



# Introduction to Microbiology

**Dr. Shama A. Baig**  
**Dr. Sanju Sinha**



# Introduction to Microbiology



**First Volume**

**Editors**

Dr. Shama. A. Baig  
Dr. Sanju Sinha



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# Preface

We are delighted to present first edition of the book entitled “Introduction to Microbiology” for U.G Students who opted a keen interest in this subject. This book covers the basics microbiology which is first stair to graduates. This book provides the basic information in the various fields of microbiology, the History and developments, scope of microbiology, various systems of classification. It chronologically includes the chapters on viruses and their complex structures, bacteria and its types, structure and morphology, archaebacteria; their origin on the earth and the complication of their cell wall is well explained, fungi – its structure, types & economic importance, Phycology; its economic importance, Protozoology; diseases and their life cycles, microscopy, sterilization and isolation staining techniques in the field of microbiology are included in this book.

It is obligatory to provide the recent study material made in the field of microbiology to the readers so as to stretch out the expectations of the readers. Hope our book will reach out to the reader’s expectation. Every book chapter of this book has a different author. The author’s have immensely worked hard to make every single chapter captivating for all the readers.

*Dr. Shama A. Baig*

*Dr. Sanju Sinha*

# Acknowledgement

I am pleased to endorse this book on Introduction to Microbiology which is basics about microbiology. The book provides details insight about all the groups of microorganism, their classification and economic importance. All the authors have done an excellent job of presenting the topics in simple and understandable way. The book is perfection for the student entering for their graduation in the field of microbiology. It is a matter of great privilege to Exton the cognition of my fellow professors who have contributed their chapters for this book and have made this book to come through for the benefit of students. I owe special thanks to Miss. Yogita Lokhande and Miss. Samiksha Mishra for their cooperation and immense help in the completion of this work at the time of need they were always supportive for their help. All the time on my way towards my goal the everlasting blessings and love of my parents, my husband, my daughter and other family members has always been a source of enlighten. Lastly I wish to apologize for any inadvertent omissions of the names of person who helped me in one way or the other. Nothing is possible without the blessing of all which I always felt very close to my heart.



***Dr. Shama A. Baig***


***Dr. Sanju Sinha***


# Contents

1	History and Development of Microbiology ..... <i>Dr. Kiran Jain &amp; Samiksha Jain</i>	1-19
2	Classification System ..... <i>Dr. Anita Mahiswar &amp; Dr. Shama A. Baig</i>	20-29
3	Virology ..... <i>Dr. Arpita Mukherjee</i>	30-50
4	Bacteriology ..... <i>Dr. Seema Sahu</i>	51-77
5	Archaeobacteria (Archaea) ..... <i>Miss. Samiksha Mishra</i>	78-90
6	Mycology ..... <i>Dr. Reena Kulshrestha</i>	91-105
7	Phycology ..... <i>Dr. Sweta Gaikwad</i>	106-126
8	Protozoology ..... <i>Dr. Sanju Sinha and Dr. Alka Mishra</i>	127-162
9	Microscopy ..... <i>Amit Kumar Sahu</i>	163-173
10	Sterilization and Staining Techniques in Microbiology ..... <i>Dr. Sanju Sinha</i>	174-189
11	Isolation and Staining Techniques ..... <i>Ms. Yogita Lokhande</i>	190-200







# Index



<p><b>1</b></p>	<p><b>History and Development of Microbiology</b></p> <p>Fundamentals of Microbiology History Development of Microbiology Golden Era of Microbiology Fields of Microbiology Major groups Role of Microbes in Daily Life Pioneers of Microbiology Antony von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Fleming, Martinus W. Beijerinck Sergei N. Winogradsky, Selman A. Waksman, Paul Ehrlich, Elie Metchnikoff, Edward Jenner, Hans Christian Gram.</p>	<p><b>1. Dr. Kiran Jains,</b> Asst. Prof. Botany Govt. Digvijay Autonomous College, Rajnandgaon (C.G.). Teaching experience of 26yrs in Botany, specialization in Microbiology, JRF - DGHS and completed Phd , MSC and BSC from Dr. Harisingh gaur University (Sagar, MP).</p> <p><b>2. Ms. Samiksha Jain,</b> Completed B. Pharmacy from SSTC-FPS (CSVTU) Bhilai, M. Pharmacy in Pharmaceutics from RGPV (Bhagyoday Tirth Pharmacy College (Sagar, MP).</p>	  
<p><b>2.</b></p>	<p><b>Classification System</b></p> <p>Principles of Classification Binomial Nomenclature Haeckel's three Kingdom Whittaker's five Kingdom Carl Woese's 3 domain system Concept of Prokaryotic and Eukaryotic Microorganisms.</p>	<p><b>1. Dr. Anita Mahiswar,</b> Ph.D. Botany, Presently Professor &amp; Head, Dept. of Botany, Government Digvijay Autonomous College, Rajnandgaon (C.G.). She has more than 39 years of teaching experience. Dean of Life Sciences, Hemchand Yadav University Durg and Ex Chairman of Botany in, Hemchand Yadav University Durg. She has attended 30 above</p>	



