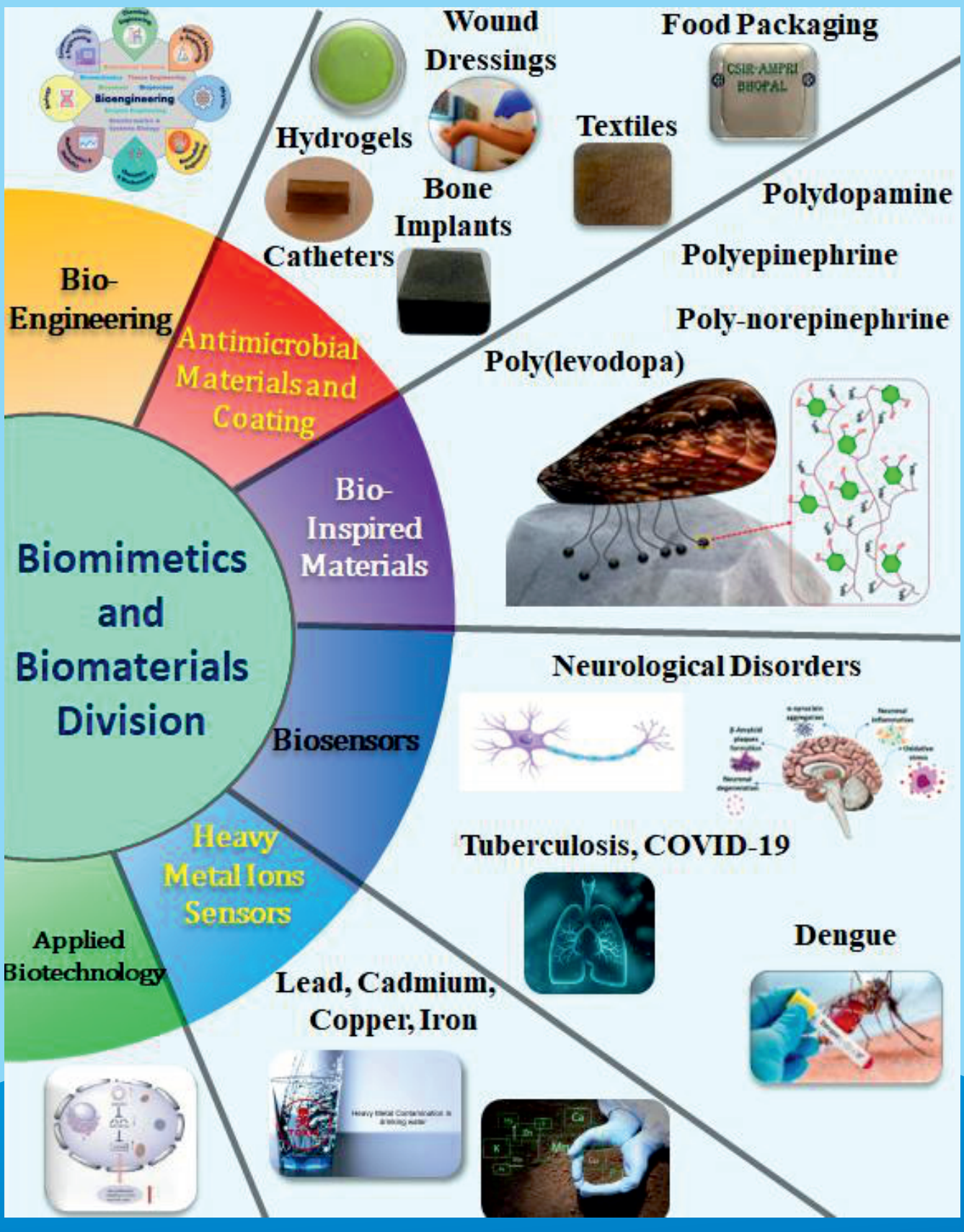
सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

सीएसआईआर-एम्प्री
CSIR-AMPRI

BIOMIMETICS AND BIOMATERIALS DIVISION
(Established in 2024)

CSIR - Advanced Materials and Processes Research Institute (AMPRI)
Bhopal (M.P.)-462026, India



CSIR - Advanced Materials and Processes Research Institute (AMPRI)
Bhopal (M.P.)-462026, India

CONTENT

CONTENT

सत्यमेव जयते

डॉ. (श्रीमती) एन. कलैसेल्वी
सचिव
वैज्ञानिक और औद्योगिक अनुसंधान विभाग, तथा
महानिदेशक

Dr. (Mrs.) N. Kalaiselvi
Secretary
Department of Scientific & Industrial Research, and
Director General

सीएसआईआर
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भारत का नवाचार इंजन
The Innovation Engine of India

भारत सरकार
विज्ञान और प्रौद्योगिकी मंत्रालय
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्
वैज्ञानिक और औद्योगिक अनुसंधान विभाग
Government of India
Ministry of Science and Technology
Council of Scientific & Industrial Research
Department of Scientific & Industrial Research

MESSAGE

I am delighted to learn that CSIR-AMPRI has established a new **Biomimetics and Biomaterials Division**. This specialized division will focus on the fundamental and advanced applications of biomimetic materials, bio-inspired materials, and biomaterials, including their integration with life sciences across diverse sectors such as biomedicine, biotechnology, strategic initiatives, and defence.

I am confident that CSIR-AMPRI's efforts will position CSIR at the forefront of cutting-edge research in biomimetics and biomaterials, paving the way for innovative technologies that will benefit society as well as the strategic and defence sectors, either directly or indirectly.

Through this initiative, CSIR-AMPRI is expected to develop antimicrobial products such as skin patches, wound dressings, food packaging materials, oral care solutions, cancer therapies, urinary catheters, bone implants, and more in the coming years. These advancements will not only contribute to Atmanirbhar Bharat but also support other research institutions across the country in conducting advanced biomedical research.

I extend my heartfelt congratulations to CSIR-AMPRI for establishing this specialized division. My warmest wishes for the success and progress of this new division and for the dedicated CSIR-AMPRI team driving these efforts.

N. Kalaiselvi

January 24, 2025
New Delhi

(N. Kalaiselvi)

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Vinod K. Singh, FNA, FTWAS
Institute Chair Professor

January 24, 2025

To whomever it may Concern

I congratulate CSIR-AMPRI for the foundation and establishment of a new division titled "**Biomimetics and Biomaterials**". The division is dedicated to designing and developing advanced functional biomimetics and biomaterials for societal benefit. This new division will contribute immensely to advancing basic science and generating new technologies and products based on biomimetics and biomaterials to cater to national and international needs and visualize global scenarios. The products designed here will directly impact society by improving healthcare. It will also help our nation to reduce dependency on other countries for various biomedical products and thus support Aatmanirbhar Bharat. The various products under development in the near future in this division are advanced wound dressings, tissue engineering scaffolds, antimicrobial urinary catheters, antimicrobial bone implants, biosensors for neurological disorders, self-healable skin patches, healthcare including life sciences and many more. I am sure this division will help other universities and institutes in Madhya Pradesh and nearby states perform advanced biomedical research. I convey my best wishes to this new division and the team's progress and upliftment.

Finally, I congratulate Dr Avanish Kumar Srivastava, the Director, CSIR-AMPRI and Head, Dr J P Chaurasia, Head of BBD, for their extensive efforts to establish this unique and ambitious department of **"Biomimetics and Biomaterials"** for the CSIR-AMPRI and the country. My warmest wishes for the success and advancement of this new division and the involved CSIR team.

With best wishes,

VKSingh

Vinod Singh
Chairperson, Research Council,
CSIR-AMPRI Bhopal

सीएसआईआर–प्रगत पदार्थ तथा प्रक्रम अनुसंधान संस्थान (एम्प्री)
CSIR-Advanced Materials and Processes Research Institute (AMPRI)
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद
Council of Scientific and Industrial Research
(वैज्ञानिक और औद्योगिक अनुसंधान विभाग के तहत एक स्वायत्त निकाय, विज्ञान और प्रौद्योगिकी मंत्रालय भारत सरकार)
(An autonomous body under the Department of Scientific & Industrial Research, Ministry of Science & Technology, Govt. of India)
CSIR-AMPRI

डॉ. अवनीश कुमार श्रीवास्तव
निदेशक

Dr. Avanish Kumar Srivastava
Director

Message from Directors Desk

The Director, CSIR-Advanced Materials and Processes Research Institute (CSIR-AMPRI) expresses immense pride and enthusiasm for the establishment of the new "Biomimetics and Biomaterials Division", recognizing it as a testament to the institute's dedication to scientific excellence and innovations. This development underscores the unwavering commitment of CSIR-AMPRI to pioneering innovative research and advancing material science and engineering. Since its inception as the Regional Research Laboratory (RRL) in 1981, CSIR-AMPRI has continually evolved, expanding its research horizons from mineral processing to cutting-edge materials and technologies. The renaming to CSIR-AMPRI in 2007 marked a pivotal moment, transforming the institute into a premier research centre with national and international acclaims.

The new Biomimetics and Biomaterials Division, which includes microbiology, medical microbiology, biotechnology, biochemistry, and biophysics labs, represents a strategic leap forward, aiming to bridge biology and engineering by developing sustainable solutions inspired by nature's designs. This division will focus on materials innovation, sustainable solutions, and interdisciplinary research, leveraging nature's intricate designs and efficient systems to address contemporary challenges. Additionally, the division boasts advanced facilities to investigate biological properties of the materials including antimicrobial, biocompatibility, pharmacology etc. for supporting the cutting-edge research, enabling scientists to explore and harness the potential of biomimetic and biomaterial principles fully.

I believe that this division will not only enhance the institute's research capabilities but also enhance collaborations with national and international partners, fostering the commercialization of innovative medical technologies. This achievement will reflect CSIR-AMPRI's journey of growth and its strategic vision to address global challenges through interdisciplinary research and sustainable development. The establishment of the Biomimetics and Biomaterials division, positions CSIR-AMPRI at the forefront of material science research, driving advancements in biomedical fields that benefit society and contribute to a sustainable future.

(Avanish Kumar Srivastava)

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सी एस आई आर - प्रगत पदार्थ तथा प्रक्रम अनुसंधान संस्थान
वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद् (सी एस आई आर)
होशंगाबाद रोड, हबीबगंज नाका के पास
भोपाल - 462 064 (म.प्र.), भारत

CSIR - ADVANCED MATERIALS AND PROCESSES RESEARCH INSTITUTE (AMPRI)
Council of Scientific and Industrial Research (CSIR)
Hoshangabad Road, Near Habibganj Naka
Bhopal - 462 064 (M.P.), INDIA

डॉ. जमना प्रसाद चौरसिया
वरिष्ठ प्रधान वैज्ञानिक, प्रमुख, पीपीडी, बीबीडी, एचआरडी
Dr. Jamana Prasad Chaurasia
Sr. Principal Scientist, Head PPD, BBD & HRD

Message from Head Desk

The establishment of our new Biomimetics and Biomaterials Division marks a major milestone for our department and is a testament to our institute's dedication to pioneering research and innovation in material science and engineering .

The establishment of the new Biomimetics and Biomaterials Division represents a transformative advancement for our department. This division is committed to the integration of biology and engineering, with a focus on the development of materials and technologies inspired by natural principles. By harnessing the concepts of biomimicry, we aim to explore innovative solutions to contemporary scientific and environmental challenges. The division's scope includes microbiology, medical microbiology, biotechnology, biochemistry, biophysics and healthcare exemplifying our interdisciplinary approach to research.

I extend my deepest gratitude to the CSIR Headquarter, Research Council and the Director for providing approval of the division with dedicated 25 posts of scientists. We highly acknowledge the visionary leadership and unwavering support of the Director and all concerns in making this division a reality. Their guidance has been instrumental in driving CSIR-AMPRI's growth and success.

Our primary goals for the new division include:

Innovative Materials: Developing new materials, technologies and solutions of various problems and also support strategic sector through bio-inspired materials and strategies by performing basic research to high-end research.

Sustainable Solutions: Creating environmentally friendly technologies to address national and global challenges.

Interdisciplinary Research: Promoting collaborative research across various scientific fields to drive advancements.

As we embark on this new chapter, I am confident that our collective efforts will significantly enhance our research capabilities and open new avenues and wings for collaboration with national and international partners. This will foster the commercialization of our innovative technologies and reinforce our strategic vision of addressing global challenges through interdisciplinary research and sustainable development.

Collectively, we shall advance our department to new pinnacles, establishing CSIR-AMPRI as a new paradigm in the country at the vanguard of material and life science research. Let us remain steadfast in our commitment to core values, support one another, and pursue excellence in all our endeavours.

(J. P. Chaurasia)

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ADVANCED MATERIALS AND PROCESSES RESEARCH INSTITUTE (AMPRI)
Formerly: Regional Research Laboratory / पूर्व में : क्षेत्रीय अनुसंधान प्रयोगशाला
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद)
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क्रमांक/Ref.No.

दिनांक/Date.....

डॉ चेतना ढांड
प्रमुख वैज्ञानिक

Dr. Chetna Dhand
Principal Scientist

Message from Division Coordinator

CSIR-AMPRI is nationally recognized for its cutting-edge research in materials and process development. CSIR-AMPRI is making rapid progress in biomaterials to cater clinical and biomedical needs of the society. Under the umbrella of biomaterials, we are working in the field of advanced wound dressings, self-healing dermal patches, antimicrobial coatings for implants, antimicrobial biodegradable food packaging, advanced electrochemical biosensors for the diagnosis of infectious diseases and neurological disorders etc. To expand our wings in the area of biomaterials, we are establishing this new department "Biomimetics and Biomaterials Division" at our institute. The prime aim of this division is to design and develop advance functional bio-inspired materials, biomimetic materials and biomaterials for directly or indirectly benefitting the society. Performing advanced biotechnology and biomedical research using this material is among the prime objectives of this division.

This division will in-house advanced microbiology, cell culture, tissue engineering, pharmacology, nanofiber fabrication, electrochemical biosensor, biotechnology and biochemistry laboratories along with the dedicated laboratory for the synthesis, fabrication and processing of bio-inspired materials, biomaterials and biomimetic materials. These facilities enable us to conduct high-end research on exploring novel biomaterials and biomimetic materials and to develop potential technologies for healthcare for societal benefits. This division will be first of its kind nationally particularly focusing on biomaterials, bio-inspired materials and biomimetic materials. This division will support other national institutes and industries to deliver technologies to the nation under make-in-India mission of government of India and thus reducing foreign dependency. We hope that this division will foster the advancements in science and technology in the field of biomimetic materials and biomaterials.

Cdhand

(Dr. Chetna Dhand)

Vision of the Division

Biomimetics and Biomaterials Division is dedicated for the design and development of advance functional biomimetics and biomaterials for societal benefit. Performing advanced biotechnology and biomedical research is among the prime objectives of this division.

The division will focus on performing basic science and high-end R & D to cater national and international needs visualizing global scenario.

This division will in-house advanced microbiology, cell culture, tissue engineering, pharmacology, nanofiber fabrication, biotechnology and biochemistry laboratories along with the dedicated laboratory for the synthesis and fabrication of bio-inspired materials, biomaterials and biomimetic materials. This division is established with the vision to design potential technologies for healthcare and strategic sector for societal benefits.

This division will be first of its kind nationally particularly focusing on biomaterials, bio-inspired materials and biomimetic materials.

It will support Indian Industries to deliver technologies to the nation under make-in-India mission of government of India and thus reducing foreign dependency.

Mandate of the Division

Performing high-end research on design and development of advanced biomimetics materials, bio-inspired materials and biomaterials for Societal Benefits.

Discovering novel biomaterials inspired from nature, natural processes etc. for healthcare and strategic applications.

Development of novel bio-inspired and botanicals inspired antimicrobial agents to tackle global issue of growing antibiotic resistance.

Development of biomimetic materials and biomaterials based medical technologies and products for commercialization to support Atmanirbhar Bharat.

To execute cutting-edge research in the area of bioengineering, genetic-engineering, medical Biotechnology/Medical microbiology, pharmacology/pharmacognosy including botanicals, nanomedicines, biochemistry and biophysics.

To undertake grant-in-aid, sponsored, consultancy & other national and international projects for both public and private sectors in the area of biomimetics and biomaterials.

Mission of the Division

To synthesize, design, innovate and improve biomimetic materials, bio-inspired materials and biomaterials inspired from the nature, natural processes etc. directed towards industrial, societal, national and global implementation for a sustainable realization through scientific interventions.

