



"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities in summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book *Homo Scientia* covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts. I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni



Gems Arts & Science College (Affiliated to University of Calicut), Ramapuram, Kadungapuram (PO), Malappuram (DT) Pin - 679321

GEMS ₹ 570

Layout and design: Selen Athiraman

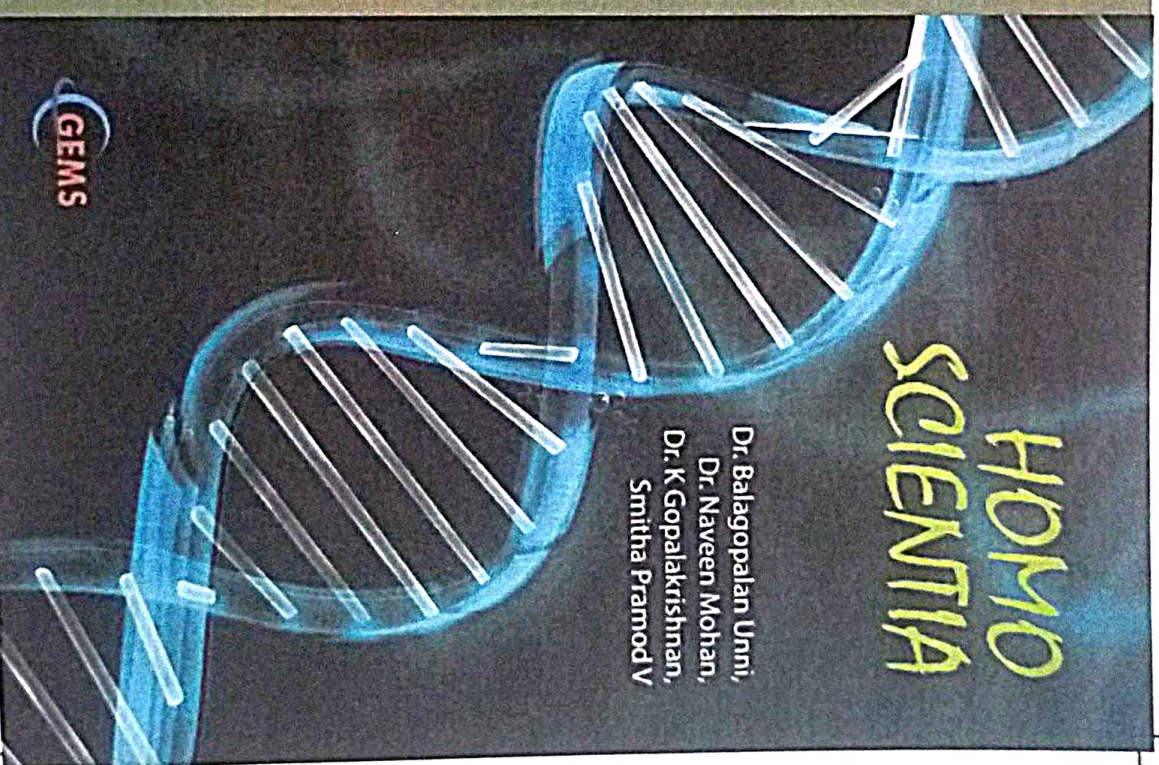


ISSN 978-81-927332-1-3

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HOMO SCIENTIA

Dr. Balagopalan Unni,
Dr. Naveen Mohan,
Dr. K Gopalakrishnan,
Smitha Pramod V



DR. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321



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Dr. NAVEEN MOHAN
PRINCIPAL

GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321

ENGLISH LANGUAGE

Book of Gems Science Association
Science/Articles

By Dr.B.G.Unni, Dr.Naveen Mohan,
Dr.K.Gopalakrishnan, Smitha Pramod V
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First Published September 2023

PUBLISHER

GEMS ARTS AND SCIENCE COLLEGE

An ISO 9001:2015 Certified Institution

(Affiliated to University of Calicut and UGC Recognized

Under Section 2(F) of UGC Act 1956)Registration No:

KI/2019/0242803(NGO-DARPAN) NITI AAYOG,

GOVERNMENT OF INDIA)

<https://gemsasc.ac.in/>

gemsasc@gmail.com

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PRINCIPAL

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MALAPPURAM DT., KERALA-679 321