		<p>Conferences and 18 Webinars at National and International levels and presented papers. She has published 15 research papers, and has 1 patent.</p> <p><b>2. Dr. Shama Afroze,</b> Baig,( GATE, JRF, SRF, RA, Ph.D. Life-Sciences) Head of Department (Microbiology) at Swami Shri Swaroopanand Saraswati Mahavidyalaya, Hudco, Bhilai, C.G. She has 24 years of teaching experience. Member of Board of studies, Hemchand Yadav University Durg. She has been honored with 12th M.P Young Scientist Award 1997, She has a membership in around 20 Committees. She has attended 80 above Conferences and 33 Webinars at National and International levels and presented papers. She has published 32 research papers, 1 Book and 3 patents (2 National, 1 German).</p>	
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<p><b>3.</b></p>	<p><b>Virology</b></p> <p>General Introduction Morphology and ultra structure of viruses Viral genomes Viral related forms-visions, viroids, virusoids, and prions Classification (Bacteria, Plant &amp; Animal) Brief description of Bacteriophage T4, Lambda, TMV, CMV, Adenovirus, Poxvirus Retrovirus.</p>	<p><b>1. Dr. Arpita Mukherjee,</b> Assistant Professor Biotechnology at Sai College, Sector 6, Bhilai. She is B.Sc Microbiology, M.Sc. Biotechnology and Ph.D Biotechnology. She has published various research and review paper in Journal and in Conference proceedings.</p>	
<p><b>4.</b></p>	<p><b>Bacteriology</b></p> <p>Morphology and Ultrastructure of Bacteria Cell wall of gram positive and gram negative structure and functions of organelles and membranes, plasmids Spore formation,</p>	<p><b>1. Dr. Seema Sahu,</b> Presently working as an Asst.Prof. Botany at Gurukul Mahila Mahavidyalaya, did her M.Sc(Botany) from Govt. D.B. Girls PG College Raipur, Ph.D,Botany from Pandit Ravishankar Shukla University Raipur 2017. She has published more than 10 papers .She has attended 30 International and National seminar and presented papers, posters. She was 9 year teaching experience.</p>	
<p><b>5.</b></p>	<p><b>Archaeobacteria</b></p> <p>Methanogens Thermophiles Halophiles Eubacteria: Gram positive- High G+C; Streptomyces, Frankia, Low G+C; Bacillus, Clostridium,</p>	<p><b>1. Miss. Samiksha Mishra,</b> Assistant Professor of Microbiology at Swami Shri Swaroopanand Saraswati Mahavidyalaya. She has worked in the position of Executive Tutor at a company serving US</p>	

	<p>Staphylococcus Gram negative; Non-Proteobacteria- Deinococcus, Spirochetes; Alpha Proteobacteria- Rhizobium, Agrobacterium; Gamma Proteo Bacteria- Escherichia coli, Pseudomonas</p>	<p>students online. She has done her Masters in Microbiology from Hemchand Yadav University securing place in merit with 9th rank across University. She has been actively participating in several workshops in her domain.</p>	
<p><b>6.</b></p>	<p><b>Mycology</b></p> <p>Domain Classification General features, Structure, Reproduction, Economic Importance, Brief description of Penicillium, Aspergillus, Rhizopus and Yeast.</p>	<p><b>1. Dr. Reena Kulshrestha,</b> PhD in Microbiology have been associated with academics since last 30 years of which having nearly 22 years of teaching experience in Medical and Dental Colleges of India. Presently working as Coordinator – College Administration and HOD – Medical Departments at Rungta College of Dental Sciences and Research, Bhilai, The urge and love towards Medical Microbiology propelled me to bring on this chapter regarding Mycology. In addition to this, she has 2 Patents, secured 2nd merit in postgraduate. With her teaching experience, she has transformed thousands of lives in this field. She own YouTube channel, where you can find herlectures on parasitology, culture media etc.</p>	