Founder Members of the Division

Prof. Avanish Kumar Srivastava is presently the director of CSIR-AMPRI, Bhopal, and an Outstanding Professor at AcSIR Ghaziabad. He is the founder of the Biomimetics and Biomaterials Division. He received his M.Sc. (Hons) in Physics from IIT Roorkee (1986), M.Tech. in Materials Science from IIT Kanpur (1988), and Ph.D. in Metallurgy from IISc Bangalore (1996). His prolific research is applied to understanding the nucleation-growth mechanisms, phase transformations, microstructures & defects of various materials, bioinspired materials, etc. He has published more than 450 research articles in high-impact internationally reputed journals with about 14,000 citations, an h-index of 62, and an i10 index of 215. He has edited 6 books and delivered several invited talks at different scientific meetings in India and abroad. He has 34 patents in his credits and 25 technologies/know-how from various industry partners. He has guided 13 Ph.D. students and supervised more than 30 M.Sc. & M.Tech. dissertations. Some of his outstanding publications are in prestigious high-impact journals like Nature Communication, Nano Letters, Acta Material, Nano Energy, Chemical Engineering, etc. His consistent guidance and motivation lead to the evolution of the Biomimetics and Biomaterials Division at CSIR-AMPRI, Bhopal. Along with this division, he is also instrumental in establishing (i) the Centre for Advance Radiation Shielding and Geopolymeric Materials, (ii) the Translational Center for graphene-based materials and Devices, and (iii) state of the art 5-star rated green building in the built-up area of 13,500 sq.mt., at CSIR -AMPRI in 11 acre. Under his leadership, first time in the country, using the PPP model of CSIR – NMITLI, high-end Raman Spectrometers (model: CTR 300 & 150) are manufactured and commercialized. He is a Fellow of the Indian National Academy of Engineering (INAE), Indian Institute of Metals (IIM), and Electron Microscope Society of India (EMSI). He is also the former President of EMSI, and the former Director (officiating) of CSIR – National Metallurgical Laboratory (NML) for one year.

Email: director@ampri.res.in

Dr Jamana Prasad Chaurasia is the founder Head of Biomimetics and Biomaterials Division. He received his M.Sc. in Botany-Plant Pathology (1992) and Ph. D. in Life Sciences (Natural Sciences) from Dr. H. S. Gour Central University, Sagar (1995). Dr. Chaurasia did courses on Controlling Laboratory Bio-risk (CLB) and Transportation of Infectious Substances and Diagnostic Specimens (TISDS) in 2009 from Sandia National Laboratories, Albuquerque, NM, USA. He did PDF in Life sciences: Mycology & Plant Pathology in 2000 and University Malaysia Pahang University, Malaysia Pahang Jul 2010 - Jul 2011 · He is former Lecturer in the Department of Botany, Dr. Hari Singh Gour Central University, Sagar during 1992-2001.He is presently working as a Senior Principal Scientist, Head PPD & Head Biomimetics & Biomaterials Division, Chairman Recruitment & Assessment and Head, Human Resource Development, CSIR-AMPRI. He has published more than 30 research articles in high impact internationally reputed journals with >549 citations, h-index of 12 and i12 index of 369. He has published one Book and edited 3 books, and delivered several invited talks at different scientific meetings in India and abroad.

He has 03 patents in his credits and almost identical number of technologies/know-hows to various private partners. He has prepared one documentary CEC/UGC Educational Film Paan which is include in the best educational film in the country by the UGC, Govt. of India. He is Guide of 01 Ph.D. student & Co-guided 01 Ph.D. students and supervised more than 10 M.Sc. & M.Tech. dissertations. Dr. Chaurasia is the pioneer worker in the field of Agriculture Homeopathic drugs. Dr. Chaurasia is the former Coordinator of CSIR- BSL 3 program, CSIR, Govt. of India. He has received Governor award in 1995, Dr. C.V. Raman Vigyan Lokpriyakaran Shikshak Samman in 1998, Dr. Hari Singh Gour Jan-Vigyan Samman, 1998, Young Scientist Award in 2000 and best employ award for working in Hindi Language in 2010. He is Member of Governing Body of Science Centre (Gwalior, M.P.)which is working for National Children Science Congress in the Country. His research interests include Management of Science and Technology: R&D support activities, Research and Development Management, Technology Transfer, Business Development, Technical Man Power Planning, Research Data Base Management and research on Life Sciences specially on Biomimetic and Biomaterials, Biotechnology, Microbiology, Plant Pathology, Biosafety, Antibiotics, Isolation of Biomaterials and Screening of drugs/Materials against bacteria & fungal organisms, Betel vine and Medicinal Plants etc. He had been instrumental in creating this division at CSIR-AMPRI, Bhopal.

Dr. Chaurasia is the former members of Research Council member of CSIR-NBRI and CSIR-CIMAP as CSIR Hqrs, New Delhi representative. He is also former members of Inter-Ministerial Committee/ Board of Govt of India: in various committees viz. NMPB, NHM, NBM, GEAC/ RCGM /MEC, PHTM–UNDER CSS, PSE/EMRP-AYUSH, ICFRE, IHR-DSIR,PAC, National Bamboo Mission, etc. Dr. Chaurasia gave his comments for approval of various National Missions (EFC/FFC), documents of the different Ministries, Govt. of India during his tenure. He is also support to creation of Various facilities & R&D programs of CSIR Laboratories.

On behalf of Department of State Security engagement program and US Defence Threat Reduction Agency, Sandia National Laboratories, Albuquerque, NM, USA has Nominated Dr. Jamana Prasad as Nodal Officer of BSL3 and Biosafety program in the year 2010 from 25-27 October to finalize Bio-risk management protocol during the international workshop. Under this program

His major contributions are establishment of 5 BLS 3 and 1 BSL 4 Labs in CSIR LABS under CORE 11 Projects with the Help of Sandia National Laboratory and WM Zender Company Malaysia under CSIR HQ coordinated Project as a Coordinator of the Project.

Effective R&D Management, Industrial linkage, Enhance the ECF and image-building of CSIR AMPRI

Establishment of Graphene Center and Biomimetics and Biomaterials Division at CSIR AMPRI, Bhopal

He is also work as Coordinator of CSIR-AMPRI ArCoNM (COVID-19) Group and Graphene QD Group to speed up research in fast track manner.

Dr. Chaurasia has solve the problems about 20 Lakhs Betel vine former through his research work and Book " Betel vine Cultivation and Management of Diseases".

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Dr Chetna Dhand is the coordinator and nodal scientist of Biomimetics and Biomaterials Division. She is working as principal scientist at CSIR-Advanced Materials and Processes Research Institute, Bhopal. She is responsible for running and maintaining this division. She has completed her PhD on Nano-Inspired Biosensors from University of Delhi and National Physical Laboratory, New Delhi, India. She served as Postdoctoral Research Fellow at Singapore Eye Research Institute, Singapore and adjunct assistant professor at the ACP in Ophthalmology and Visual Sciences, Duke-NUS, Singapore. She is the recipient of Excellence in Microscopy award 2023, Young Investigator Award 2016, Sing-health Publish Award 2016 and Sing-health Publish Award 2017. Her excellent research credentials is reflected by having > 90 international SCI Publications, 1 edited book, 10 patents, 3 transferred technology with citations of >5700 and H-index of 40. Her major research interests include biomimetics and biomaterials, nanobiomaterials, 2D layered Nanomaterials, bio-inspired materials, antimicrobial materials and coatings, miniaturized electrochemical sensors/biosensors, 3D printing of biopolymers, targeted drug delivery, tissue engineering and related healthcare applications.

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Plan for Biomimetics and Biomaterials Division

- To establish Biomimetics and Biomaterials Synthesis Laboratory for fabrication and designing of novel bio-inspired materials, biomaterials and biomimetic materials for various biomedical applications.
- To create high-end world-class biological facility at CSIR-AMPRI, Bhopal for evaluating the biological properties and assessing the biomedical applications of the designed materials.
- To establish an advanced nanofiber laboratory with high-end facilities to develop versatile nanofiber materials for various areas including life sciences, healthcare and strategic sectors.
- To establish Biotechnology and Bioengineering Laboratories including Life sciences/Biological Sciences to support futuristic work on Skin Patch, Transparent Self Healing Material, Tissue engineering etc.
- To establish Electrochemical Sensors and Devices Laboratory to Advance the Existing Diagnostics for Neurological disorders, Infectious Diseases and Heavy Metal Ion poisoning.
- To develop advanced pharmacology, biochemistry and biophysics laboratory for fabrication of advanced biomedical products for therapeutic applications.
- This division will be first of its kind nationally particularly focusing on biomaterials, bio-inspired materials and biomimetic materials.
- To establish this division as the central facility for Madhya Pradesh, Chhattisgarh and other neighboring states to investigate the various advanced biological properties of the developed materials and products which will foster the development of more biomedical technologies that will impact the society directly.
- HR Development- Contribute to generate highly skilled scientific manpower in the area of Biomimetic and Biomaterials through providing training B.Sc., B.Tech., M.Sc., M.Tech., PhD, Women Scientists and PDF.
- MOU/NDA signing with the institutes of national and international repute for futuristic R&D and manpower exchange.

Targeted Technologies of the Division in Next 5 Years

- Natural products/Phytochemicals Based Herbal Wound Dressing Materials for Infection Control and Diagnosis.
- Bio-inspired chemical functionalization of Polymeric Nanofibers to tailor their surface properties for enhanced Wound Care.
- Transparent self-healing bio-inspired skin patches.
- Advanced skin patches for skin regeneration.
- Antimicrobial Coatings for Fixtures and Accessories in Hospital Settings.
- Bio-inspired Nanocoatings on Bone-Implants for preventing microbial contamination.
- Antimicrobial and Biodegradable Food Packaging Materials.
- Antimicrobial urinary catheters for prohibiting CAUTI's.
- Screening of Biomaterials for urinary tract infections.
- Screening of Biomaterials against antibiotic resistance microorganisms.
- Screening of Biomaterials/botanicals against microorganisms.
- Oral care solutions using biomaterials.
- Graphene Nanocomposite Based Flexible and Non-flexible Electrodes for Lead Detection.
- Nano-Bio-Inspired Hand-Held Devices for the detection of Parkinson's Disease Biomarkers.

Way-Forward and Futuristic Technologies

Recruitment of all sanctioned 25 posts of scientists (by CSIR HQ and 49th Research Council, CSIR-AMPRI) with the highly trained and experienced manpower under the mandate of the division in next 5-7 years.

Development and Identification of Novel Biomaterials and Antimicrobials against antibiotics resistant bacterial and fungal pathogens.

Development of highly efficient culture media for microbial culturing.

Screening of natural biomaterials and plant-based antimicrobial with special reference to health-related problems.

Screening of Biomaterials for anti-cancerous activity.

Development of new materials for strategic sector.

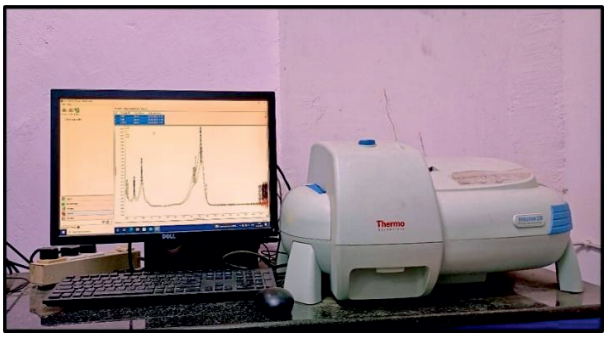
Development of biomaterials for biotechnology, healthcare, agriculture, space and defense applications in future.

Division will cover healthcare theme, 4M theme, CIE theme, sub themes of CLP (Polymers & Inorganic Chemicals, Performance Chemicals & Smart Materials) and sub-themes of AEISS theme (Biomedical Instrumentation & Smart Agriculture, Aerospace Materials Coatings & Chemical), Ecology, Environment Earth & Ocean Sciences and Water etc.

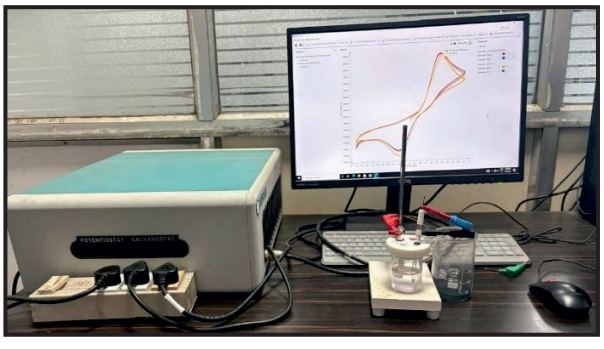
Deliverables

- Performing advance research in the field of Biomimetics and Biomaterials and exploring their application in the area of Healthcare, Agriculture, Nutrition & Biotech sector and strategic sector.
- Generation of basic science in the field of Biomimetics, Bio-inspired materials and Biomaterials.
- Development of biomimetics and biomaterials based medical technologies and products for commercialization to support Atmanirbhar Bharat.
- To execute cutting-edge research in the area of bioengineering, biotechnology, medical microbiology, Pathology pharmacology/pharmacognosy including botanicals, nanomedicines, biochemistry and biophysics.
- To undertake grant-in-aid, sponsored, consultancy & other national and international projects for both public and private sectors in the area of biomimetics and biomaterials.
- Contribute to generate highly trained scientific manpower in the area of Biomimetic and Biomaterials through providing training B.Sc., B.Tech., M.Sc., M.Tech., PhD, Women Scientist and PDF.
- MOU/NDA signing with the institutes of national and international repute for futuristic R&D and manpower exchange.
- Efforts will be made to publish high quality research article, patents and technologies.

Divisional Facilities



UV Spectrophotometer



Electrochemical Workstation

Lyophilizer

Laminar Air Flow

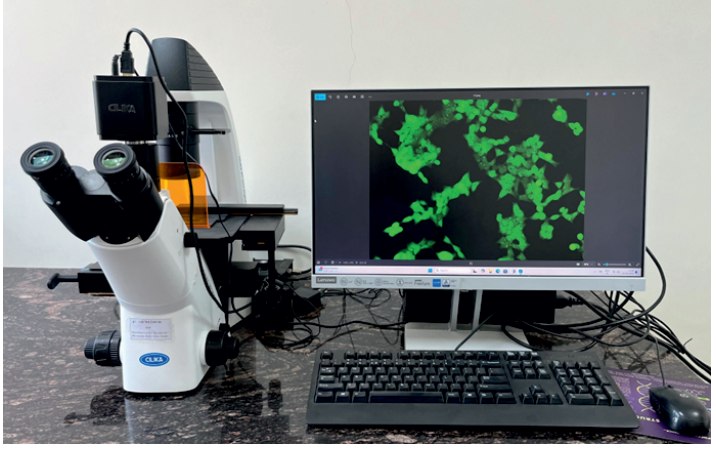
Incubator

Microplate Reader

Nitrogen Storage Container

Electrospinning Machines

Autoclave



Fluorescence Microscope

Multi PalmSens 4

Co_2 Incubator

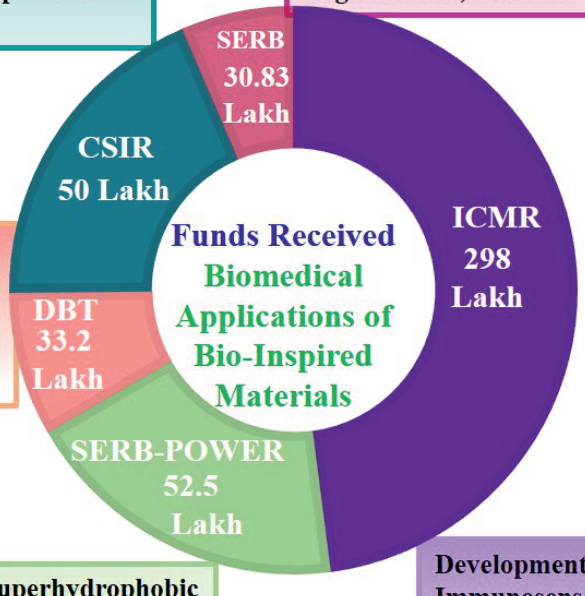
Completed and Ongoing Projects on Biomimetics and Biomaterials

