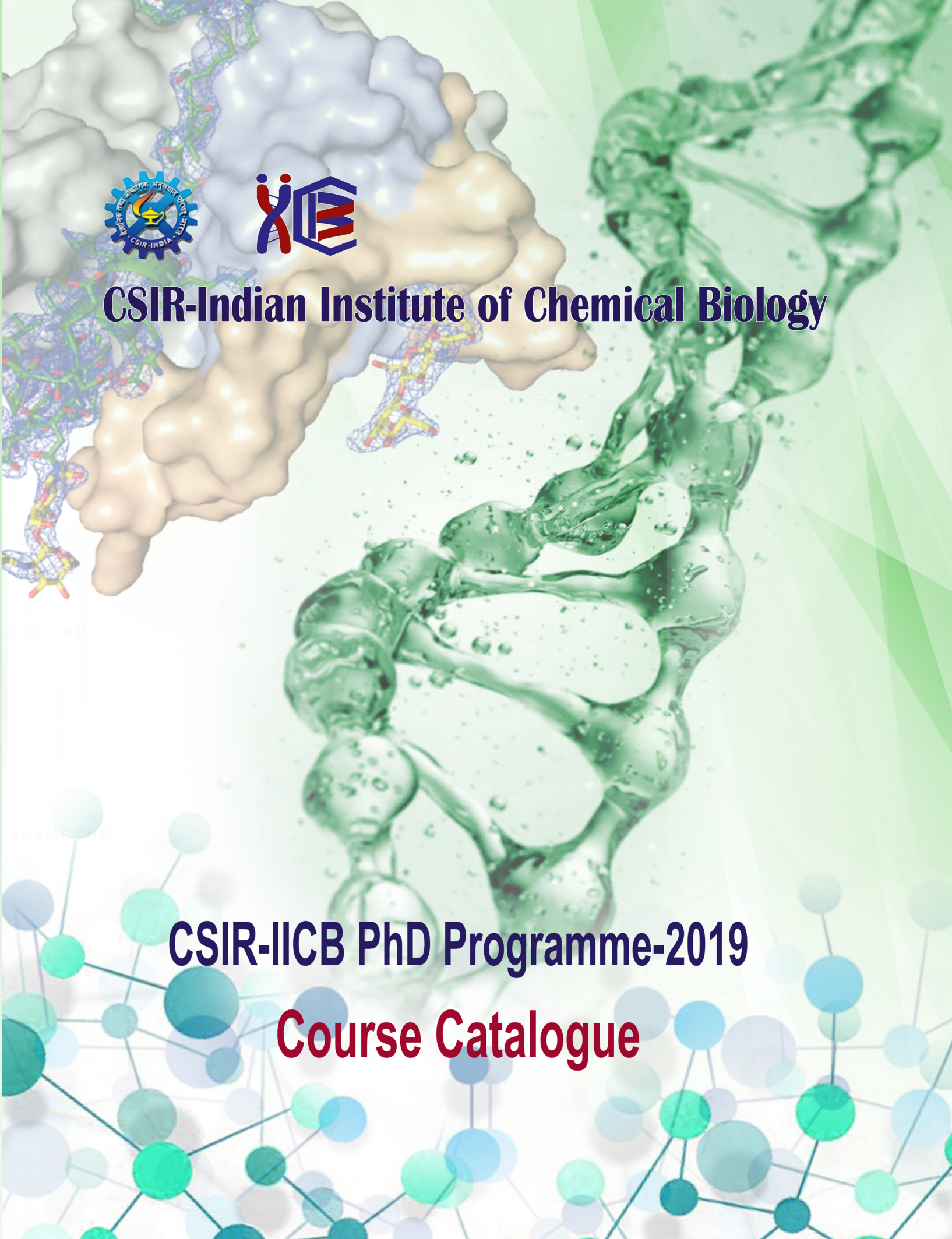


CSIR-Indian Institute of Chemical Biology

CSIR-IICB PhD Programme-2019

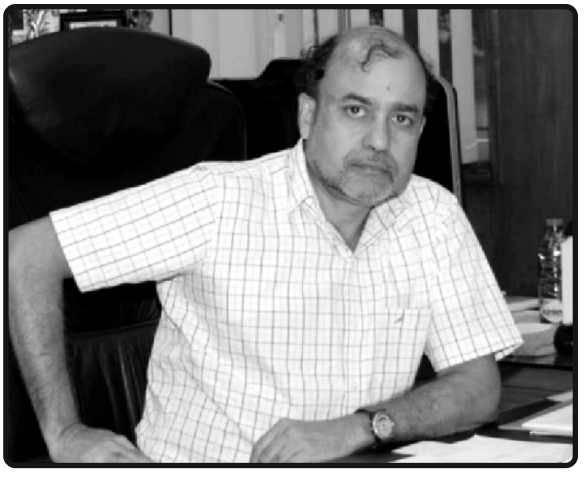
Course Catalogue

CSIR-Indian Institute of Chemical Biology

CSIR-IICB PhD Programme-2019

Course Contents

Director's Note



CSIR-IICB was born about eighty years ago, in difficult times. Only a dream kept it alive and idealism sustained it. That dream was to offer affordable healthcare to all the citizens of the country. Despite all odds, the dream did not die — it is transforming itself today; slowly and inexorably to reality.

In order to strengthen the basic research and to attain a translational objectives very recently a second campus, the CSIR-IICB Translational Research Unit of Excellence (TRUE) was established at Saltlake, Kolkata. The overall mandate of TRUE being translation of the state-of-the-art fundamental and indigenous innovations to affordable technology for social benefits of the common man.

Milleniums ago, Indian civilization was the leader of world science. After a lull of several centuries, we are on the threshold of becoming a world leader again. Thus, today, we aspire to create future leaders of Indian science. For that to happen we need to prepare you in ways that are different from the past. You have to not only know your research area, you have to know other areas as well. You have to communicate your ideas, dreams, aspirations and abilities to others. You have to create an eco-system where your colleagues, friends and mentors are comfortable at the same time feel inspired. With that in mind we bring you a significantly different doctoral program, which will help you to become a complete scientist and teacher and create the future leaders that this country needs.

Prof. Samit Chattopadhyay
Director

Chairperson's Note

