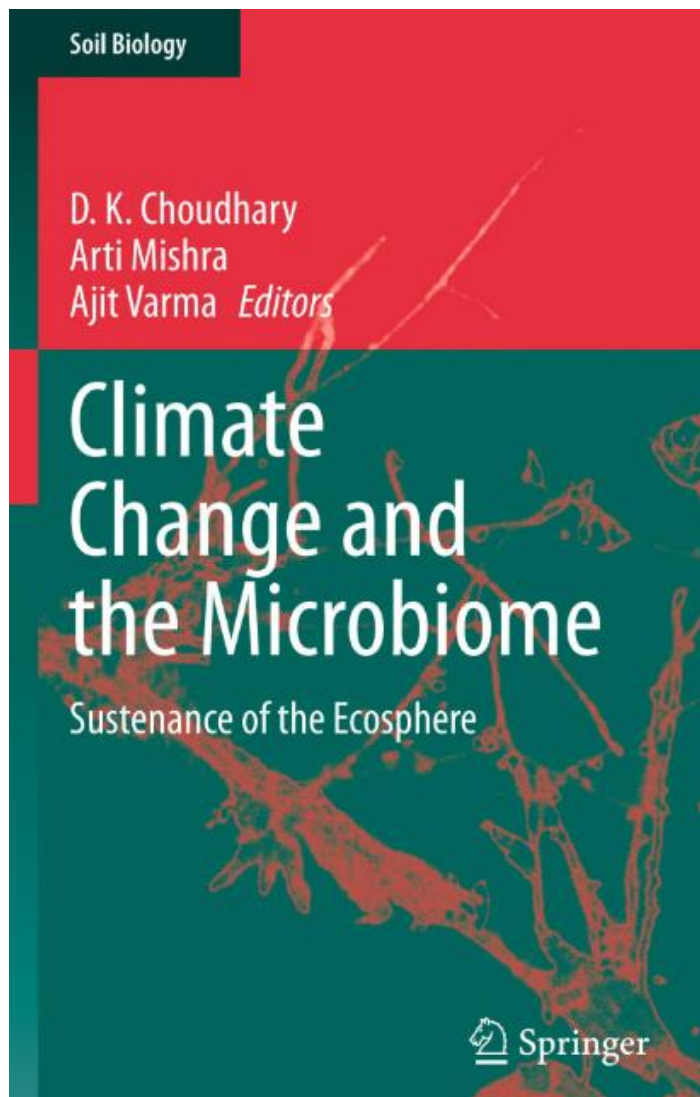
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## Abstract

In the study of global changes and ecosystem impacts, it is very important to consider mycorrhiza, because they hold a critical position at the plant-soil interface. Human-induced environmental changes on earth depend on number of factors such as increasing atmospheric CO<sub>2</sub>, nutrient enrichment by atmospheric deposition (N<sub>2</sub>), altered precipitation and temperature. All these changes taking place in present and will surely increase in the future can impact the association of fungi with plant roots in a positive or negative direction. These factors are classified on the basis of their impact on colonization of mycorrhiza viz. factors affecting arbuscular mycorrhiza (AM) fungi indirectly by altered allocation of carbon from the host and factors that directly affect AM fungi i.e. altered precipitation, temperature and nitrogen deposition. For the study of global climate change and its impact on AM fungi, this distinction in responses to different factors is very important. These global change factors always occur in association, since experimental examination of a large number of scenarios would not be possible in-situ. Therefore for the study of global changes on AM fungi, large spatial and temporal scale assessments have been considered. The majority of experiments only permit to extract short-term responses, though long-term responses are more appropriate. For example, CO<sub>2</sub> springs, global distribution of plant communities and regional extinction because of climate change. AM fungal community may also be impacted according to host biodiversity at local scales. Further, changes in AM fungal community that are not affected by the changes in plant community should be studied to find precise response of mycorrhizas to global change.