S.No.	Title of Project	Funding Agency	Funding Amount	Date of Sanction and Duration
1.	Development of Hand-Held Immunosensor Device using Bioinspired Graphene Based Nanocomposites for the detection of Parkinson	ICMR	298 Lakhs	December 2023 4 Years GAP-142 Ongoing
2.	Development of Bio-inspired Superhydrophobic Antimicrobial Nanocoatings on the Urinary Catheters to Impede Microbial Biofilm Formation and Catheter-associated urinary tract infection	SERB-POWER, DST	52.5 Lakhs	November 2023 3 Years GAP-138 Ongoing
3.	Development of Highly Sensitive and Selective Aptasensor for early diagnosis of Parkinson Biomarker Alpha-synuclein using MXene Based Nanobiocomposites	DBT	33.20 Lakhs	December 2023 3 Years GAP-137 Ongoing
4.	Bio-Inspired Surface Functionalization of Carbon Nanostructures with Catecholamine/Catechol Rich Polymers: Novel Approach to Develop Advance Biosensors	CSIR	50 Lakhs	April 2020 2 Years MLP-205 Completed
5.	Development of Nanofibrous Antimicrobial Wound Dressings for Chronic Wound Infections and Skin Regeneration	SERB-SRG, DST	30.83 Lakhs	February 2020 2 Years GAP-105 Completed

Funding Support Received to Explore the Biomedical Applications of Bio-Inspired Materials & Biomaterials

Bio-Inspired Surface Functionalization of Carbon Nanostructures with Catecholamine/Catechol Rich Polymers: Novel Approach to Develop Advance Biosensors, MLP205

Development of Nanofibrous Antimicrobial Wound Dressings for Chronic Wound Infections and Skin Regeneration, GAP105



Development of Highly Sensitive and Selective Aptasensor for early diagnosis of Parkinson Biomarker Alpha-synuclein using Mxene Based Nanobiocomposites, GAP137

Development of Bio-inspired Superhydrophobic Antimicrobial Nanocoatings on the Urinary Catheters to Impede Microbial Biofilm Formation and Catheter-Associated Urinary Tract Infection, GAP138

Development of Hand-Held Immunosensor Device using Bioinspired Graphene Based Nanocomposites for the detection of Parkinson's Disease Biomarkers, GAP142

Bioinspired Materials for the Development of Antimicrobial Coatings

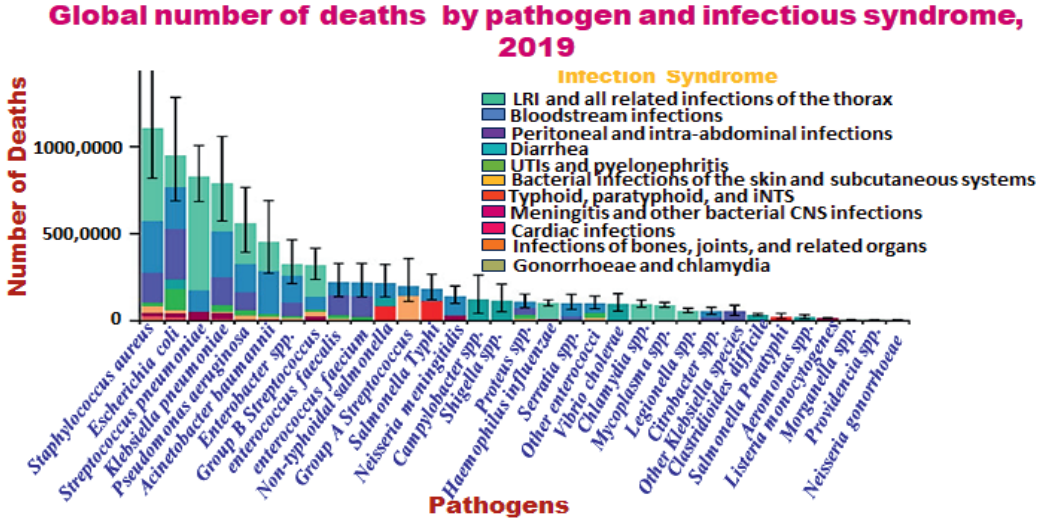
Problem Statement

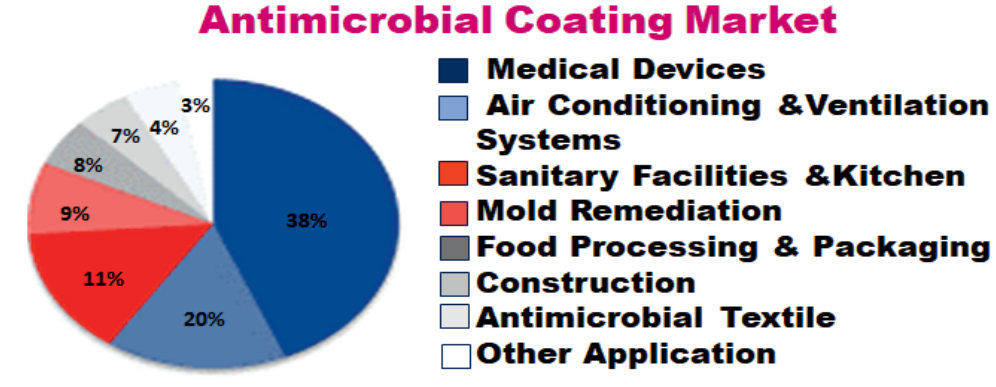
- An antimicrobial coating is a surface treatment or finish that inhibits the growth and spread of microorganisms such as bacteria, viruses, fungi, and mold through surfaces.
- These coatings are applied to various surfaces to provide long-lasting protection against harmful pathogens.

Common Carriers of Microbial Contamination

Key Benefits of Antimicrobial Coating

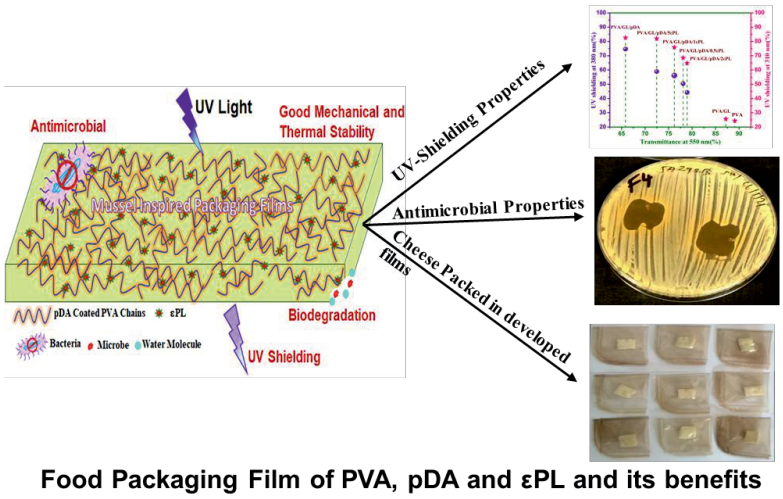
- Reduces Cross Contamination
- Extend Product's Lifetime
- Stay fresh for Longer
- Reduces Microbes Growth





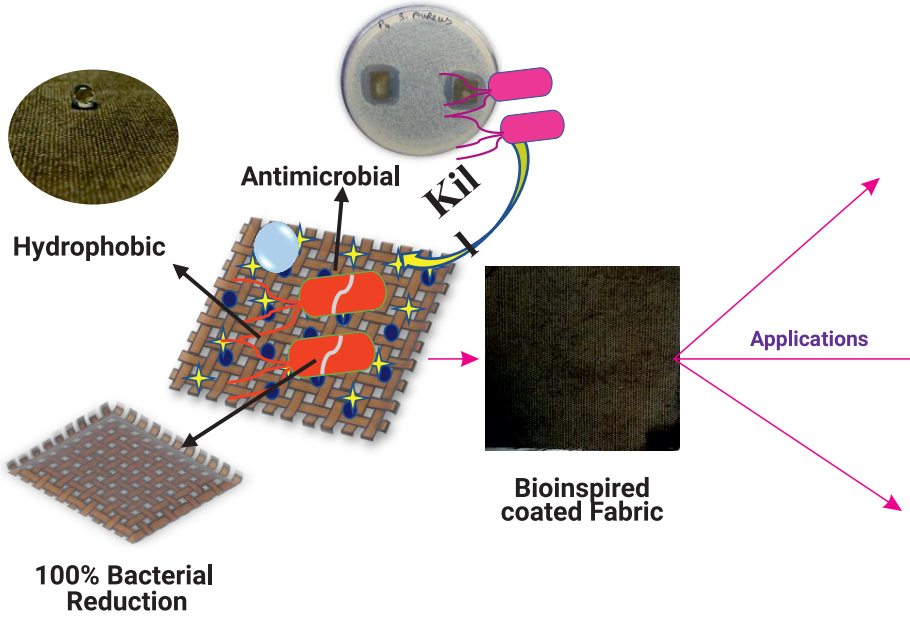
Bioinspired Materials for the Development of Antimicrobial Coatings

Bioinspired Antimicrobial Biodegradable Food Packaging Film

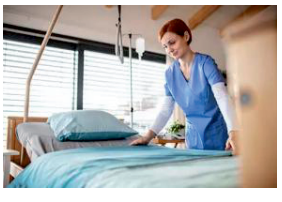


Food Packaging Film of PVA, pDA and εPL and its benefits

Bioinspired Antimicrobial coating on Cotton Textile



100% Bacterial Reduction



Hospital apparels

Defense apparels

Antimicrobial Protection for Transportation

Antimicrobial Technologies Under Development

- Antimicrobial Coatings for Medical Devices including contact lenses and urinary tract catheters.
- Antimicrobial Wound Dressings
- Antimicrobial Coatings for High Touch Surfaces for Hospital Settings

Targeted Sustainable Development Goals

pH-Responsive for Smart Antimicrobial Hydrogel Wound Dressings for Infection Eradication and Diagnosis

Chronic Wounds

Deep Wounds that will take several days to weeks or months for healing including

Burn wounds, diabetic foot ulcers, pressure sores etc.

Causes of Wound Infections

- Inadequate cleaning and care of the wound
- Bacterial Contamination
- Trauma or Re-injury
- Delayed Wound Healing

Problem Related to Traditional Dressing Materials

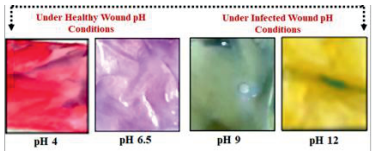
- Inadequate Infection Prevention
- Antibiotic Resistance
- Moisture Imbalance
- Non-Breathable Materials
- High Costs

Why pH-Responsive Wound Dressings ?

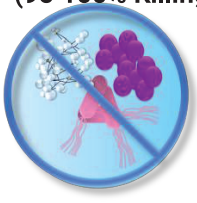
pH-Responsive wound dressings detect infections early by changing color, enabling timely intervention. They release antimicrobial agents only when needed, reducing antibiotic resistance and enhancing healing. This innovation improves patient outcomes and lowers healthcare costs, offering a smarter solution for infection control and management.

Key Properties of Smart Hydrogel Wound Dressings

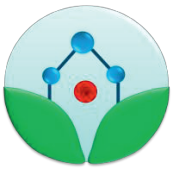
pH -responsive Behavior



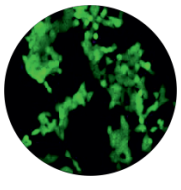
Antimicrobial (95-100% Killing)



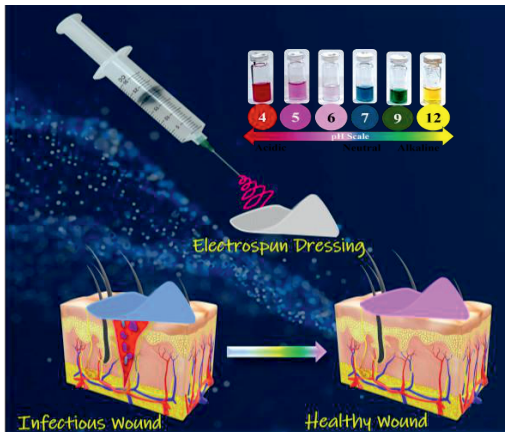
Antioxidant Properties (90% Radical Scavenging)



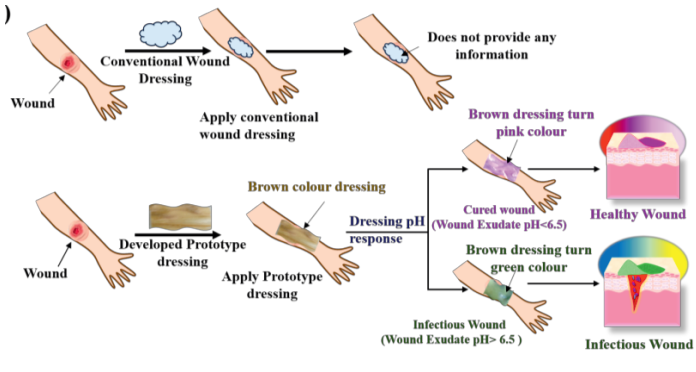
Biocompatible (100% Cell Viability)



Current Research Work



Smart wound dressings color response



Advantage of pH Responsive Hydrogel Wound Dressings

- Easy to diagnose infection & cure.
- Provide moist Environment
- Antibiotic free dressing
- Biocompatible
- Eco-friendly

Advanced Wound Dressing Market

Mussel-Inspired Wearable Hydrogel Sensor for the Real-Time Human Motion Monitoring

Wearable Sensors for Human Motion Monitoring

Comfort and Wearability

Durability and Reliability

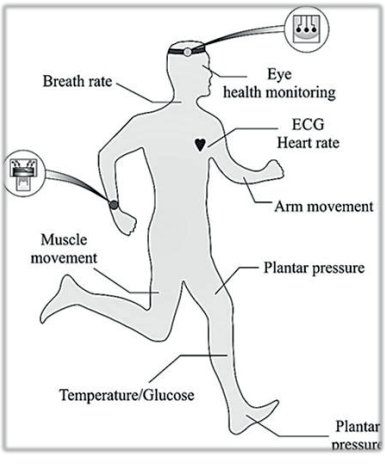
Accuracy and Precision

Why Hydrogel Wearable Sensors are Needed

Hydrogel wearable sensors are essential for continuous, non-invasive monitoring of physiological parameters such as hydration, glucose levels, and pH. Their flexible, biocompatible nature ensures comfort and long-term wearability. These sensors provide real-time data, enabling early detection and management of health conditions, improving patient outcomes, and enhancing the efficiency of healthcare delivery.