PhD students are primary assets to an institute and play an instrumental role to generate knowledge performing research with scientific temperament. A perfect and directed training before conducting research will make student further competent and productive. The rigorous curriculum of our PhD program along with dynamic learning environment offers exciting opportunities, which would be helpful for your doctoral work in the areas of chemical and biological sciences in an integrative way. The designed courses, unique academic environment and culture will definitely empower you to be creative in scientific search with rejuvenated interests in your area.

Our faculty members invest their time, their ideas, and their energies to give our doctoral students the joys of discovering. Thank you for your interest in CSIR IICB's PhD program. With your interest, you will develop your scholarly ambitions and identity in an environment where you will be nurtured, challenged, and celebrated by outstanding researchers. We all are ready to assist you in making your educational journey rewarding and to make you future leader in science.

Dr. Uday Bandyopadhyay
Chairperson
Academic Affairs Committee

Preamble

The institute offers exciting opportunities for doctoral work in trans- and inter-disciplinary areas of chemical and biological sciences in an integrative way.

Under following broad disciplines, there are ample scopes to work in frontline areas, amongst others.

Cancer Biology
Protein Science
Neuroscience
Structural Biology
Chemical Biology
Synthetic Biology
Cellular Physiology
Systems Biology
Bioanalytical Sciences
Cell and Molecular Biology
Molecular and Human Genetics
Drug discovery and related areas
Infectious Diseases and Immunology
Bioinformatics & Computational Biology
Organic & Medicinal Chemistry
Synthetic and Natural Product Chemistry

Finer details, related faculty and infrastructure are available in www.iicb.res.in.