## Chapter 21

# Impact of Climate Change on Functional AM Fungi in Rhizosphere



Manoj Kumar Singh, Sumit Sahni, and Anita Narang

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**Keywords** AM fungal community · Elevated CO<sub>2</sub> · Elevated temperature

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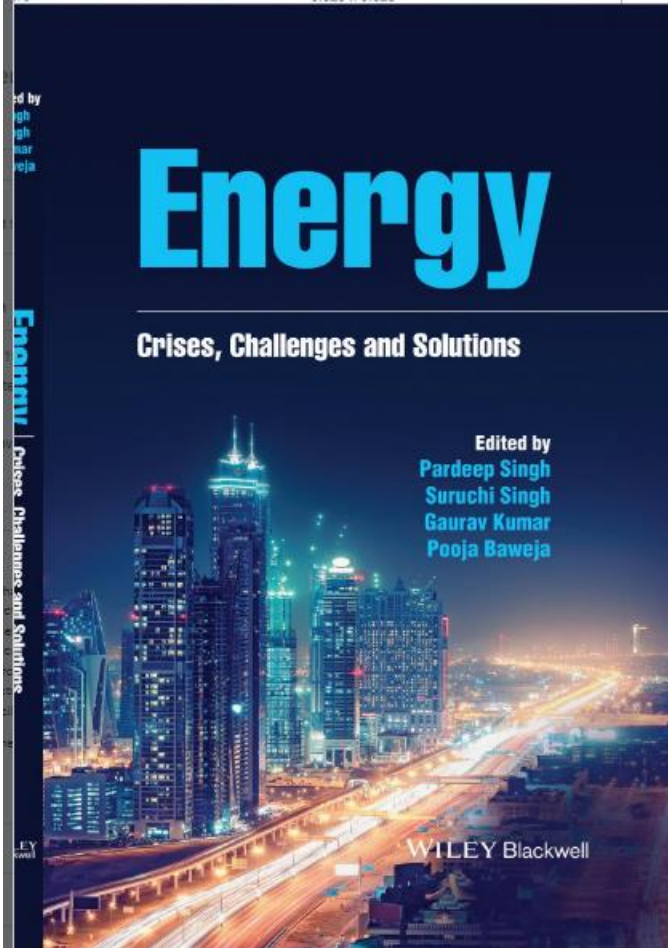
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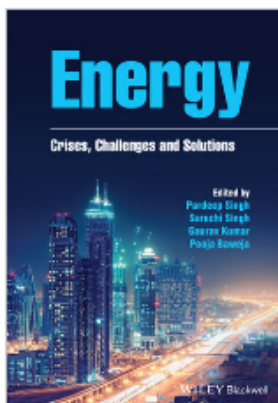
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### 12.1 Introduction

In the past two decades, gradually exhausting fossil fuel reserves and increasing environmental pollution due to excessive use of fossil energy forced many countries to put forward the 'energy strategy' for their sustainable development. This strategy promotes the use of renewable energy resources in place of fossil fuels (Han et al. 2019). According to the 2018 report of the US Energy Information Administration (USEIA), fossil fuels contribute 80% of the total energy consumed worldwide, and this share is going to reduce somewhat (70%) by 2050 (International Energy Outlook 2019), which is clearly unsustainable. Therefore, the production of renewable fuels is urgently required by using renewable resources to replace these non-renewable conventional fuels. At the present time, the main sources of renewable energy include solar energy, wind energy, biomass, hydrogen energy, geothermal energy and ocean energy. Among these renewable energy resources, biomass contributes 70%, the highest of all the available renewable energies (Panwar et al. 2011; Jurasz et al. 2020). The term biomass comprises any material coming from microbes, plants and animals which can be used as an energy source. In the perspective of biomass energy, it is generally called lignocellulosic biomass (LCB), which mainly consists of plant-based materials and plant dry matter. LCB consists of three structural components i.e. cellulose, hemicellulose and lignin with composition varying from 40 to 60, from 20 to 40 and from 10 to 25 wt%, respectively. Cellulose, a linear carbohydrate polymer, consists of 100 to over 10000 of  $\beta$ -D-glucose units linked through glycosidic linkages. In contrast, hemicellulose is a branched copolymer of pentose and hexose monomer units situated in a plant cell wall along with lignin. Lignin is the most complex of all, is an amorphous polymer of phenolic compounds and has high energy density than cellulose and hemicellulose. After depolymerization of lignin, phenolic compounds such as phenol, guaiacol, syringol and other derivatives were obtained (Saidur et al. 2011; Schutyser et al. 2015; Nanda et al. 2016).