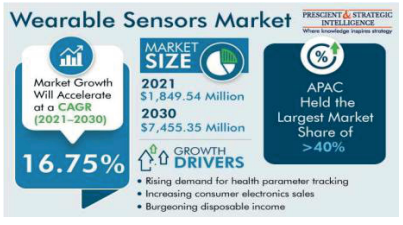
Consequences of Inadequate Health Monitoring

- Reduced Quality of Life
- Healthcare Inequities
- Higher Healthcare Costs

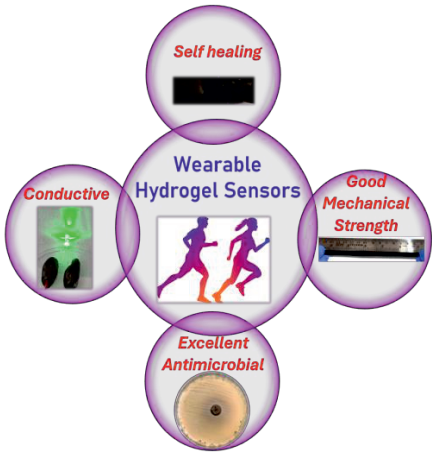


Ongoing Work

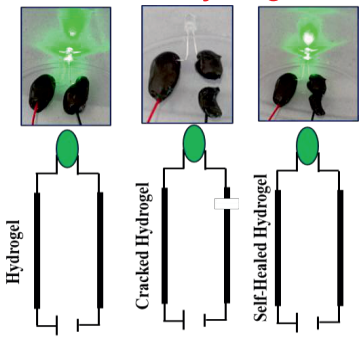
Wearable Sensor Market



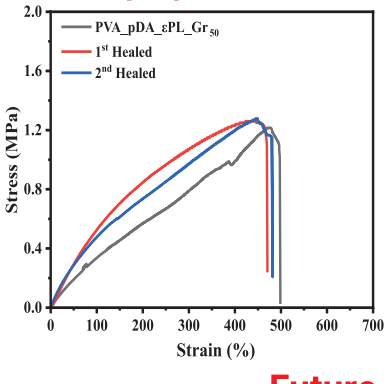
Key Properties of Developed Hydrogel Sensor



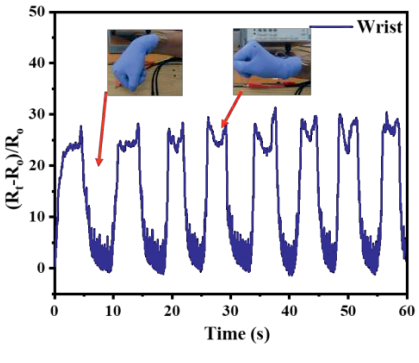
Conductive & Self - Healable Hydrogels



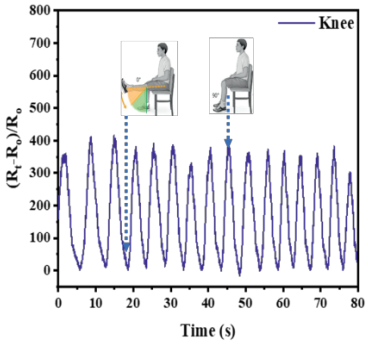
Excellent Self-Healing properties



Wrist Motion Sensing



Knee Motion Sensing



Future Prospects

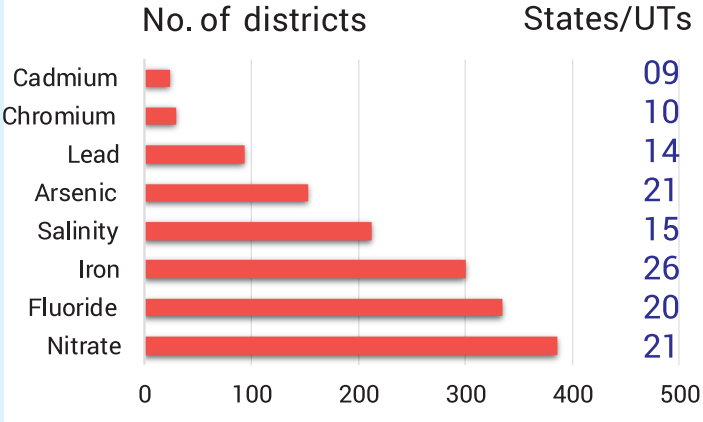
- Future hydrogels will be customized for targeted drug delivery, wound healing, environmental monitoring, and remote health.
- As wearable hydrogel sensors are attracting lot of attention in healthcare, streamlined regulatory approvals, commercialization, and standardization will ensure safety and drive widespread adoption.
- Wearable hydrogel sensors may harvest energy from body movements or ambient sources, enabling self-sustaining operation.

Bio-Inspired Materials to Develop Electrochemical Sensors for Heavy Metal Ions Detection

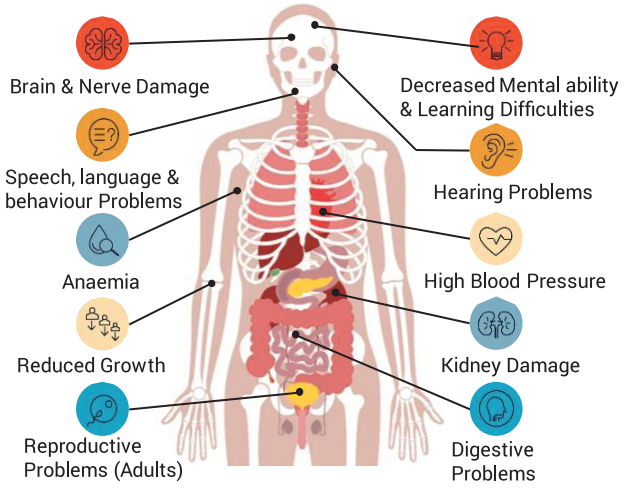
Problem Statement

- The heavy metal refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations.
- Some of the toxic HMI cause serious health issue include Cd, Pb, Cu, As, Fe, Hg, Cr, etc.
- The heavy metal ions are non-biodegradable and can be accumulated into the human body through drinking water and food chain therefore it is necessary to develop a sensitive technique to detect HMIs.
- According to the World Health Organization (WHO), Pb poisoning particularly kills an estimated 1 million people each year.

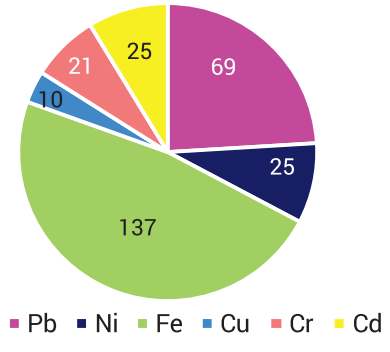
Presence of elements in ground water beyond permissible limit



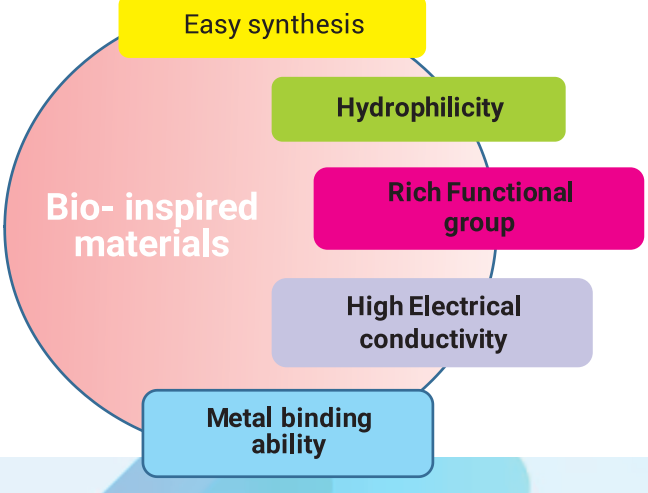
Toxic Effect of HMI Poisoning



Number of affected Rivers



Bio-inspired material for HMI detection



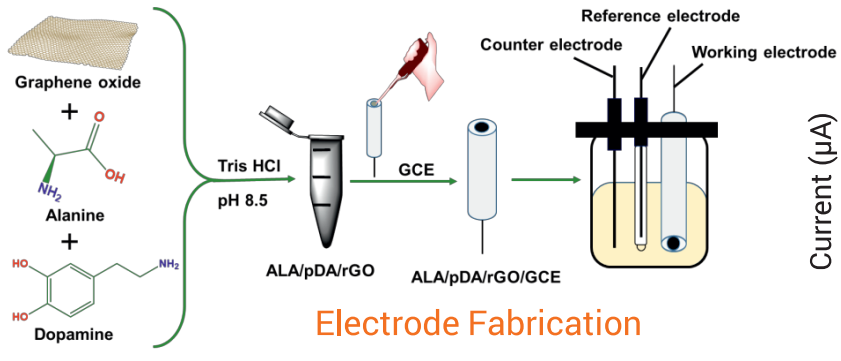
Targeted HMI

Metal Ion	Permissible Limit [1,2]	Related Diseases
Cu	2 mg/l	Wilson's disease, Hepatocellular degeneration, Necrosis
Pb	0.01 mg/l	Neurodevelopment and neurological disorder anaemia
Cd	0.003 mg/l	Bone demineralization, lung cancer, coronaryheart disease
Fe	0.3 mg/l	Parkinson's and Alzheimer's diseases hypotension, metabolic acidosis

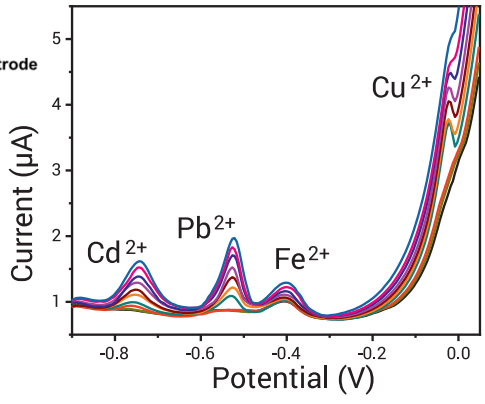
[1]Guidelines for Drinking-water Quality FOURTH EDITION INCORPORATING THE FIRST ADDENDUM .
[2]B. of Indian Standards,Disclosureto Promotethe Right To Information

Bio-Inspired Materials to Develop Electrochemical Sensors for Heavy Metal Ions Detection

HMI sensor for simultaneous detection

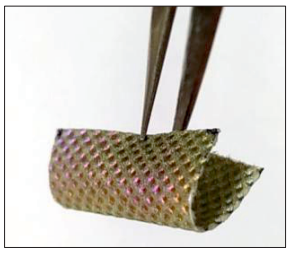


Electrode Fabrication

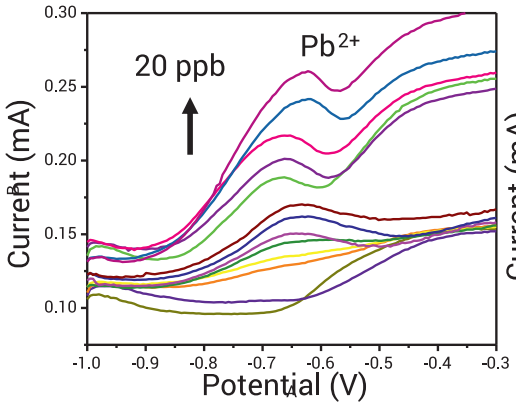


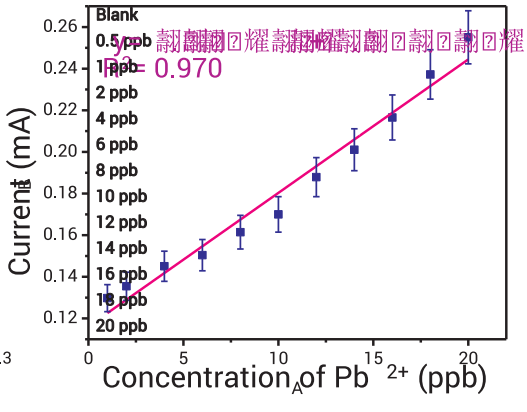
Flexible and disposable sensor for Pb^{2+} ion detection

Flexible Sensingelectrodecomposedofbio-inspired rGO nanocomposite, hydrogenated amorphouscarbon, and copperfilm on the flexible substrate



Flexible Sensing Electrode





Detection of Pb ion using flexible electrode

Applications

Detection of metal ions in various matrices

Water

Soil

Food

Future Plan

- Developmentof hand-held device
- Pb ion sensingin Biologicalsamples

Sustainable Development Goals

Social Impact

Environmental Protection

Safe Drinking Water

Public Health Improvement

Reduced Healthcare Cost

Bio-Inspired Nanocomposite Material for the Development of Electrochemical Biosensors for Neurodegenerative Disorders

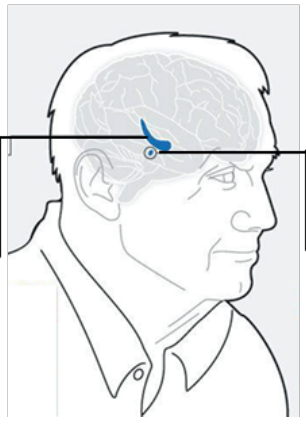
Alzheimer's Disease symptoms

Cognitive: Memory loss and deterioration in thinking and planning functions.

Physical: In mid-stage, disease could include slowness, rigidity and tremors.

INSIDE THE BRAIN (Site of disease)

The cortex, particularly the **hippocampus,** key to memory, shrinks.



Parkinson's Disease symptoms

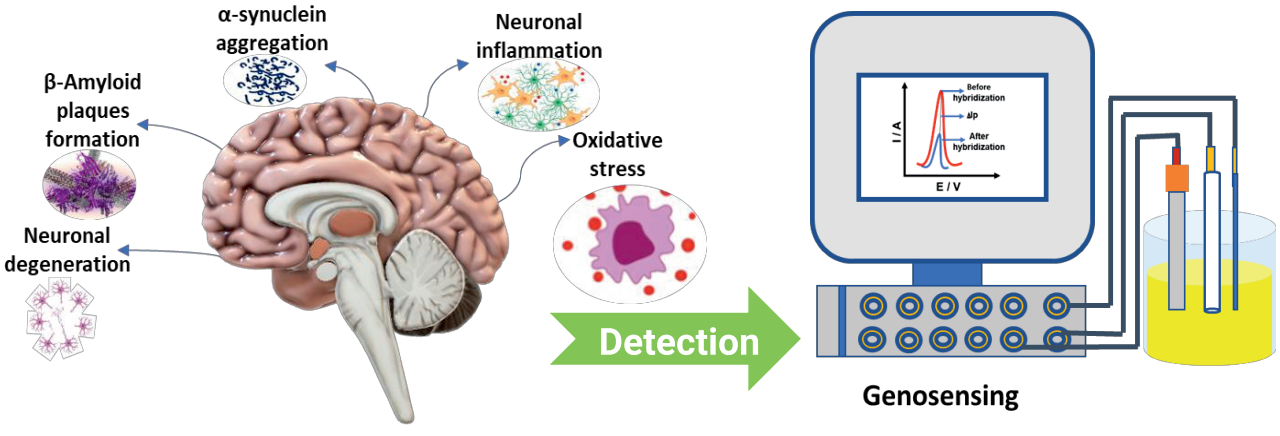
Cognitive: Loss of executive functions, including planning, decision making and controlling emotions.

Physical: Tremors, stiffness and slowed movements.

INSIDE THE BRAIN (Site of disease)

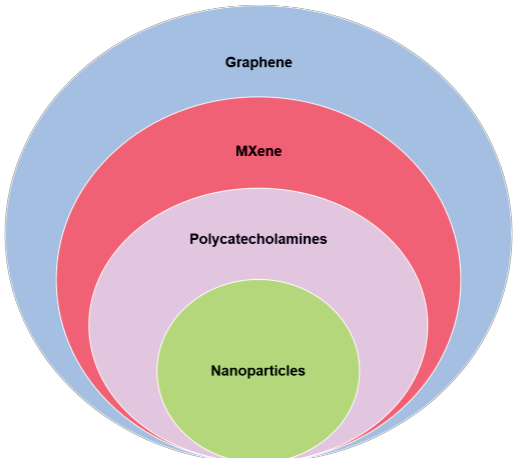
Cells shrink in the **substantia nigra,** where dopamine is produced.

- Neurological disorders are disorders that affect the brain as well as the nerves found throughout the human body and the spinal cord.
- Among all Parkinson's disease (PD) and Alzheimer disease (AD) are the most common chronic and progressive neurodegenerative disorder in the world and affects more than 10 million people worldwide.



Biomarkers of Parkinson's and Alzheimer disease

Bio-Inspired Nanocomposites for Parkinson's and Alzheimer Disease Diagnosis



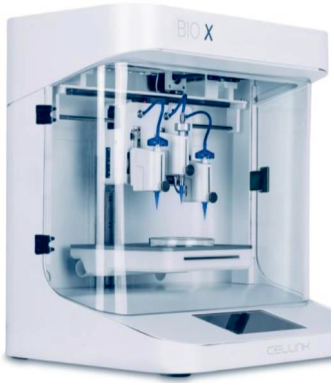
Future Prospects

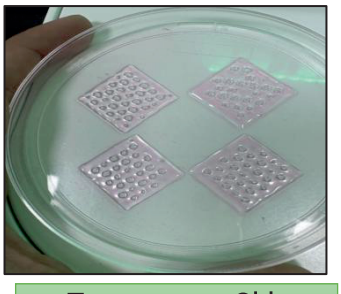
- Development of Biomimetic and Biomaterials based Biosensor Devices for Alzheimer and Parkinson's disease diagnosis.
- Testing on Human Biological Fluids.
- Designing Hand-Held Biosensor Devices.

Sustainable Development Goals in Focus

Transparent Self Healable Bioinspired-Skin Patches via 3D Bio-Printing

Skin patches for wound healing are bioengineered materials designed to promote skin regeneration, protect wounds, and control infections.





Transparent Skin Patches

•Application of these Skin Patches will be:
- •Wound Healing
- •Drug Delivery
- •Burn Treatment
- •Other Skin Infection Treatment

3D Bio-Printer

Key Features

Good printability.

Favorable rheological properties (shear thinning and rapid recovery).

Biocompatibility.

Safer Cross-linking method

Problem statement

Necessity of skin Patches

Chronic wounds, such as burn injuries and diabetic foot ulcers, present a significant burden on both patients and healthcare systems worldwide These non-healing wounds are highly susceptible to bacterial infections, which trigger inflammationand complicate the healing process Bacterial infections hinder re-epithelialization and collagen production, leading to longer hospital stays and higher healthcare costs. As result, there is a critical need for skin a patches that can reduce infection rates and promote faster wound healing.