There shall be classroom instructions, internal assessment, examination, review and seminars during the course work.

Classroom Instructions:

- 1 credit is equivalent to 15 lecture-hour
- 2 credit is equivalent to 30 lecture-hour

Explanation of the Course code:
The **Course Codes** in this Course Catalogue are presented as per AcSIR courses

Example:

'BIO-IICB-1-0002: Computation & bioinformatics : 1-0-0-1' signify

Cluster Laboratory Level - Course Number: Subject: L-T-P-C

Cluster	: 'BIO' for Biology
Laboratory	: IICB
Level	: 1 for 100
Course number	: 0002
Subject	: Computation & bioinformatics
L-T-P-C	: Lecture - Tutorial-Practical-Credit (1-0-0-1)

[1 lecture per/week with 0 Tutorial & Practical and with 1 credit]

The Levels 100, 200 and 300 are equivalent to Levels 500, 600 and 700 respectively of international standard.

MODE OF EVALUATION

In order to qualify in the course, every PhD student must meet following minimum requirements:

- A grade point of at least 6.00 has to be secured in all mandatory subjects in a scale of 1-10. The grades and their **equivalent Grade Points are:**

A+	**10**	**outstanding**
A	**9**	**excellent**
B+	**8**	**very good**
B	**7**	**good**
C+	**6**	**average**
C	**5**	**not qualified**

- A minimum of 6.00 Semester Grade Point Average (SGPA) is to be secured in individual semester, but after two semesters the Cumulative Grade Point Average (CGPA) has to be 6.5.

- Every student has to maintain a 80% or more attendance in taught courses and delivered seminars. The 20% allowed absence is inclusive of any authorised leave.

  Failure to attain any of above requirements shall call for a review about subsequent continuance of the PhD Student in the programme.

Details about courses and requirements are available in **Course Catalogue**. In order to earn required number of course credits, certain 'compulsory' and 'optional' courses are to be undertaken depending on the Fellow's research area and recommendation of associated guide/supervisor.

In order to develop personal skills, there shall be training programme, viz,

Communication, Ethics & Safety (bio & chemical)

For CSIR-IICB PhD Course Work related affairs please contact HRG (Academic Affairs) Division:

Dr. Siddhartha Majumdar
Head, HRG & Coordinator
Email: siddhartha@iicb.res.in
Tel: 033-24995913

For technical assistance
Ms. Debasree Das
Email: debasree@iicb.res.in / hrgiicb@iicb.res.in
Tel: 033-24995702

CSIR-IICB PhD Course work 2019:Courses

Level	Course Code & Name	Credits
Level 100: Basic level *Total 4 Credits (all compulsory)*	BIO-IICB-1-0004: Research Methodology , Communication/ Ethics/ Safety: 1-0-0-1	1
	BIO-IICB-1-0001:Biostatistics:1-0-0-1	1
	BIO-IICB-1-0002: Computation / bioinformatics : 1-0-0-1	1
	BIO-IICB-1-0003: Basic Chemistry : 1-0-0-1 OR CHE-IICB-1-106: Introduction to Chemical Biology : 1-0-0-1	1
Level 200: Mid-level **Optional Courses** *Total 4 Credits*	BIO -IICB-2-2801 : Biotechniques and Instrumentation: 2-0-0-2 *[compulsory course for both Biology & Chemistry students]*	2
	Biology Courses *(Any one)* BIO-IICB-2-2802: Biology of Macromolecules:2-0-0-2 BIO-IICB-2-2804: Protein Science and Proteomics: 2-0-0-2 BIO-IICB-2-2805: Cell Biology and Cell Signaling : 2-0-0-2 BIO-IICB-2-2807: Molecular and Cellular Immunology : 2-0-0-2	 2 2 2 2
	Chemistry Courses *(Any one)* CHE-IICB-2-004: Advanced Analytical Chemistry:2-0-0-2 CHE-IICB-2-203: Advanced Organic Chemistry:2-0-0-2 CHE-IICB-2-226: Green Chemistry:2-0-0-2 CHE-IICB-2-219: Advances in Nanoscience and Nanotechnology : 2-0-0-2	 2 2 2 2
Level 300: Advanced level **Optional Courses** *Total 4 Credits*	**Biology Courses** *(Any two)* BIO-IICB-3-2802: Cancer Biology :2-0-0-2 BIO-IICB-3-2807: Eukaryotic Gene Regulatory Mechanisms: 2-0-0-2 BIO-IICB-3-2803: Cell and Tissue Engineering :1-0-0-1 BIO-IICB-3-2808: Chemical Biology: 1-0-0-1 [Both Biology & Chemistry students can opt this course]	 2 2 1 1
	Chemistry Courses *(Any two)* CHE-IICB-3-356: Natural Products and Drug Discovery :2-0-0-2 CHE-IICB-3-313: Total Synthesis :2-0-0-2 CHE-IICB-3-312: Supramolecular Chemistry : 1-0-0-1	 2 2 1
	BIO-IICB-3-2801: Seminar & Critical Appraisal: 1-0-0-1 [*compulsory course for both Biology & Chemistry students*]	1

