

## *MHRD Scheme - Global Initiative on Academic Network (GIAN)*

# BIO-BASED AND BIO-INSPIRED MATERIALS: CORNERSTONES FOR SUSTAINABLE FUTURE

## Overview

Biological systems are being engineered to produce specific products of interest. From the advent of genetic engineering approaches in the 1970s to the recent emergence of the field of synthetic biology, the research community continues to push the boundaries of biological engineering and the complexity of the products that are synthesized by biological systems. Biomimetic approaches have produced environmentally friendly, innovative, smart, or intelligent materials and these biological designs are sustainable. Nature has evolved a number of strategies to create outstanding functional properties with comparatively cheap base materials. Structural bio-inspired materials design makes use of the biological structures by inserting synthetic materials and processes that augment the structures' capability while retaining their essential features. Interdisciplinary research will further develop bio-inspired processes for obtaining new function by structuring and assembling of known elements. The research prospects and directions of this rapidly developing field will open up new avenues for developing novel bio inspired materials for sustainable development. In this context, numerous marine biological functions have been mimicked regarding respiration and nutrition (oxygen capture, nutrients filtration); adhesion (mechanical bio-adhesives, biological glue, antifouling); protection (active molecules biosynthesis, composite materials, hierarchical structures); and communication (acoustic and chemical signals, inter/intra-species communication, camouflage).

## Objectives

- To provide the student with knowledge of the chemical and physicochemical behavior of natural polymers, biopolymers and bio-inspired materials, their morphology, structure properties, specificities and their potential applications.
- To study the behavior and properties of biobased materials.
- To illustrate advanced functional applications



**Prof. Dr. Susana De Matos Fernandes, Ph.D,**  
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 Research Interests : Valorization Marine Biomass;  
 Marine Inspired Biomaterials; Biopolymers Chemistry;  
 Bio-based Materials; Blue Biotechnology; Bioactive  
 Nanocomposites; Sustainability; Oceans Environment;  
 Human Health  
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**Prof. Dr. Sabu Thomas Ph.D, FRSC, FEurASc,**  
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 Director, School of Energy Materials, Director,  
 International and Inter University Centre for  
 Nanoscience and Nanotechnology, Former Director,  
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 Prof. Sabu Thomas is one of India's most renowned  
 scientists known for his contributions in polymer  
 science and Nanotechnology.  
 Published over 1400 research articles in international  
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**Dr Sreeraj Gopi, PhD, FRSC, FRSA, CChem**  
 With a PhD in bio nano-materials and nano drug  
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*Online Course*

*from*

*17<sup>th</sup> to 21<sup>th</sup> October 2023*

**5 days Course (12 hrs.)**

**on**

**“ BIO-BASED & BIO INSPIRED  
 MATERIALS- CORNERSTONES  
 FOR SUSTAINABLE FUTURE”**

*Conducted by*

*International and Inter University Centre  
 for Nanoscience and Nanotechnology  
 Mahatma Gandhi University ,Kottayam  
 Kerala India*

*Course Co-Ordinator :*

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#### Step 1. Web Portal Registration:

Visit <http://www.iitkgp.ac.in/GREGN/index> and create a login User ID and Password. Fillup the blank registration form and do web registration by paying Rs. 500/- online through Net Banking/Debit/Credit card as per instructions given therein. This provides the user with lifetime registration to enroll in any number of GIAN courses offered.

#### Step 2 Course Registration:

Login to the GIAN portal again with the user ID and Password already created in Step 1. Click on the Course Registration option at the top of the Registration form. Select the Course titled **“BIO-BASED AND BIO-INSPIRED MATERIALS: CORNERSTONES FOR SUSTAINABLE FUTURE ”** from the list and click on the save option. Confirm your registration by clicking on Confirm Course..

## Modules. 5 days (12 hrs)

### Day 1

Lecture 1	<i>Introduction to natural polymers I:</i>
Lecture 2	<i>Introduction to natural polymers II:</i>
Lecture 3	<i>Cellulose and derivatives I</i>
Lecture 4	<i>Cellulose and derivatives II</i>
Lecture 5	<i>Cellulose derivatives III (1. Cellulose esters, 2. Cellulose ethers)</i>
Tutorial 1	<i>Video -Extraction of nanocellulose from agricultural waste</i>

### Day 2

Lecture 6	<i>Starch and its derivatives I Sources and origin</i>
Lecture 7	<i>Starch and its Derivatives I</i>
Lecture 8	<i>Starch and its Derivatives III</i>
Lecture 9	<i>Starch and its Derivatives IV</i>
Tutorial2	<i>Video - Fabrication of Starch based Composites</i>

### Day 3

Lecture10	<i>Exocellular Polysaccharides</i>
Lecture11	<i>Exocellular Polysaccharides II</i>
Lecture12	<i>Exocellular Polysaccharides III</i>
Lecture13	<i>Marine-based Polymers I</i>
Lecture14	<i>Marine-based Polymers I</i>
Tutorial3	<i>Video-Extraction of Nanochitin from Sea Food Waste</i>

### Day 4

Lecture15	<i>Marine-based Polymers III- Chitosan</i>
Lecture16	<i>Marine-based Polymers IV-Alginates</i>
Lecture17	<i>Blue Biotechnology I</i>
Lecture18	<i>Blue Biotechnology II</i>
Tutorial4	<i>Characterization Analysis of Nanochitin and Nanocellulose FTIR, UV-Vis, Raman spectroscopy, XRD, DLS, AFM, SEM, TEM, XPS.</i>

### Day 4

Lecture19	<i>Bio-inspired Materials</i>
Lecture20	<i>Bio-inspired Materials II</i>
Lecture21	<i>Nutraceutical Applications of Nanomaterials</i>

## Evaluation

### Who all should Attend ?

- PG/Ph.D. students, Faculty members with research focus in Bio materials
- Researchers from manufacturing, service and government organizations including R&D laboratories interested in Biopolymers, Biomimetic and Bio-inspired Materials
- Graduate and Undergraduate students who would like to pursue a short research in biobased materials.

*No registration fee*