Targeted Human- Material Interaction (HMI) for skin patches designed
User-Friendly Application
Comfort and Flexibility
Safe and Biocompatible Interaction
Sustained Therapeutic Interaction
Minimal Maintenance

Fabrication of Biomimetic Skin Patches

Hypothesis Test room temperature stability, ready-to-use hydrogels for fabrication of biomimetic skin patches

Goal: Develop a bio-ink mimicking the in-vivo Skin patch model and then print the ink with the help of 3D-Bioprinter.

Key Features of the Patch

Self-healing properties for durability.

Transparency for wound monitoring without removal.

Biocompatibility and non-toxicity.

Transparent Skin patch developed by 3D Bioprinter

Focused Research Areas of Biomimetics and Biomaterials Division

Bioinspired Smart Materials

Bioinspired Smart Materials : Material that adapt to external stimuli (e.g., temperature, light, or pressure). Inspired by cephalopods (for colour change) and plants (for environmental response).

Applications: Self -healing polymers, shape-memory materials, adaptive hydrogel.

Self-Healing Materials

Advanced Self-Healing Materials : Autonomously repair damage, inspired by biological systems like skin and bones. Enhanced functionality with electrical, thermal, and mechanical self-healing.

Applications: Self-healing composites, adaptive surfaces, dynamic covalent materials.

Self Healable Dermal Patches

Bio fabrication & 3D Bioprinting : Creating lifelike tissues and organs using bioinks and 3D printing technology. Scaffolds and matrices that mimic natural tissue structures.

Applications: 3D-printed tissues and organs, organ-on-a-chip, regenerative medicine.

Advanced Dignostics

Biosensors for Health Monitoring: Real-time, continuous tracking of vital biomarkers (e.g., glucose, lactate).Non-invasive sensors for personalized healthcare management.

Applications: Wearable glucose monitors, hydration trackers, multi-analyte sensors.

Computational Biology

Computational Biology for Materials Science : Genetically engineered organisms to produce novel, sustainable biomaterials. Production of engineered proteins and complex materials through microbial systems.

Applications: Bioengineered silk, microbial biopolymers, sustainable biomaterials.

Biosafety & Biomaterials

Innovative Surface Modifications: The success of orthopedic and dental implants depends on effective integration with surrounding tissues. Functional coatings are being developed to enhance biocompatibility and osseointegration, incorporating bioactive substances that promote cell adhesion. Antimicrobial coatings are also crucial for preventing post-surgical infections by inhibiting bacterial growth while maintaining biocompatibility. Additionally, smart coatings that respond to environmental changes offer tailored therapeutic applications. As research progresses, these advancements in functional coatings are set to improve implant longevity and performance, leading to better patient outcomes.

Futuristics Research Areas of Biomimetic and Biomaterials Division

Bioreactors, Enzyme, Toxins, Antimicrobials Production	**Biomimetic Application** : Bioreactors that emulate the functioning of organs such as the liver (for enzyme production) could be advanced through biomimetic designs. By mimicking the complex interactions within cells and tissues, these bioreactors could lead to more efficient production of biological compounds, such as enzymes and antibiotics. Bio-inspired flow systems can optimize nutrient and gas exchange.
Tissue Engineering & Regenerative Medicine/Biomaterials	**Biomimetic Tissue Scaffolds:** Nature-inspired designs, such as the hierarchical structures seen in bones and soft tissues, can drive advancements in tissue engineering. Biomaterials that encourage cell adhesion, proliferation, and differentiation (as seen in natural ECM – extracellular matrices) could revolutionize organ regeneration and repair through biomimetic scaffolds.
3D Printing Metamaterials Towards Tissue Engineering	**Bioinspired Metamaterials :** Drawing from natural structures like bone, spider silk, or coral, 3D-printed metamaterials could be designed to replicate the multifunctionality and adaptability of biological tissues These could be used to create bioengineered organs or highly customized implants that closely match the mechanical and biological properties of native tissues.
Immune modelling	**Mimicking Cellular Communication** : Advanced biomaterials for heart tissue repair could be inspired by the way cells communicate in nature. By understanding and mimicking molecular signaling mechanisms, future biomaterials might respond to their environment dynamically, promoting healing and reducing the risk of immune rejection.
Mimicking Biological Repair Biosafety & Biomaterials	**Mimicking Biological Repair** : Devices like vascular grafts could be developed to emulate the dynamic nature of human tissues Skin grafts could mimic the regenerative capabilities of certain amphibians, improving healing and integration longevity and performance, leading to better patient outcomes.
Gene Therapy and Drug Delivery	**Revolutionizing Treatment Approaches** : Gene therapy targets genetic disorders by correcting defective genes, relying on effective delivery systems like viral vectors and lipid nanoparticles. Advances in targeted drug delivery allow for precise therapeutic release, minimizing side effects. Together, these innovations promise to transform personalized medicine. We will develop bio-materials and bio-inspired materials based smart nanocarriers - For drug delivery, gene therapy and advanced therapeutics.

Futuristics Research Areas of Biomimetic and Biomaterials Division

Bio Machines	**Nature-Inspired Robotics**: Future bio machines may incorporate biomimetic designs seen in soft robotics, inspired by the movements of organisms like octopuses or muscle fibers. These machines could interact seamlessly with human tissues, providing support for damaged organs or serving as implantable devices with regenerative functions.
Stem Cells, Biocompatibility	**Biomimetic Microenvironments:** Biomaterials designed to closely mimic stem cell niches in the body could lead to breakthroughs in regenerative medicine. Using biomimetic environments to cultivate stem cells could lead to more successful therapies for tissue regeneration, ensuring higher biocompatibility and functionality.
Bioinspired Enhancement	**Bioinspired Enhancements**: Future medical devices, like intraocular lenses could be enhanced with bioinspired surface treatments that mimic natural tissues. For example, vascular grafts could be designed to emulate the elasticity and cellular structure of native blood vessels, improving integration and longevity.
Nanocrystalline Materials	**Biomimetic Nano surfaces:** Nanocrystalline materials could be designed based on the natural nanostructures found in surfaces like lotus leaves (for water repellency) or shark skin (for antibacterial properties). These materials can be applied to implants, improving their interaction with the human body and reducing infection risks.
Surface Treatment of Biomaterials	**Inspired by Biological Interfaces:** Surface treatments for biomaterials can mimic the way biological surfaces interact with their environment, such as the self-cleaning properties of lotus leaves or the adhesion mechanisms of geckos. These treatments can enhance the performance of implants by improving biocompatibility and reducing wear or biofouling
Bioinspired Materials for Space and Defense	**Extreme Environment Biomaterials:** Materials inspired by organisms that survive in harsh environments (e.g., extremophiles) could be adapted for use in space or defense. These biomimetic materials might resist radiation, extreme temperatures, or mechanical stress, making them ideal for space missions or protective gear.
Biosafety & Biomaterials	**Bioinspired Safety Mechanisms:** To improve biosafety, materials could be designed to degrade in a controlled manner similar to natural tissues. They could also include built-in sensors to monitor and signal any adverse biological responses, mimicking the body's own feedback systems. Work on sudden outbreak of biological threads and transportation of BSL 1, BSL2, & BSL3 microorganism. Establishment of BSL2+ or BSL3 biosafety lab.

Futuristics Research Areas of Biomimetic and Biomaterials Division

Biosafety & Biomaterials	**Bio-Invisibility**: Future biomaterials could take inspiration from biological examples of transparency or camouflage, such as the skin of certain cephalopods (e.g., octopuses). These materials might be used in defense or in creating stealth medical devices that are less detectable by
Invisible Bioinspired Materials	**Bioinspired Safety Mechanisms:** To improve biosafety, materials could be designed to degrade in a controlled manner similar to natural tissues. They could also include built-in sensors to monitor and signal any adverse biological responses, mimicking the body's own feedback systems.
DNA Genetically Encoded Biomaterials	**Biomimetic Genetic Encoding:** Future biomaterials might be designed using genetically encoded sequences, allowing for programmable materials that adapt or respond to environmental stimuli, much like how living organisms respond to changes in their environment.
Bioinspired Materials for Space Defense	**Extreme Environment Biomaterials:** Materials inspired by organisms that survive in harsh environments (e.g., extremophiles) could be adapted for use in space or defense. These biomimetic materials might resist radiation, extreme temperatures, or mechanical stress, making them ideal for space missions or protective gear.
Transcription of mRNA, Protein Sequences of Proteins	**Biological Machinery Inspiration**: The molecular machinery of cells could inspire future biomaterials capable of synthesizing or modulating protein production. These biomaterials could be used to create self-healing tissues or responsive implants.
Biopharmaceuticals & Pharmacognosy	**Biomimetic Drug Design:** Future biopharmaceuticals could be inspired by natural compounds from plants, fungi, and marine organisms. Pharmacognosy can guide the discovery of bioactive molecules that mimic these natural substances, offering more effective and targeted therapies. Genetically engineered organisms may also be used to produce complex drugs, like antibodies and hormones, more efficiently.
Artificial Heart Valves & Next-Generation Implants	**Futuristic Biomimetic Research:** Future artificial heart valves and implants could be inspired by natural processes of tissue regeneration and self-healing, using bioinspired materials that can mimic the mechanical and biological properties of natural heart valves. Nanotechnology and 3D bioprinting will play key roles in making valves and implants more efficient and adaptable to each patient's biological environment, enhancing longevity and reducing complications.

Articles Published in International SCI Journals on Bio-Inspired Materials and Biomaterials from CSIR-AMPRI

S. No.	Author(s)	Year	Title	Complete Reference of Journal
	Antimicrobial Materials and Coating			
1.	Raj Kumar Sen, Priyanka Prabhakar, Shruti, Priya Verma, Apeksha Vikram, Aradhana Mishra, Ashish Dwivedi, Vijay Sorna Gowri, Jamuna Prasad Chaurasia, Dehi Pada Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2024	Smart Nanofibrous Hydrogel Wound Dressings for Dynamic Infection Diagnosis and Control: Soft but Functionally Rigid	ACS Applied Bio Materials 7, 2, 2024, 999-1016. [Impact Factor: 4.6]
2.	Raj Kumar Sen, Priyanka Prabhakar, Venkatesh Mayandi, Neeraj Dwivedi, Amit K Yadav, Pratima R Solanki, Ayush Gupta, VS Gowri, Rajamani Lakshminarayanan, Navin Kumar Verma, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*	2023	Metal mediated high performance antimicrobial hydrogel films for wound infection management: Zn, Cu, and Mg versus Ag and Au	Materials Chemistry and Physics, 2023, 297, 127365. (Impact Factor: 4.778)
3.	Priyanka Prabhakar, Raj Kumar Sen, Venkatesh Mayandi, Monika Patel, B Swathi, Jeet Vishwakarma, VS Gowri, Rajamani Lakshminarayanan, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2022	Mussel-inspired chemistry to design biodegradable food packaging films with antimicrobial properties	Process Safety and Environmental Protection, 2022, 162, 17-29. (Impact Factor: 7.93)
4.	Neha Bisht, Neeraj Dwivedi, Pradip Kumar, Mayandi Venkatesh, Amit K Yadav, Deepti Mishra, Pratima Solanki, Navin Kumar Verma, Rajamani Lakshminarayanan, Seeram Ramakrishna, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*	2022	Recent Advances in Copper and Copper-Derived Materials for Antimicrobial Resistance and Infection Control	Current opinion in biomedical engineering, 2022, 24, 100408. (Impact Factor: 4.16)
5.	Priyanka Prabhakar, Raj Kumar Sen, Monika Patel, Neeraj Dwivedi, Shiv Singh, Manisha Chouhan, Amit K Yadav, Dehi Pada Mondal, Pratima R Solanki, Avanish Kumar Srivastava, Chetna Dhand*	2022	Development of Copper Impregnated Bio-Inspired Hydrophobic Antibacterial Nanocoatings for Textiles	Colloids and Surfaces B: Biointerfaces, 2022, 220, 112913. (Impact Factor: 6.00)

S. No.	Author(s)	Year	Title	Complete Reference of Journal
6.	Chetna Dhand, Raghavendra Ramalingam, Venkatesh Mayandi, Chak Ming Leung, Hariharan Ezhilarasu, Sathish Kumar Karuppannan, Praseetha Prasannan, Seow Theng Ong, Nandhini Sunderasan, Ilango Kaliappan, Mohammed Kamruddin, Veluchamy Amutha Barathi, Navin Kumar Verma, Seeram Ramakrishna, Rajamani Lakshminarayanan, Kantha Deivi Arunachalam	2021	Core–Shell Structured Antimicrobial Nanofiber Dressings Containing Herbal Extract and Antibiotics Combination for the Prevention of Biofilms and Promotion of Cutaneous Wound Healing	ACS Appl. Mater. Interfaces 2021, 13, 21, 24356–24369. (Impact Factor: 9.229)
7.	Chetna Dhand, Chun Yan Ong, Neeraj Dwivedi, Jayasudha Varadarajan, Mercy Halleluyah Periayah, Edward Jianyang Lim, Venkatesh Mayandi, Eunice Tze Leng Goh, Raymond P Najjar, Lai Wah Chan, Roger W Beuerman, Li Lian Foo, Xian Jun Loh, Rajamani Lakshminarayanan	2020	Mussel-inspired durable antimicrobial contact lenses: The role of covalent and noncovalent attachment of antimicrobials	ACS Biomaterials Science & Engineering, 2020, 6, 3162-3173. (Impact Factor: 5.395)
8.	Venkatesh Mayandi, Alvin Chua Wen Choong, Chetna Dhand, Fui Ping Lim, Thet Tun Aung, Harini Sriram, Neeraj Dwivedi, Mercy Halleluyah Periayah, Sreepathy Sridhar, Mobashar Hussain Urf Turabe Fazil, Eunice Tze Leng Goh, Gorka Orive, Roger W. Beuerman, Timothy Mark Sebastian Barkham, Xian Jun Loh, Zhao-Xun Liang, Veluchamy Amutha Barathi, Seeram Ramakrishna, Si Jack Chong, Navin Kumar Verma, Rajamani Lakshminarayanan	2020	Multifunctional antimicrobial nanofiber dressings containing e-polylysine for the eradication of bacterial bioburden and promotion of wound healing in critically colonized wounds	ACS applied materials & interfaces, 2020, 12, 15889-16005. (Impact Factor: 10.383)

S. No.	Author(s)	Year	Title	Complete Reference of Journal
Sensors and Biosensors				
1.	Mansi Chaturvedi, Monika Patel, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2024	Bio-inspired graphene nanocomposite enabled electrochemical immunosensor for detection and quantification of NS1 protein of dengue virus	Electrochimica Acta 475, 2024, 143630. [Impact Factor: 6.6]
2.	Monika Patel, Pankaj Bharti, Priyanka Prabhakar, Sweksha Shrivastava, Preeti Mehar, Pradip Kumar, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand, Neeraj Dwivedi	2024	Functionally gradient multilayer coating enabled flexible sensors for lead detection in water and soil	Chemical Engineering Journal, 149441 (Impact Factor: 15.1)
3.	Sneh Nema , Monika Patel , Shubham Jaiswal , Chetna Dhand , Neeraj Dwivedi	2024	Polydopamine modified Ti3AlC2 MAX phase promotes electrochemical heavy metal detection,	Surfaces and Interfaces Volume 51, 104752 [Impact Factor: 5.7]
4.	Himanshi Goel, Monika Patel, Mansi Chaturvedi, Gaurav Kumar Gupta, Anup Kumar Khare, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Maumita Das Mukherjee, Chetna Dhand*	2024	Polydopamine functionalized Ti3AlC2 MAX based electrochemical biosensor for early and sensitive detection of Mycobacterium tuberculosis	Microchemical Journal 197, 2024, 109899 (Impact Factor: 4.8)
5.	Mansi Chaturvedi, Monika Patel, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2024	Bio-inspired graphene nanocomposite enabled electrochemical immunosensor for detection and quantification of NS1 protein of dengue virus	Electrochimica Acta 475, 2024, 143630. [Impact Factor: 6.6]
6.	Monika Patel, Pankaj Bharti, Priyanka Prabhakar, Sweksha Shrivastava, Preeti Mehar, Pradip Kumar, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand, Neeraj Dwivedi	2024	Functionally gradient multilayer coating enabled flexible sensors for lead detection in water and soil	Chemical Engineering Journal, 149441 (Impact Factor: 15.1)