LEVEL 100: Basics courses
[All Compulsory]
Total: 4 Credits

BIO-IICB-I-0003 and CHE-IICB-I-106 is compulsory for Biology and Chemistry students respectively.
Rest of the 100 level courses are compulsory for all.

LEVEL 100: Basics courses [All Compulsory]
Total: 4 Credits

BIO-IICB-1-0002: Computation / Bioinformatics : 1-0-0-1

Computers : introduction, evolution and classification of computers. Fundamentals of computing. Bit and Byte, introduction to types of Hardware and Software. Components of computer, introduction to operating systems, introduction to Computer Viruses.

Network**:** introduction, network structure and architecture, hierarchical networks, ethernet and TCP/IP family of protocols, transport protocol design, types of network, topologies of network, router, switch, data communication, concept of wireless networking, LAN, WAN, MAN, security of the network, fire-walls, network applications.

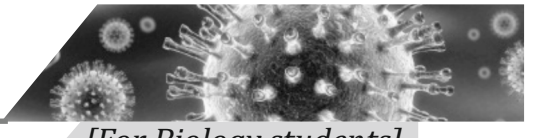
Information Technology: concepts of client server architecture, concept of search engine, database search engines, introduction to Internet.

Introduction to Word, Powerpoint and Excel.

Introduction to Bioinformatics: history of Bioinformatics, genome sequencing projects, Human Genome Project, applications of Bioinformatics.

Introduction to databases: type and kind of databases, applications and limitations.
Literature Search Databases, nucleic acid and protein databases, animal and plant databases, Ensembl Genome project TIGR database, biotechnological databases, motifs and pattern databases, databases for species identification and classification, structural databases, database retrieval and deposition systems.

Web tools and resources for sequence analysis: pairwise and multiple sequence alignment, sequence similarity search: BLAST, pattern recognition, motif and family prediction, restriction map analysis, primer design, gene prediction, phylogenetic tree, protein structure prediction and visualization.



[For Biology students]

BIO-IICB-1-0003: Basic Chemistry : 1-0-0-1

Thermodynamics, Solutions and Ions ; Chemical bonding and molecular structure; Chemical Kinetics ; Stereochemistry; Introduction to drug discovery (medicinal chemistry approach) ;
Drug target, discovery and development (forward and reverse approach).

[For Chemistry students]

CHE-IICB-1-106: Introduction to Chemical Biology : 1-0-0-1

Introduction to Chemical Biology ; Macromolecular Structure: Protein, DNA, RNA, lipid, polysaccharide structures; detection, quantification and stability of the molecules and their interactions.