Brief Biography

Dr. B.G.Unni, (Balagopalan Unni) Ph.D
(Allahabad central University)
FRES (London), FIANSc , FISAgBc, FICCE


Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents, 1 technology. 18 chapters in books, edited 3 books and 29 students



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PRINCIPAL
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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science & Technology, Department of Biotechnology, Central Silk Board, GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award, COSTED Travel Award, DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR, Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India (USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri, Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee , Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific





Dr. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPOURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321

Advisor International Foundation of Science, Sweden, Member,
Board of Studies Raiganj University (2017----), Member
Research Review committee Tea Board of India (2016-2019),
Member Advisory Committee Cancer Research Advisory
Board, North East Cancer Hospital & Research Institute (2017-
-) President, Tea Improvement Consortium, Ltd, Tocklai Assam
(2018-2020) .

Dr.Unni visited USA, Germany, Israel, Jordan, France,
Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE
under various exchange program.





Dr. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
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Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology. A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific





Dr. NAVEEN MOHAN
PRINCIPAL
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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine ,and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly Rhizophora species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of Rhizophora species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention ,however, it was very difficult to differentiate the sexual identity




Dr. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
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in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book. Carbapenem-resistant *A. baumannii* (CRAB), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of *Ganoderma lucidum* by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters, the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite




Dr. NAVEEN MOHAN

PRINCIPAL

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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities. In summary, The faculties (Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book "Homo Scientia". covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

Dr. Balagopalan Unni

Ph.D (Allahabad Central University), FRES (London)
Director Academic & Research
GEMS Arts & Science College, Malappuram Kerala
(Former Chief Scientist, CSIR-DST, Govt of India)
dir.ac.res@gemscollege.in




Dr. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
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(Signature)
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THE EVOLUTION OF COMPUTER GRAPHICS: FROM PIXELS TO REALISM

Rahma P
Assistant Professor
Department of Computer Science

ABSTRACT

Computer graphics have undergone a remarkable evolution over the years, transforming from simple pixel-based displays to astonishingly realistic and immersive visual experiences. This article provides a comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism. By examining the major milestones and breakthroughs, we gain insights into the transformative power of computer graphics and its impact on various industries such as entertainment, gaming, design, and virtual reality, from entertainment and gaming to architecture and design.

INTRODUCTION:

Computer graphics have come a long way since their inception, revolutionizing the way we interact with digital media and virtual environments. The evolution of computer graphics has been driven by technological advancements, pushing the boundaries of what is possible in terms of visual fidelity and immersion. Over the years, computer graphics have evolved significantly, driven by advancements in hardware capabilities, software development, and cutting-edge algorithms. From the early days of pixel-based displays to the current era of

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GEMS ARTS AND SCIENCE COLLEGE
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MALAPPURAM DT., KERALA-679 321

photorealistic rendering, the evolution of computer graphics has been driven by technological advancements and the pursuit of achieving greater realism.

This article aims to trace the evolution of computer graphics, highlighting the key developments that have shaped the field and exploring the impact of these advancements on various industries. Computer graphics have experienced a remarkable journey of evolution, progressing from simple pixel-based displays to breathtakingly realistic and immersive visual experiences. The advancements in hardware, software, algorithms, and the constant pursuit of more lifelike virtual worlds have driven this evolution. In this article, we will embark on a captivating exploration of the evolution of computer graphics, tracing its path from pixels to realism.

1. The Pixel Era: The advent of computer graphics was marked by the emergence of pixel-based displays. Pixels, tiny square units of color, formed the basis of digital imagery. In the early days, monochrome screens gradually evolved into color displays, expanding the range of visual possibilities. Initially used for basic line drawings and charts, pixel-based graphics laid the foundation for subsequent advancements in the field. Computer graphics primarily focused on simple line drawings, charts, and diagrams, laying the foundation for future advancements.

2. 2D Graphics and Vector Graphics: With the increasing power of computers, 2D graphics became more sophisticated, utilizing bitmap graphics that represented images using pixels. Bitmap graphics, which utilize pixels to represent images, became the standard for visual representation. Simultaneously, vector graphics emerged, enabling the creation of scalable and resolution-independent graphics through mathematical formulas instead of pixels. These advancements laid the groundwork for digital artwork, user interface design, and graphical data visualization.