S. No.	Author(s)	Year	Title	Complete Reference of Journal
7.	Mansi Chaturvedi, Monika Patel, Archana Tiwari, Neeraj Dwivedi, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*	2023	An insight to the recent advancements in detection of Mycobacterium tuberculosis using biosensors: A systematic review	Progress in Biophysics and Molecular Biology, 2023. [Impact Factor: 3.8].
8.	Himanshi Goel, Priyanshi Gupta, Kanak Jha, Monika Patel, Neeraj Dwivedi, Kumar Rakesh Ranjan, Chetna Dhand, Maumita Das Mukherjee	2023	Mxene-based nanocomposites for biosensing: Recent developments and future prospects	Flatchem 42, 2023, 100576. [Impact Factor: 6.2].
9.	Neha Bisht, Monika Patel, Neeraj Dwivedi, Pradip Kumar, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*,	2023	Bio-inspired polynorepinephrine based nanocoatings for reduced graphene oxide/gold nanoparticles composite for high-performance biosensing of Mycobacterium tuberculosis	Environmental Research, 227, 2023, 115684. [Impact Factor: 8.4].
10.	Mansi Chaturvedi, Monika Patel, Neha Bisht, Maumita Das Mukherjee, Archana Tiwari, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2023	Reduced Graphene Oxide-Polydopamine-Gold Nanoparticles: A Ternary Nanocomposite-Based Electrochemical Geno sensor for Rapid and Early Mycobacterium tuberculosis Detection	Biosensors, 2023, 13, 342. (Impact Factor: 5.743)
11.	Monika Patel, Neha Bisht, Priyanka Prabhakar, Raj Kumar Sen, Pradip Kumar, Neeraj Dwivedi, Mohammad Ashiq, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*	2023	Ternary nanocomposite-based smart sensor: Reduced graphene oxide/polydopamine/alanine nanocomposite for simultaneous electrochemical detection of Cd2+, Pb2+, Fe2+, and Cu2+ ions	Environmental Research, 2023, 221 115317. (Impact Factor: 8.431)
12.	Chetna Dhand*, Neha Bisht, Neeraj Dwivedi, Ajit Khosla, DP Mondal, Avanish Srivastava	2023	Recent Advances in Polydopamine-based Electrochemical Biosensors	Journal of The Electrochemical Society, 2022, 169, 107505. (Impact Factor: 4.316)

S. No.	Author(s)	Year	Title	Complete Reference of Journal
13.	Neha Bisht, Monika Patel, Neeraj Dwivedi, Pradip Kumar, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*,	2023	Bio-inspired polynorepinephrine based nanocoatings for reduced graphene oxide/gold nanoparticles composite for high-performance biosensing of Mycobacterium tuberculosis	Environmental Research, 227, 2023, 115684. [Impact Factor: 8.4].
14.	Mansi Chaturvedi, Monika Patel, Neha Bisht, Maumita Das Mukherjee, Archana Tiwari, DP Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2023	Reduced Graphene Oxide-Polydopamine-Gold Nanoparticles: A Ternary Nanocomposite-Based Electrochemical Geno sensor for Rapid and Early Mycobacterium tuberculosis Detection	Biosensors, 2023, 13, 342. (Impact Factor: 5.743)
15.	Monika Patel, Neha Bisht, Priyanka Prabhakar, Raj Kumar Sen, Pradip Kumar, Neeraj Dwivedi, Mohammad Ashiq, DP Mondal, Avanish Kumar Srivastava, Chetna Dhand*	2023	Ternary nanocomposite-based smart sensor: Reduced graphene oxide/polydopamine/alanine nanocomposite for simultaneous electrochemical detection of Cd2+, Pb2+, Fe2+, and Cu2+ ions	Environmental Research, 2023, 221 115317. (Impact Factor: 8.431)
16.	Raj Kumar Sen, Priyanka Prabhakar, Neha Bisht, Monika Patel, Shruti Mishra, Amit Kumar Yadav, Divya Vadakkumana Venu, Gaurav Kumar Gupta, Pratima R Solanki, Seeram Ramakrishnan, Dehipada Mondal, Avanish Kumar Srivastava, Neeraj Dwivedi, Chetna Dhand*	2022	2D Materials-Based Aptamer Biosensors: Present Status and Way Forward.	Current Medicinal Chemistry, 2022, 1 (4), 673-685. (Impact Factor: 4.74)
17.	Chetna Dhand*, Neha Bisht, Neeraj Dwivedi, Ajit Khosla, DP Mondal, Avanish Srivastava	2022	Recent Advances in Polydopamine-based Electrochemical Biosensors	Journal of The Electrochemical Society, 2022, 169, 107505. (Impact Factor: 4.316)
18.	Pushpesh Ranjan, Arpana Parihar, Surbhi Jain, Neeraj Kumar, Chetna Dhand, S Murali, Deepti Mishra, Sunil K Sanghi, JP Chaurasia, Avanish K Srivastava, Raju Khan	2020	Biosensor-based diagnostic approaches for various cellular biomarkers of breast cancer: A comprehensive review	Analytical Biochemistry, 2020, 610, 113996. (Impact Factor: 3.191)

Other Publications in the Field of Bio-Inspired Materials and Biomedicines				
1.	Pankaj Bharti, Shubham Jaiswal, Rajeev Kumar, Pradip Kumar, Anup Kumar Khare, Chetna Dhand, Neeraj Dwivedi	2024	Large control of friction and wear enabled by Ti3AlC2 MAX-multilayer graphene-polydopamine composites	FlatChem, 46, 100671. (Impact Factor: 6.2)
2.	Raj Kumar Sen, K Karthikeyan, Priyanka Prabhakar, Jeet Vishwakarma, Gaurav Gupta, SN Mishra, Alka Mishra, JP Chaurasia, SAR Hashmi, DP Mondal, Pratima R Solanki, AK Srivastava, Chetna Dhand, Neeraj Dwivedi	2022	Fast-tracking of adulterants and bacterial contamination in food via Raman and infrared spectroscopies: paving the way for a healthy and safe world	Sensors & Diagnostics, 2022, 1, 673-685. (Impact Factor: 3.5)
3.	Pradip Kumar, Chetna Dhand, Neeraj Dwivedi, Shiv Singh, Raju Khan, Sarika Verma, Archana Singh, Manoj Kumar Gupta, Surender Kumar, Rajeev Kumar, Avanish Kumar Srivastava	2021	Graphene quantum dots: A contemporary perspective on scope, opportunities, and sustainability	Renewable and Sustainable Energy Reviews (Accepted, Dec 2020). (Impact Factor: 16.8)
4.	Priyanka Prabhakar, Raj Kumar Sen, Neeraj Dwivedi, Raju Khan, Pratima R. Solanki, Avanish Kumar Srivastava, Chetna Dhand*	2021	3D-Printed Microfluidics and Potential Biomedical Applications	Frontiers in Nanotechnology, 2021, DOI: 10.3389/fnano.2021.609355. (Impact Factor: 4.1)
5.	Neeraj Dwivedi, Chetna Dhand, Pradip Kumar, AK Srivastava	2021	Emergent 2D materials for combating infectious diseases: the potential of MXenes and MXene–graphene composites to fight against pandemics	Materials Advances, 2021, 2, 2892-2905. (Impact Factor: NA)
6.	Raymond P Najjar, Juan Manuel Chao De La Barca, Veluchamy A Barathi, Candice Ee Hua Ho, Jing Zhan Lock, Arumugam R Muralidharan, Royston KY Tan, Chetna Dhand, Rajamani Lakshminarayanan, Pascal Reynier, Dan Milea	2021	Ocular growth and metabolomics are dependent upon the spectral content of ambient white light	Scientific Reports 2021, 11, Article number: 7586. (Impact Factor: 4.996)
7.	A. K. Srivastava, Neeraj Dwivedi, Chetna Dhand, Raju Khan, N Sathish, Manoj K Gupta, Rajeev Kumar, Surender Kumar	2020	Potential of Graphene-based Materials to Combat COVID-19: Properties, Perspectives and Prospects	Materials Today Chemistry 2020, 18, 100385. (Impact Factor: 7.613)

Other Publications in the Field of Bio-Inspired Materials and Biomedicines				
1.	JP Chaurasia, J P Shukla, Neelam Pandey,- International Journal for Research in Applied Science & Engineering Technology (IJRASET) - Volume 3 Issue VII, (July 2015) @ - A . If:7.894	2015	Antimalarial Property of Tetra Combination (TC) Of Biomaterial with Special Reference to Spilanthes Acmella	International Journal for Research in Applied Science & Engineering Technology (IJRASET) - Volume 3 Issue VII, (July 2015) : - : . If:7.894
2.	Chaurasia JP and Vyas K.M	2022	In vivo evaluation of some homeopathic drugs against betel vine Phytophthora disease,	Indian Phytopath,50(4): 148-153
3.	Srivastava AK, Chaurasia JP*, Khan R, Dhand C, Verma S	2020	Role of Medicinal Plants of Traditional Use in Recuperating Devastating COVID-19 Situation	Medicinal & Aromatic Plants (Los Angeles), August 31, ,Vol.9 Iss.5 No:359.IF:26.36
4.	Medha Mili, Ayush Jaiswal, Vaishnavi Hada, Sai S. Sagiri, Kunal Pal, Rashmi Chowdhary, Rejesh Malik, Radha S. Gupta, Manoj K. Gupta, Jamana P. Chaurasia, SAR Hashmi, Sanjai K.S. Rathore and Avanish K. Srivastava	2021	Development of Graphene Quantum Dots by Valorizing the Bioresources-a critical review	Chemistry Select (European Chemical Societies Publishing), 6, 9990-10001. IF:2.1
5.	Pushpesh Ranjan, Shalu Yadav, Mohd. Abubakar Sadique, Raju Khan, Jamana Prasad Chaurasia and Avanish Kumar Srivastava	2021	Functional Ionic Liquids Decorated Carbon Hybrid Nanomaterials for the Electrochemical Biosensors	Biosensors journal,,11,414, https://doi.org/10.3390/bios11110414. IF:5.519

6.	Sen, Raj Kumar, Karthikeyan, Prabhakar, Priyanka, Vishwakarma Jeet, Gupta Garuv, Mishra S.N., Mishra Alka, Chaurasia J.P., Hashmi S, Mondal D.P., Solanki Pratima, Srivastava A, Dhand Chetna, Dwivedi Neeraj	2021	Fast Tracking of food fraud and viruses: paving the way for a healthy and safe world, sensors & Diagnostic	" published by Royal Society of Chemistry, IF 8.36
7.	Neeraj Dwivedi, Chetna Dhand, Pradip Kumar, AK Srivastava	2021	Emergent 2D materials for combating infectious diseases: the potential of MXenes and Mxene–graphene composites to fight against pandemics	Materials Advances, 2021, 2, 2892-2905. (Impact Factor: NA)
8.	Raymond P Najjar, Juan Manuel Chao De La Barca, Veluchamy A Barathi, Candice Ee Hua Ho, Jing Zhan Lock, Arumugam R Muralidharan, Royston KY Tan, Chetna Dhand, Rajamani Lakshminarayanan, Pascal Reynier, Dan Milea	2021	Ocular growth and metabolomics are dependent upon the spectral content of ambient white light	Scientific Reports 2021, 11, Article number: 7586. (Impact Factor: 4.996)
9.	A. K. Srivastava, Neeraj Dwivedi, Chetna Dhand, Raju Khan, N Sathish, Manoj K Gupta, Rajeev Kumar, Surender Kumar	2020	Potential of Graphene-based Materials to Combat COVID-19: Properties, Perspectives and Prospects	Materials Today Chemistry 2020, 18, 100385. (Impact Factor: 7.613)

Patents Filed and Granted in the area of Biomaterials

S. No.	Name of the Inventors	Country	Title	Filed on (Date)
1.	Chetna Dhand, Neeraj Dwivedi, Monika Patel, Pradip Kumar, Dehi Pada Mondal, Avanish Kumar Srivastava	India	Multilayer coating enabled flexible electrodes for lead detection and preparation thereof	Patent No. 0144NF2023
2.	Neeraj Dwivedi, Chetna Dhand, Rajeev Kumar, S. A. R. Hashmi, S. K. S. Rathore, A. K. Srivastava	India	Hand Sanitizer With Enhanced Skincare,	Patent No. 0068NF2020
3.	Sarika Verma, Medha Mili, Chetna Dhand, Alka Mishra, Raju Khan, Jamana, Prasad Chaurasia, Mohammed Akram Khan, Syed Azhar Rasheed Hashmi, Sanjai Kumar Singh Rathore, Avanish Kumar Srivastava	India	AMPRI CARE Disinfectant Box-UV rays Hybrid technology	Patent No. 0129NF2020

Book Published

S. No.	Name of the Author	Year	Book Title	Publisher
1.	Dr. J.P. Chaurasia	2001	Betel vine Cultivation and Management of Diseases	ISBN13- 9788172332761 & ISBN 81 72332769 Published by Scientific Publishers, Jodhpur, ISBN 81 72332769 Rs. 1200in India, USA/Canada 158.50 US$, Australia/ NZ. A$ 238.80,Other Countries 174.30 US Websites: http: www.netstoreUSA.com/scintificpub.Com / dkagencies.co

Book Edited

S. No.	Editor(s)	Year	Book Title	Publisher
1.	Raju Khan, Chetna Dhand, S. K. Sanghi, Thankaraj S. Shabi and A. B. P. Mishra	2021	Advanced Microfluidics Based Point-of-Care Diagnostics: A Bridge Between Microfluidics and Biomedical Applications	CRC Press, Taylor and Francis Group
2.	Mansi Chaturvedi, Chetna Dhand, Neeraj Dwivedi, J. P. Chaurasia (Under Preparation)	2024	A Comprehensive Exploration of Advancements in Biosensor Technology for Mycobacterium tuberculosis Detection	CRC Press, Taylor and Francis Group

Book Chapter Published

S. No.	Author(s)	Year	Title	Publisher
1.	Priyanka Prabhakar, Raj Kumar Sen, Neeraj Dwivedi, Pratima Solanki, A. K. Shrivastava, Chetna Dhand	2021	3D printed microfluidics device with integrated biosensors for biomedical applications	CRC Press, Taylor and Francis Group
2.	Neeraj Dwivedi, Chetna Dhand, Avanish Kumar Srivastava	2021	Commercialization of microfluidic point-of-Care diagnostic devices	CRC Press, Taylor and Francis Group
3.	Neeraj Dwivedi, Chetna Dhand, Avanish Kumar Srivastava	2023	Materials Science to Combat COVID-19	CRC Press, Taylor and Francis Group
4.	Neeraj Dwivedi, Chetna Dhand, Avanish Kumar Srivastava	2023	Biocompatibility and Cytotoxicity of 2D Materials	CRC Press, Taylor and Francis Group
5.	Neeraj Dwivedi, Chetna Dhand, Avanish Kumar Srivastava	2023	2D Materials as Antiviral Agents to Combat COVID-19	CRC Press, Taylor and Francis Group
6.	J.P. Chaurasia	2014	"Environmental Pollution in 21st Century" Effect of Osmium sanctum leaf extract on betel vine Phytophthora disease: An ecofriendly new approach	Narendra Publishing House, Delhi. ISBN 81-85375- 46-1
7.	Madhuri Sonekar, Neha Chaurasia, J.P. Chaurasia and J.P. Shukla	:	Moringa Oleifera as Best Bio coagulant and Natural Water Purifier	Technologies for Sustainable Rural Development Having Potential for Socio-Economic Upliftment--ISBN:978-81-8424-862-3-Published by Allied Publishers Pvt. Ltd. , New Delhi-110064

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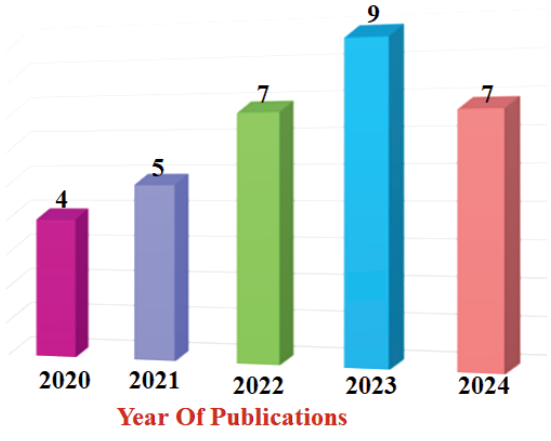