<p><b>7.</b></p>	<p><b>Phycology</b></p> <p>Domain  Classification  General features, Structure  Reproduction  Economic Importance  Brief description of  Cyanobacteria  Spirulina, Nonstoc,  Anabena.</p>	<p><b>1. Dr. Sweta Gaikwad,</b>  Presently working as an  Assistant Professor of  Botany at Shri  Shankracharya  University and having  16years of teaching and  research experience at  different recognized  and renound  institutions. Have  published 10 research  papers in various  national and  international journals  as well as 2 impressive  book chapters till date.</p>	
<p><b>8.</b></p>	<p><b>Protozoology</b></p> <p>Domain  Classification  General features,  Structure, Reproduction,  Economic Importance,  Brief description of  Diseased caused by &amp; Life  cycle of Entamoeba,  Giardia, Leishmania,  Plasmodium,  Trypanosoma</p>	<p><b>1. Dr. Sanju Sinh, (Ph.D.</b>  LifeSciences) Gold  Medalist M.Phil. Pt  Ravishankar Shukla  University, Raipur.  Presently she is  working as an Assistant  Professor of Zoology in  Govt. V.Y.T. PG  Autonomous College;  Durg .She has more  than 25 years of  research experience  with work on  Environmental  Biology, Pollution  Biology, Biodiversity  with extensive works  on protozoa of  Chhattisgarh. She has  more than 10 research  papers in National and  International Journals.  To her credit she has  published 6 books. She  had served as Senior  Scientific Officer in  Chhattisgarh Council  of Science and  Technology for more</p>	

		<p>than 9 Years. 5 students enrolled under her for Ph.D. degree.</p> <p><b>2. Dr. Alka Mishra,</b> passed her M.Sc. from Govt. V.Y.T. PG Autonomous College, Durg. She obtained her M.Phil, and Ph.D. degree from Pt Ravishankar Shukla University, Raipur. She has more than 25 years of research experience. She has more than 15 research papers in National and International Journals. To her credit she has published 3 books. Presently she is working as an Assistant Professor of Zoology in Govt. V.Y.T. PG Autonomous College, Durg and is guiding 4 students for Ph.D. degree.</p>	
<p><b>9.</b></p>	<p><b>Microscopy</b></p> <p>Introduction to microscopy Bright Field Dark Field Phase Contrast Fluorescent Microscope Electron Microscope Sterilization Techniques Gram Staining Negative Staining Acid Fast Staining Sterilization techniques (Physical and Chemical)</p>	<p><b>1. Amit Kumar Sahu,</b> Presently Junior Scientific Officer in Chhattisgarh Swami Vivekanad Technical, is pursuing PhD in Microbiology from Hemchand Yadav University Durg Chhattisgarh. His manifold fields of interest include organic farming, Biofertilizer, vesicular arbuscular mycorrhiza as future biofertilizer and environmental science. He has presented his</p>	

		<p>research papers at various conferences and seminars. He has more than 4 research papers in National and International Journals. To his credit he has published 1 book chapter.</p>	
<p><b>10.</b></p>	<p><b>Sterilization Techniques</b>          Gram Staining          Negative Staining          Acid Fast Staining          Sterilization techniques          (Physical and Chemical)</p>	<p><b>1. Dr. Sanju Sinha,</b> (Ph.D. LifeSciences) Gold Medalist M.Phil.Pt RSS Uni., Raipur. Presently she is working as an Asst. Prof. Zoology in Govt.V.Y.T. PG Autonomous College,Durg.She has more than 25 years of research experience with work on Environmental &amp; Pollution Biology, Biodiversity with extensive works on protozoa of C.G. She has published more than 10 research papers in National &amp; International Journals. To her credit she has published 6 books. She served as Senior Scientific Officer in Chhattisgarh Council of Science and Technology for 9years. 5 students enrolled under her for Ph.D. degree.</p>	