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PRINCIPAL
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3. The Rise of 3D Graphics: The introduction of 3D graphics marked a monumental leap in the evolution of computer graphics, significant milestone, bringing a new level of realism and immersion to virtual environments. Advanced mathematical techniques and algorithms enabled the rendering of three-dimensional objects on two-dimensional screens. Initially used in scientific and engineering applications, 3D graphics quickly found their way into the entertainment industry, revolutionizing video games, animation, and special effects and computer-generated imagery in movies.

4. Polygonal Modeling and Texturing: Polygonal modeling became the prevailing method for representing 3D objects, allowing the creation of complex shapes such as triangles or quadrilaterals by assembling polygons. The ability to manipulate, transform, and texture these polygons enhanced the realism of computer-generated objects. Texture mapping further improved visual fidelity, enabling the application of surface textures such as colors, patterns, and bump maps to the 3D models.

5. Lighting and Shading: Realistic lighting and shading techniques played a pivotal role in advancing computer graphics towards greater realism. Simple flat shading used to provide objects with a basic sense of depth and evolved into more sophisticated techniques such as Gouraud shading and Phong shading, simulating the interaction of light with surfaces more accurately. These techniques simulated the interaction of light with surfaces more accurately, enabling the creation of smooth gradients, highlights, and shadows. The improved lighting and shading capabilities significantly elevated the realism of computergenerated scenes.

6. Ray Tracing and Global Illumination: The breakthrough technique of ray tracing revolutionized computer graphics by simulating the behavior of light in a highly realistic manner. By accurately modeling the physics of light, ray tracing allowed for more realistic rendering of reflections,

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refractions, and shadows. Initially computationally intensive, recent advancements in hardware and algorithms have made real-time ray tracing possible, leading to photorealistic graphics in interactive applications, enabling immersive experiences in video games and virtual reality with stunningly realistic visuals.

7. The Rise of Physically-Based Rendering: Physically-based rendering represents the state-of-the-art in computer graphics, aiming to simulate light and materials accurately. PBR aims to simulate the behavior of light and materials with exceptional accuracy, resulting in highly realistic and visually captivating graphics. By considering physical properties such as reflectivity, transparency, and surface roughness, PBR creates materials that closely resemble their real-world counterparts. PBR finds extensive use in industries like architecture, product design, and film, where visual accuracy and realism are paramount.

8. Virtual Reality: Virtual Reality creates a simulated environment that replaces the real world entirely, immersing users in a computergenerated 3D environment. VR typically involves wearing a headset that encompasses the user's vision and may include handheld controllers for interaction. It provides a sense of presence, making users feel as if they are physically present in the virtual environment. VR finds applications in gaming, entertainment, training simulations, design and architecture, healthcare, and more. The technology requires powerful hardware to render and display high-quality graphics and often relies on motion tracking sensors for user movement.

9. Augmented Reality: Augmented Reality overlays digital content onto the real world, enhancing the user's perception by adding virtual elements. AR is experienced through devices like smartphones, tablets, smart glasses, or headsets, using cameras and sensors to blend the virtual and real worlds. It enables users to interact with both digital and physical objects simultaneously, enhancing real-world experiences. AR has applications in gaming, education, navigation, marketing,



Dr. NAVEEN MOHAN
PRINCIPAL
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remote assistance, industrial maintenance, and more. It can provide contextual information, interactive guides, and real-time data, improving productivity and user engagement.

Both Virtual Reality and Augmented Reality are two transformative technologies that alter our perception of reality and enable new experiences. Here's a closer look at each. They have the potential to transform various industries and revolutionize how we interact with digital content. While VR offers complete immersion in virtual worlds, AR enhances the real world with digital overlays, creating exciting possibilities for entertainment, education, training, and practical applications.

CONCLUSION

The evolution of computer graphics has been a remarkable journey that has revolutionized the way we create, perceive, and interact with digital imagery. From simple pixel-based displays to the sophisticated and realistic graphics we see today, computer graphics have undergone tremendous advancements. With the development of powerful hardware, software, and algorithms, we have witnessed the emergence of visually captivating and immersive virtual worlds in industries like gaming, film, architecture, and design. The integration of computer graphics with virtual reality and augmented reality has further expanded the possibilities, offering new ways to engage and interact with digital content.

As technology continues to progress, the future of computer graphics holds exciting prospects, paving the way for even more realistic visuals and transformative experiences. The evolution of computer graphics has truly transformed the way we perceive and interact with the digital realm, opening up endless possibilities for creativity, entertainment, and practical applications.



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Dr. NAVDEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321