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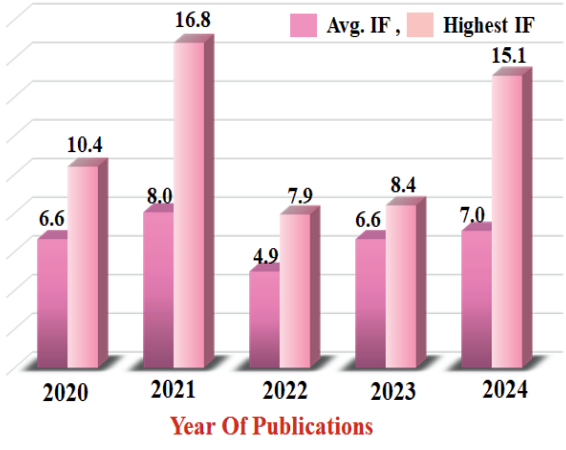

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ROYAL SOCIETY OF CHEMISTRY

Researchers Working in the field of Biomimetics Materials in India

S. No.	Scientists	Institute	Research interests
1.	Dr. Ambarish Ghosh	IISc, Bengaluru	Mimicking the shapes and swimming methods of micro-organisms, such as the corkscrew motion of bacterial flagella and the flexible oar-like motion of spermatozoa to power and control the motion of nanoscale objects in different fluids.
2.	Dr. Sujoy K. Das	CSIR-IICB, Kolkata	Development of novel strategies for the controlled nanomaterial synthesis using living organisms as natural nanofactory.
3.	Prof. Shyamanta M. Hazarika	IIT, Guwahati	Development of biomimetic neuroprostheses and intelligent assistive devices for robotic neurorehabilitation.
4.	Dr. V. Ramgopal Rao	IIT, Delhi Vice-Chancellor for the Birla Institute of Technology & Science (BITS) Pilani	Development of nano-biomimetic devices and sensors, which include bio-inspired nanoelectronics for healthcare applications.
5.	Dr. Sujoy K. Guha	IIT, Kharagpur	Development of biomimetic implants and medical devices.
6.	Prof. Suman Chakraborty	IIT, Kharagpur	Micro/nano scale fluid dynamics. Further, he innovated a biomimetic tumour-on-a-chip technology for unleashing the mechanisms of cancer progression.
7.	Dr. Amitabha Chattopadhyay	CSIR-CCMB, Hyderabad	Development of Biomimetic membranes and their applications in understanding cell membrane organization and function.
8.	Dr. Soumen Sen	CSIR-CMERI, Durgapur, WB	Developing Biomimetic Underwater Swimming Robot for Autonomous Surveillance

Researchers Working in the field of Biomimetic Materials Internationally

S. No.	Name of Researcher	Institute	Research Work
1.	Joanna Aizenberg	Harvard University, USA	Focuses on developing new materials inspired by biological systems (**Lotus Leaves**: For self-cleaning surfaces due to their water-repellent properties, **Moth Eyes**: For creating anti-reflective surfaces that improve optical performance, **Coral Reefs**: For designing structural materials with unique light and thermal properties, **Arthropod Exoskeletons**: For developing impact-resistant and adaptive materials), particularly in the areas of bioinspired photonic systems and self-healing materials. Aizenberg's work bridges materials science and biology to create advanced functional materials.
2.	Robert F. Shepherd	Cornell University, USA	Works on soft robotics and bioinspired materials, focusing on the development of materials that mimic the flexibility and resilience of biological tissues. Shepherd's research aims to create adaptive, versatile robots and materials with applications in medicine, manufacturing, and environmental sensing.
3.	Markus J. Buehler	Massachusetts Institute of Technology (MIT), USA	Studies the mechanical properties of biological materials and develops new materials inspired by natural structures such as spider silk and bone.
4.	Andre Studart	ETH Zurich, Switzerland	Works on bioinspired materials and structures, focusing on the development of materials with hierarchical structures (bone and wood), similar to those found in nature.

Researchers Working in the field of Biomimetic Materials Internationally

S. No.	Name of Researcher	Institute	Research Work
5.	Janine Benyus	Biomimicry 3.8, USA	Known for her work in the field of biomimicry, advocating for the design of products and systems inspired by natural processes and organisms.
6.	Tony Turner	Linköping University, Sweden	Focuses on biosensors and bioinspired materials, with applications in healthcare and environmental monitoring.
7.	Carmel Majidi	Carnegie Mellon University, USA	Works on soft materials and robotics, drawing inspiration from the flexibility and adaptability of biological tissues.
8.	Anna C. Balazs	University of Pittsburgh, USA	Develops theoretical models and simulations of bioinspired materials, focusing on their dynamic behaviour and self-healing properties.
9.	Shu Yang	University of Pennsylvania, USA	Responsive and adaptive materials inspired by natural systems. She develops surfaces with unique properties inspired by nature, such as self-cleaning surfaces like lotus leaves, adhesive surfaces like gecko feet, and anti-reflective surfaces like moth eyes. These surfaces have potential applications in various industries, including medical devices, optics, and consumer products. Also, her work includes creating materials that can change their properties in response to environmental stimuli. This includes materials that can alter their shape, colour, or other physical properties in reaction to changes in temperature, light, humidity, or mechanical stress.

Researchers Working in the field of Biomimetic Materials Internationally

S. No.	Name of Researcher	Institute	Research Work
10.	Thomas Speck	University of Freiburg, Germany	Bioinspired materials and structures, particularly plant-inspired materials. Speck's work involves studying the mechanical properties of plants and translating these principles into new materials and structures. This includes the design of lightweight, strong, and flexible materials inspired by the hierarchical organization of plant tissues.
11.	Peter Fratzl	Max Planck Institute of Colloids and Interfaces, Germany	Biomimetic materials inspired by bone and other biological tissues Fratzl studies the structure and function of biological materials to inspire the design of new synthetic materials. This includes examining how natural materials, such as bone, shell, and spider silk, achieve their unique properties through hierarchical organization and composition.
12.	Julian Vincent	University of Oxford, UK	Biomimetics in mechanical engineering and biological systems Vincent investigates how principles from biology can be applied to solve engineering problems and design innovative materials. This includes analysing how natural organisms achieve their functions and using these insights to inspire new technologies and materials.
13.	Ille C. Gebeshuber	Vienna University of Technology, Austria	Bioinspired nanomaterials and surface engineering Gebeshuber investigates nanomaterials that are inspired by natural structures and functions. This includes studying the nanostructures of biological systems to develop new materials with enhanced properties, such as improved mechanical strength, optical characteristics, or self-cleaning abilities.

Researchers Working in the field of Biomimetic Materials Internationally

S. No.	Name of Researcher	Institute	Research Work
14.	Herbert Waite	University of California, Santa Barbara, USA	Bio-adhesives inspired by marine organisms. Waite is renowned for his studies on the adhesive mechanisms of marine organisms, such as mussels, barnacles, and sea stars. His work investigates how . these organisms produce and use natural adhesives to attach to various surfaces in aquatic environments.
15.	Mathias Kolle	Massachusetts Institute of Technology (MIT), USA	Structural colors and optical materials inspired by nature. Kolle investigates the use of structural colors, which are produced through the physical arrangement of materials rather than pigments. His work includes studying how natural organisms, such as butterflies and peacocks, achieve vibrant colors through micro- and nanostructures. He applies these principles to create materials with advanced photonic properties, such as colour-changing surfaces and optical sensors.
16.	Bharat Bhushan	Ohio State University, USA	Nanotribology and biomimetics, including surfaces inspired by lotus leaves and gecko feet. He explores how natural systems achieve efficient and effective surface interactions, such as the self-cleaning properties of lotus leaves, the adhesion mechanisms of gecko feet, and the anti-fogging characteristics of certain insects' eyes. Bhushan applies these insights to design and develop synthetic materials with similar properties.

Market Analysis in Biomimetics and Biomaterial Sector

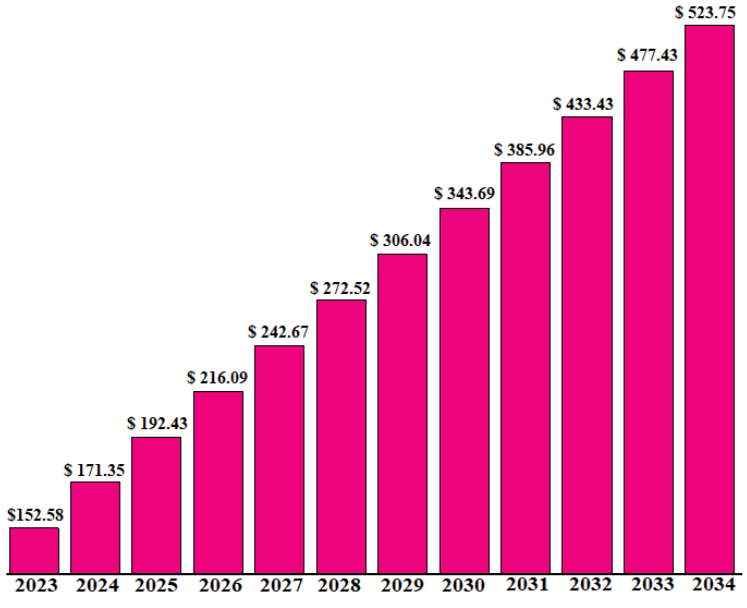
Market Overview

The global biomaterials market was valued at USD 176.73 billion in 2023 and is projected to grow to USD 503.42 billion by 2031, representing a CAGR of 13.98% during the forecast period (2024–2031).

Biomaterials have gained significant traction due to their application in healthcare, especially in medical devices, tissue engineering, and regenerative medicine.

Increasing R&D activities and materials science are key drivers of this market advancements in biotechnology and.

Biomaterials Market size 2023 to 2034 (USD Billion)



Key Segments in the Biomaterials Market

Natural Biomaterials
Gaining attention in biomimetics for their sustainable and eco-friendly characteristics.

Polymer -based Biomaterials
Widely used for drug delivery systems, wound care, and tissue scaffolding.

Metal-based biomaterials
Used extensively in orthopedic implants and dental applications.

Ceramic -based Biomaterials
High demand for orthopedic and dental applications, where biocompatibility is crucial.

Key Trends

Sustainable Materials
There is a growing emphasis on developing eco-friendly, biodegradable materials.

Healthcare Applications: Significant advancements in tissue engineering, implants, and drug delivery systems are driving demand.

Technological Innovations: Emerging technologies such as 3D printing and nanotechnology are facilitating the creation of novel biomimetic products.

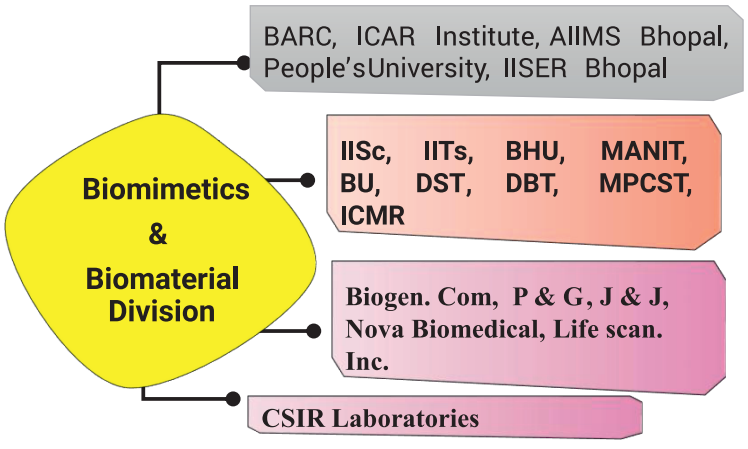
Market Segmentation

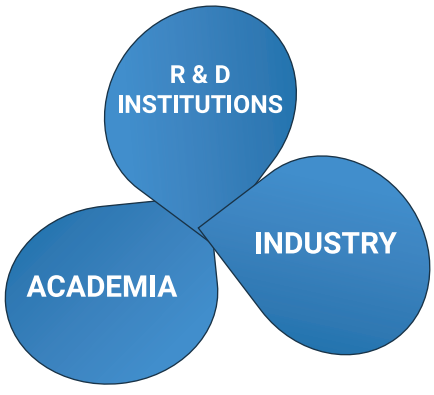
Biomimetic Materials: Includes self-healing materials, adhesives, and coatings.

Medical Biomaterials: Encompasses implants, scaffolds for tissue engineering, and drug delivery systems.

Biodegradable Polymers: Materials designed to decompose in natural environment

Global Benchmark Through Linkage with Academia and Industry

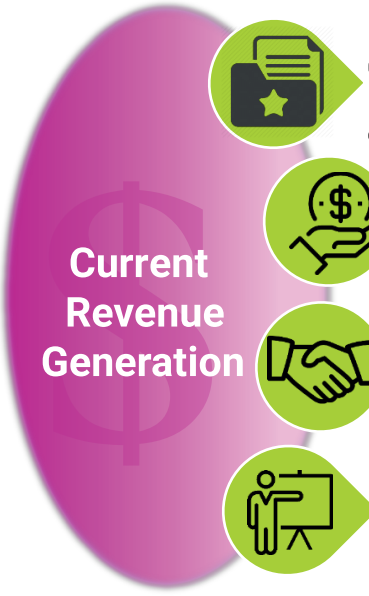




Domain and Activities
Biomimetic Materials, Biomaterials, Bioinspired Materials

Outcome Driven Goals of the Current Activities	Global Benchmarking	CSIR-AMPRI Intervention
Bio-inspired Antimicrobial and biodegradable food packaging material.	Packaging materials generate maximum plastic waste, weighing 141 million tonnes/year. However, there is problem of non-degradability for plastics-based food packaging and also it provides less shelf life to food.	These developed bio-inspired packaging films have exceptional biodegradability (46% in 1 week) and demonstrate superb antibacterial activity against gram-positive and gram-negative bacteria. It also protects the food from the UV-light.
Bio-inspired based Smart Nanofibrous Hydrogel Wound Dressings	Wound dressings that are currently available on the market are mainly used only to cure wounds.	These developed smart nanofibrous hydrogel wound dressing is used for curing as well as the diagnosis the wound infections
Bio-inspired materials-based biosensor for the detection for the SARS-CoV 19 Detection	Presently used traditional methods such as RT-PCR, Lateral flow assays for SARS-CoV 19 are time intensive, lower sensitivity and are susceptible to contamination	Poly-catecholamine-based immunosensor for the detection of SARS-CoV 19 with the detection limit of 2.32 ag/ml.
Bio-inspired material-based sensor for Heavy Metal Ion detection in water	Presently in the world, ICP-MS (inductively coupled plasma mass spectrometry) and AAS (atomic absorption spectroscopy) technology used for HMI detection	Development of Bio-inspired material-based flexible sensors for Cd^{2+} and Pb^{2+} detection. The flexible sensor has 0.5 ppb LOD for Pb^{2+} detection.
Skin patches, Bio-immuno-boosters, Bio-ointments, Oral Care Solutions and natural oral mouth fresheners, urinary tract infections and related therapy.	Currently, allopathic drug-based bio-ointments, skin patches, and oral care products play a role in preventing infections and refreshing the oral cavity. For urinary tract infections, antibiotics remain the standard treatment, enhancing patient care through targeted solutions for various health concerns.	Our developed herbal oral formulation treat oral cavity infections, cure pyuria and red sores along with simultaneously enhancing salivation by rejuvenating the salivary glands and also reduce gum inflammation. Natural phytochemical based formulation for treating UTI infections thus tackling antibiotic resistance. Bio-skin Patches and transparent self healing materials using 3D printing technique will be underway.

Revenue Generation Model



Projects

Related to Sensors/Biosensor, Antimicrobial Materials, Antimicrobial Coatings, Skin Scaffolds/Patches, Oral Care Formulations and Natural Immunoboosters, Self-Healing Materials, Biomimetics and Biomaterials etc. through funding agencies such as DST, DBT, SERB, ICMR, Ministry of Ayush etc.

Funding

Support from CSIR and external agencies including industries.

Technology transfer

TRL Development.
High TRL Technologies will be transferred to industries for mass production and societal benefits.