<p><b>11.</b></p>	<p><b>Isolation and Staining Techniques</b></p> <p>Culture Media and their types  Natural  Synthetic  Complex Media-  Differential, Enriched, Enrichment, Selective media  Pure culture isolation Techniques  Streak plate  Spread plate  Pour plate</p>	<p><b>1. Ms. Yogita Lokhande,</b>  Presently she is working as an Asst. Prof. Microbiology at Swami Shri Swaroopanand Saraswati Mahavidyalaya, Hudco, Bhilai, C.G.. Passed her M.Sc. in Microbiology and Currently Pursuing Post Graduate diploma in yoga and philosophy from Govt. V. Y. T. PG. Autonomous College, Durg. She has Published one research paper in reputed journal as well as one patent in Indian Patent Office and has attended various national and international workshop, conferences and seminar. She achieved 3 position in Hindi Essay Writing organized in joint aegis of Ferro Scrap Nigam Lmt. &amp; Hindi Kendriya Sachivalaya, New Delhi. And She is active member of Board of Studies of Microbiology &amp; Microbiologist Society India. Presently she is working as an Asst. Prof. Microbiology at Swami Shri Swaroopanand Saraswati Mahavidyalaya, Hudco, Bhilai, C.G.. Passed her M.Sc. in Microbiology and Currently Pursuing Post Graduate diploma in yoga and philosophy</p>	
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		<p>from Govt. V. Y. T. PG. Autonomous College, Durg. She has Published one research paper in reputed journal as well as one patent in Indian Patent Office and has attended various national and international workshop, conferences and seminar. She achieved 3 position in Hindi Essay Writing organized in joint aegis of Ferro Scrap Nigam Lmt. &amp; Hindi Kendriya Sachivalaya, New Delhi. And She is active member of Board of Studies of Microbiology &amp; Microbiologist Society India.</p>	
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## ABOUT AUTHORS



**Dr. Shama Afroze Baig** is Assistant Professor and Head of Department (Microbiology) at Swami Shri Swaroopanand Saraswati Mahavidyalaya HUDCO Bhilai and she has also been Head of Microbiology Dept. in Govt Digvijay Autonomous P.G. College, Rajnandgon, CG and Assistant professor in Govt VYTPG Autonomus College, Durg , C.G. She was also a JRF, SRF and RA in Pandit Ravishankar Shukla University, Raipur, M.P. She has been graduated (BSc) and pursued her MSc. And Ph.D Courses from Pt. Ravi Shankar Shukla University , Raipur Chhattisgarh .She has completed PG Diploma in Yoga and M.A. Philosophy from Hemchand Yadav University, Durg, C.G. She has been honoured with 12th M.P Young Scientist Award 1997, Award of Excellence (IUFRO Symposi um) 2011, and Best Designer Award (Navbharat) 2007 and qualified GATE (JRF). She has a lifetime membership in many Professional Bodies ( MBSI, MPCG Darshan Parishad, Advances in Life Sciences, Trends in Bio Sciences, Society for Science and Environment , ICPEP, Indian Journal of Ecology and Indian Botanical Society ). She has a membership in around 20 Committees. She has attended 45 above Conferences and 33 Webinars at National and International levels and presented paper in it. She has published 22 research papers and 3 patents (2 National, 1 German).



**Dr. Sanju Sinha**, Assistant Professor, Govt. V.Y.T. PG Autonomous College, Durg, Chhattisgarh, 490 001. She passed her M.Sc. from Govt. V.Y.T. PG Autonomous College, Durg. She obtained her M.Phil. (with gold Medal) and Ph.D. degree from Pt Ravishankar Shukla University, Raipur. She has more than 25 years of research experience with work on Environmental Biology, Pollution Biology, Biodiversity with extensive works on protozoa of Chhattisgarh. She has more than 10 research papers in National and International Journals. To her credit she has published 6 books. She had served as Senior Scientific Officer in Chhattisgarh Council of Science and Technology for more then 9 Years. Presently she is working as an Assistant Professor of Zoology in Govt. V.Y.T. PG Autonomous College, Durg and is guiding 5 students for Ph.D.



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