Transformation of LCB into liquid fuels can be achieved through many routes such as high-pressure liquefaction (Wang et al. 2008), fast pyrolysis (Wang et al. 2017), hydrolysis and fermentation (Lu et al. 2010) etc. as shown in Figure 12.1. Fast pyrolysis generates

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## Sustainable Solution for Future Energy Challenges Through Microbes

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### 13.1 Introduction

Unprecedented growth in population and increase in the socio-economic stature of the middle class globally have created an incessant demand for energy. Today, most of the global energy demand is catered by fossil fuels which have limited reserves on earth and are rapidly depleting. Hence, these cannot sustain the burden of energy demands for more than two or three decades. This led the United Nations to add energy generation and distribution in its 17-point sustainable development goals (SDGs) in which it emphasized to increase the share of renewable energy progressively. Biofuels are an important one among the many available renewable energy sources which have the potential to satiate the ever-increasing energy demand and prove as a sustainable source of energy. Anything which can be used as fuel and has its origin from living organisms can be considered as biofuel. Biofuels in the form of wood, wood chips, charcoal etc. have been in use since time immemorial but cannot take centre stage due to their own limitations. Alternative biofuels include bioethanol, biodiesel, biogas, biohydrogen and bioelectricity which are more usage-ready and can be generated from the biomass available. Based on the resources used to produce them, biofuels have been classified into four generations i.e. first, second, third and fourth. Each generation has its own merits and demerits. Some are well studied, and technologies have been developed to produce them efficiently but are competing with food crops; others have no competition with food crops; however, the technologies involved in their generation are in infancy and need lots of research for their commercialization. There are some roadblocks which deter to prove them as sustainable energy sources which will be overcome in coming years. The major organisms involved in biofuel generation are not the higher organisms but microorganisms such as bacteria, fungi and algae which contribute at each step of biofuel production ranging from presenting themselves as biomass to treatment of biomass or as producers of catalysing enzymes in myriads of biochemical reactions involved.

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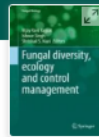
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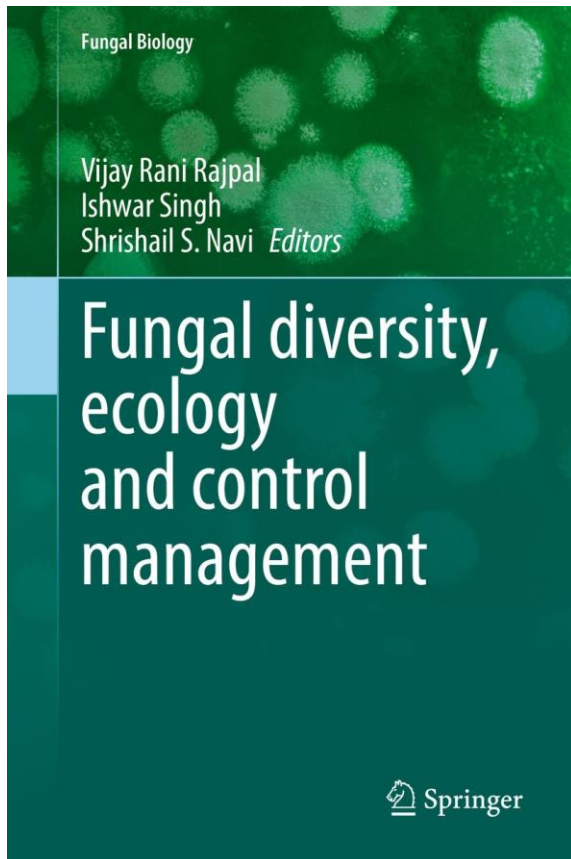
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## Facets of AM Fungi in Sequestering Soil Carbon and Improving Soil Health

Richa Agnihotri | Sumit Sahni | Mahaveer P. Sharma &amp; M. M. Gupta

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### Abstract

Soils, particularly agricultural soils, are home to a plethora of microbial communities capable of sequestering soil carbon. In this framework, arbuscular mycorrhizal fungi (AMF) play a pivotal role. This universal group of fungi form an obligate symbiotic relationship with the roots of higher plants leading to improved nutrient uptake and abiotic and biotic stress resistance. In addition, these fungi secrete a group of glycoproteins called glomalin or glomalin-related soil protein (GRSP) that sustain soil health, cement soil aggregates, and sequester soil C in a stable form. AMF symbiosis and GRSP production are however influenced by numerous aspects, including crop and soil management practices. Besides plant and soil type, soil management practices also influence AMF diversity and abundance. The soil carbon sequestration via AMF and GRSP is achievable if AMF supporting agricultural practices are employed. This chapter summarizes the cumulative role of AMF and GRSP in forming and stabilizing soil aggregates for long-term C storage, the influence of AMF-mediated agricultural practices to sequester soil carbon and improve soil quality traits.

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### Abstract

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