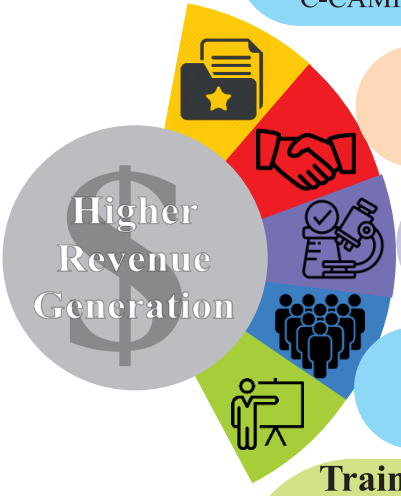
Training & HR Development

Contribute to generate highly trained scientific manpower in the area of Biomimetic and Biomaterials through providing training through internship programs

NABL Accreditation | **Institute Industry Interaction** | **Media Management**

Work done using Resources

Licensing of Patents | **Skill India Programs** | **Branding and Image building**



Projects

Other funding agencies will take interest in our projects such as DRDO, FASSAI, C-CAMP, Ministry of Ayush, Industries etc.

Technology transfer

More technologies will be designed and transferred which will enhance the revenue generation.

Utilization of high end Divisional Facility

The present equipment facilities can be utilized to generate the revenue by offering testing and training facilities.

Capacity Building (Ph.D. & MTech)

More scholars will take interest to join and contribute in the work leads to enhance the manpower of the division.

Training

More students will be willing to join and ex-trannies will find great opportunities in pharmaceutical, textile, sensors, and coatings, etc. related companies We will sign MOU's with prestigious national and international institutes and will explore manpower exchange program In future we will also design 1-2 years diploma/degree courses on Biomaterials and Biomimetic Materials for Revenue Generation,

Potential Companies for Technology Transfer

Johnson and Johnson Pvt Ltd (India)

Biocon Ltd (India)

Biogen Inc. (America)

Hydromer Inc. (United States)

Vardhman Textiles Ltd. (India)

Nippon Paint Pvt Ltd (India)

Medtronic PLC (India)

EPL Limited (India)

RPM International Inc. (United States)

Rajshree Fabrics (India)

Uflex Limited (India)

Molecular Devices Cor. (USA)

Coloplast India Pvt. Ltd. (India)

Potential Funding Agencies

सत्यमेव जयते
Department of Biotechnology

सत्यमेव जयते
Department of Science and Technology (DST)
DST

INDIAN COUNCIL OF MEDICAL RESEARCH

सत्यमेव जयते

स्वास्थ्य एवं
परिवार कल्याण मंत्रालय
MINISTRY OF
HEALTH AND
FAMILY WELFARE

सत्यमेव जयते
Ministry of AYUSH
Government of India

MPCST
1981
M.P. COUNCIL OF SCIENCE & TECHNOLOGY

DRDO
DEFENCE R&D ORGANISATION
MINISTRY OF DEFENCE

CSIR-INDIA
सीएसआईआर
CSIR
भारत का नवाचार इंजन
The Innovation Engine of India

C-CAMP
Centre for Cellular and Molecular Platforms

fssai

SREE PADMAVATHI VENKATESWARA FOUNDATION

iNSERB
DIA

Students and Project Fellows

Mr. Raj Kumar Sen received his M.Sc. degree in Chemistry from Dr. Hari Singh Gour University, Sagar, India in 2017. He is pursuing PhD at CSIR-AMPRI, Bhopal, India in the area of "Development of Potential Hydrogel Materials for Biomedical Applications". He is a recipient of Best Poster Presentation Award in "First International Conference on Technologies for Smart Green Connected Society 2021" and "India International Science Festival (IISF)", also he has received Best Micrography Award (2nd Prize) 2023 in International Conference on Electron Microscopy Society of India 2023 (EMSI-2023). He has 11 international research publications with H-index of 7 and citations of 198 with 01 Book Chapter in his credit.

rsen214@gmail.com

Ms. Priyanka Prabhakar received her M. Tech degree in Nanotechnology from UTD RGPV, Bhopal, India in 2012. She has submitted her PhD thesis from CSIR-AMPRI, Bhopal, India on "Mussel-Inspired Materials for Antimicrobial Applications". She has 11 international research publications with H-index of 7 and citations of 250 with 01 Book Chapter in her credit.

priyanka.prabhakar04@gmail.com

Ms. Monika Patel completed her M.Sc. in chemistry from Govt. M. H. College, Jabalpur in 2018. She is working as PhD Research Scholar at CSIR AMPRI, Bhopal in the field of "Development of 2D-nanomaterials based electrochemical sensor for Heavy metal ion detection. She has 14 international research peer reviewed publications with a H-index of 8 and 146 citations and 01 Patent in her credit.

m1301p@gmail.com

Ms. Mansi Chaturvedi has completed her M.Tech in Biotechnology from RGPV Bhopal in 2022. She is working as Women Scientist at CSIR-AMPRI, Bhopal. Her research mainly focused on development of nanomaterials (2D materials such as graphene, MXenes) for the detection of neurodegenerative diseases. She is a recipient of Best Micrography Award 2023 in International Conference on Electron Microscopy Society of India 2023 (EMSI-2023), DBT-Women Scientist 2023, Senior Research Fellow-CSIR 2024, MP Young Scientist Award 2024, Best Paper Presentation Award in Rastriya Hindi Vigyan Sammelan 2024. At present she is handling 01 research project from DBT as a PI. Currently, she has 04 international research publications in her credit.

mansichaturvedi8@gmail.com

Dr. Sarvesh Kumar Gupta received his Ph.D. degree from the Madan Mohan Malaviya University of Technology, Gorakhpur (U.P.), India in 2022. As a postdoctoral researcher he joined CSIR – Advanced Materials and Processes Research Institute (AMPRI), Bhopal. During this time, he is involved to develop advanced materials for applications in high energy density batteries and sensors. He has 34 international research peer reviewed publications with a H-index of 6 and 148 citations, 04 Book chapters and 01 patent.

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Ms. Sapna kaithwas completed her M.Sc. Biotechnology from Sant Hirdaram Girls College in 2021. She worked as a project assistant on the DST project at CSIR-AMPRI for 2 years. Currently, she is working as a project associate on the project "Development of bio- inspired super hydrophobic antimicrobial nano coating on the urinary catheters to impede microbial biofilm formation and catheter–associated urinary tract infection" supported by DST-POWER. She has 01 international research publication.

ksapna8213@gmail.com

Ms. Neha Bisht is a Research Scholar at CSIR-AMPRI, Bhopal. She has worked on diverse projects, including, "Bioinspired surface functionalization of carbon nanostructures with catecholamine rich polymers to develop advance biosensors (2022)", and "Engineered Shape Memory Polymer-based Portable Heat/Fire Alarm Devices (2022-2024)". She did her graduation and post-graduation in Chemical Sciences from HNB Garhwal University, India. She is a recipient of the DST-Women Scientist award 2024. Her research interests span bio-inspired catecholamine chemistry, advanced nanomaterials, and electrochemical sensors, and biosensors. She has 9 international research peer reviewed publications with a H-index of 6 and 153 citations.

bishtneha94s@gmail.com

Ms. Kajal Tiwari completed her MTech in Biotechnology from RGPV Bhopal in 2023. During her MTech, she published a review paper in the International Journal for Multidisciplinary Research, which has an impact factor of 9.24. Her MTech project focused on an in-silico approach to study insulin secretion through IP3R and melatonin receptor by agomelatine in combination with curcumin, along with the SERCA channel, for the treatment of Type II Diabetes Mellitus. She worked as Highly Skilled Manpower, assisting the Head of PPD and the Head of Biomimetics & Bio-Materials with relevant tasks in the division and CSIR AMPRI deputed to her to acquire knowledge and Expertization in the field of Bio-Skin Patch and Transparent Self Healing Material from AIIMS Bhopal under the MoU having between CSIR-AMPRI and AIIMS Bhopal. At Present Ms. Kajal Tiwari is a first Ph. D. Student of Dr. J.P. Chaurasia, Head, PPD , Head HRD and Head BBD at AcSIR, CSIR-AMPRI.

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Ms. Shivani Chaurasiya has completed her Masters in Science (M.Sc.) in Microbiology from Dr. Harisingh Gour University, Sagar (M.P.) and she is completed her 06 Month dissertation on the topic "Isolation of keratinophilic fungi production of keratinase and its characterization" and she is currently joined CSIR-AMPRI, Bhopal M.P.

Shivanichaurasiya343@gmail.com

Internship Students

Mrs. Rupali Singh has completed her M.Sc. Biotechnology from AMITY University Lucknow (UP) and did her 6 month internship from CSIR-AMPRI, Bhopal on the topic "Development of Graphene, PDA and AgNPs based Electrochemical Biosensor for Dengue detection". tomarrupali23@gmail.com

Mr Aditya Kumar has completed his bachelor's in biotechnology from Dr D.Y. Patil Biotechnology and Bioinformatics Institute, Pune. He did his 6 months internship from CSIR-AMPRI, Bhopal on the "Development of hydrogel nanofiber via electrospinning techniques".

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Ms. Himanshi Goel has completed her M.Sc. from Amity University, Noida and did her internship from CSIR-AMPRI, Bhopal on "Development of MAX-PDA based DNA Biosensor for Tuberculosis Mycobacterium detection". She published 02 international research publications with the work executed in the division. At present, she is pursuing PhD from Amity University, Noida and her research is centred on Material Chemistry research.

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Ms. Kanishka Bhatia is second year M.Sc. Chemistry student at Amity University, Noida. She had done her 1 month internship from CSIR-AMPRI, Bhopal on the "Development of Antimicrobial Nanocoating on the Urinary Catheters to impede Catheter-associated urinary tract infection". kanishkabhatia26@gmail.com

Ms. Kanak Jha has completed her M.Sc. Organic Chemistry from Amity University Noida. She had completed her summer internship from CSIR-AMPRI Bhopal, focusing on the "Development of graphene nanostructures for heavy metal detection". Additionally, She has 01 international research publications during her internship.

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Ms. Sana Bano is a second year M.Sc. Biotechnology student at AKS University satna. She is pursuing her 6 month internship from CSIR-AMPRI, Bhopal Under the guidance of Dr. J. P. Chaurasia.

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Ms. Anamika payasi is a second year M.Sc. Biotechnology student at AKS University satna. She is pursuing her 6 month internship from CSIR-AMPRI, Bhopal under the guidance of Dr. J.P. chaurasia

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Targeted Pillars of Government of India

Targeted Missions of Government of India

MAKE IN INDIA

Skill India

सॉयल हैल्थ कार्ड
स्वस्थ धरा, खेत हरा

स्वस्थ भारत
एक कदम स्वच्छ समाज की ओर

Atal Innovation Mission
AIM

स्वच्छ भारत
एक कदम स्वच्छता की ओर

Har Ghar Jal
Jal Jeevan Mission

NATIONAL HEALTH MISSION
राष्ट्रीय स्वास्थ्य मिशन

CSIR-ADVANCED MATERIALS & PROCESSES RESEARCH INSTITUTE,
HOSHANGABAD ROAD, BHOPAL – 462026

File Nol. AMPRI/Creation of Division/Gen.2024 Dated : 04.09.2024

OFFICE MEMORANDUM

Sub.: Creation of New Biomimetics and Biomaterials Division (including Life Sciences)-reg.
Ref. : RC approval no. 356/3/6/2024

Research Council (RC) during its 49th RC meeting has approved for the creation of new division "Biomimetics and Biomaterials Division (including Life Sciences)" at CSIR AMPRI, Bhopal.

1. This division will be dedicated for the design and development of advance functional biomimetics and biomaterials for societal benefit. Performing advanced biotechnology and biomedical research is among the prime objectives of this division.
2. This division will in–house advance microbiology lab, Cell culture lab, tissue engineering lab, biomimetic and biomaterials synthesis lab, Pharmacology Lab including botanicals, Advance nanofibers lab, Biotechnology and Biochemistry lab etc.
3. The B Wing (Room 16 to 30) and Bay-1 in the new Building shall be allotted for the establishment of this division after handing over of the new building by the PMC agency in future.
4. This division will be headed by Dr. J.P. Chaurasia, Sr. Prin. Scientist. & Head PPD, Dr. Chetna Dhand, Sr. Scientist will be the nodal Scientist and Co-ordinator of this division. Dr. Dhand will report to Head, Biomimetics and Biomaterials Division and her reviewing officer will be Dr. Deepti Mishra, Chief Scientist.
5. Dr. Dhand will prepare the Divisional Profile including SoP's, Research areas, objectives and deliverablas for the next five years.
6. Scientific and Technnical strength of this division will be enhanced by filling our 25 scientific positons (as sanctioned by CSIR Headquarter and approved in 49th RC held on 24.04.2024) and one technical officer. No further approval is required for filling the sanction allocated positions under the divisional mandate.

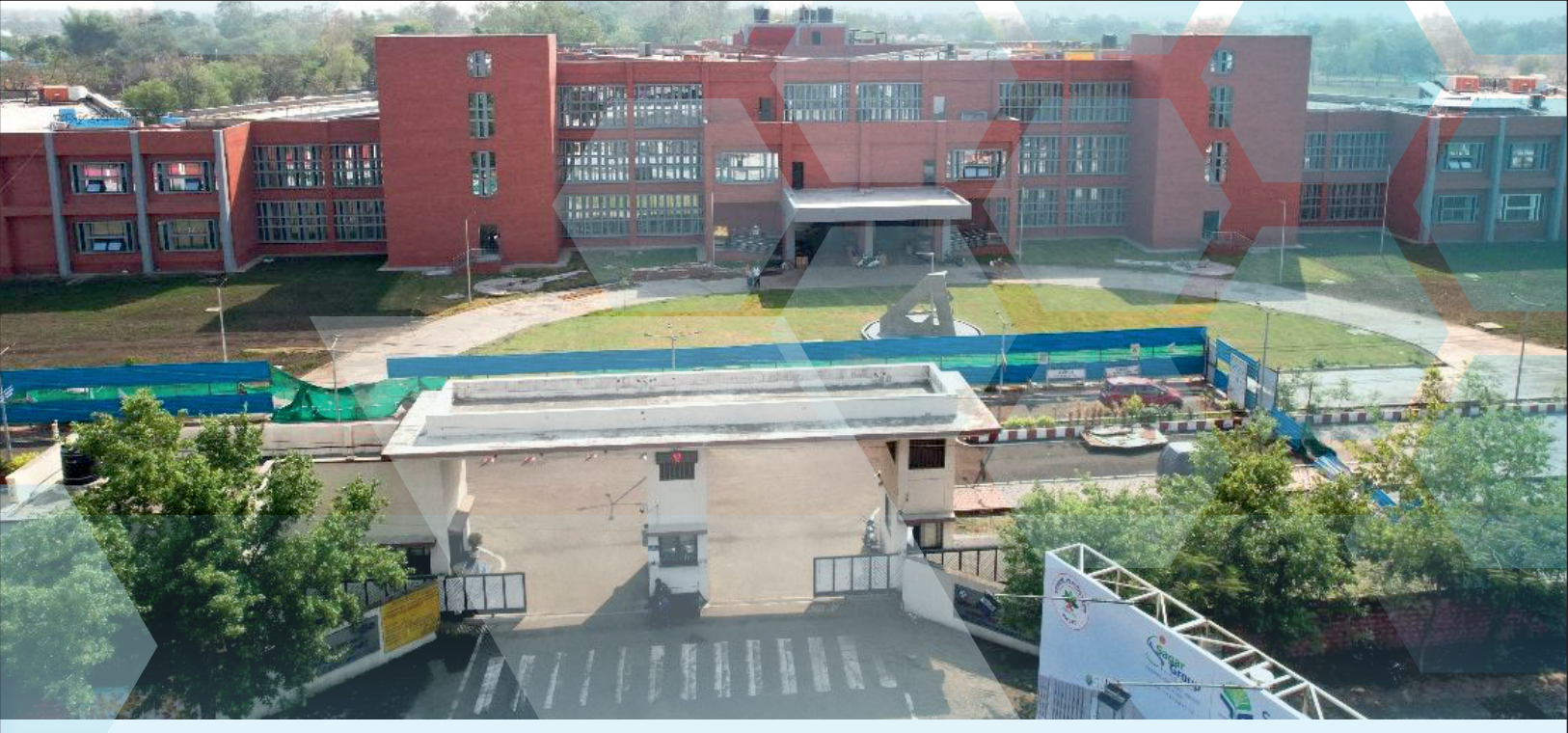
This OM has been issued with the approval of Director, CSIR-AMPRI, Bhopal

(Somnath Mazumdar)
Controller of Administration

To,
All related members

Copy to:

1. PPS to Director,
2. O/o CoA
3. SO(Rectt.)
4. All Divisional/Sectional Heads



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