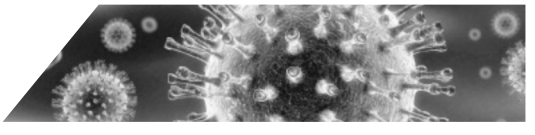
Enzymes Overview & Enzyme Kinetics: enzyme structure and functions, substrate recognition, mechanism and inhibitions, Kinetics of enzyme reactions, types of inhibitions, allostericity and regulation.

Nucleic Acids & Protein Synthesis: DNA replication, transcription (mRNA synthesis) and translation (protein synthesis).

Cell Communication and Signaling: ligand-receptor interaction, autocrine and paracrine modes of signaling, communication through adherens junctions .

Metabolic Pathways: protein, lipid and carbohydrate metabolism, amino acid and nucleotide metabolism.

Drug Discovery: drugs from nature and their interaction. Drug target identification and validation.



BIO-IICB-1-0004:
Research Methodology, Communication/Ethics/Safety : 1-0-0-1

Research Methodology :
Philosophy and structure of scientific thoughts, objective and motivation of research, meaning of the research, what constitutes a research topic? how to select a research topic?
Importance of literature review, selection of appropriate methodology, collection of data, interpretation of data, writing research paper, paper presentation in scientific conference, statistical methods, importance of documentation, procedure for Hypothesis Testing, values and ethical problems, criteria of Good Research.

Good lab practices:
Record keeping, organizing data, organizing the lab space.
Chemical, Radioactive and Biological safety: Possible hazards and precautionary measures; do and don'ts upon exposure.
What is ethics, the different interpretations & historical instances of unethical science, Case studies: Data fraud/ plagiarism and Human Ethics violation.

BIO-IICB-1-0001: Biostatistics: 1-0-0-1

Summarization of Data: measures of center, dispersion, skewness Dependence of variables: correlation, linear regression, logistic regression.

Basic probability distributions: Binomial, Normal, Chi-squares.
Estimation of parameters: method of moments, maximum likelihood Testing of hypotheses:
(a) parametric tests: t-test, z-test, chi-squares test, ANOVA .
(b) non-parametric tests: Mann-Whitney, Kruskal Wallis, Kolmogorov-Smirnov.

Workshop / Training programs for development of personal skills:

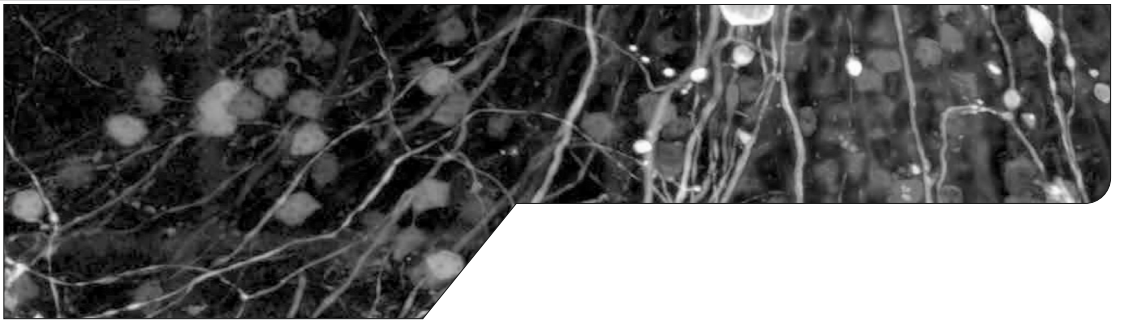
[Compulsory for all course work students]

- Bio-safety, Chemical Safety & Radioactive Safety
- Scientific Communication Skill Development, Research Proposal Writing.

LEVEL 200 : Mid-level courses

Total: 4 Credits

BIO-IICB-2-2801 is compulsory for all students. Additional 2 credits is to be taken from other 200 level courses.



BIO -IICB-2-2801 : Biotechniques and Instrumentation: 2-0-0-2

[Compulsory Course for Both Biology & Chemistry Students]

Chromatography : different chromatographic techniques, HPLC.

Centrifugation: principles and uses, application in modern biology.

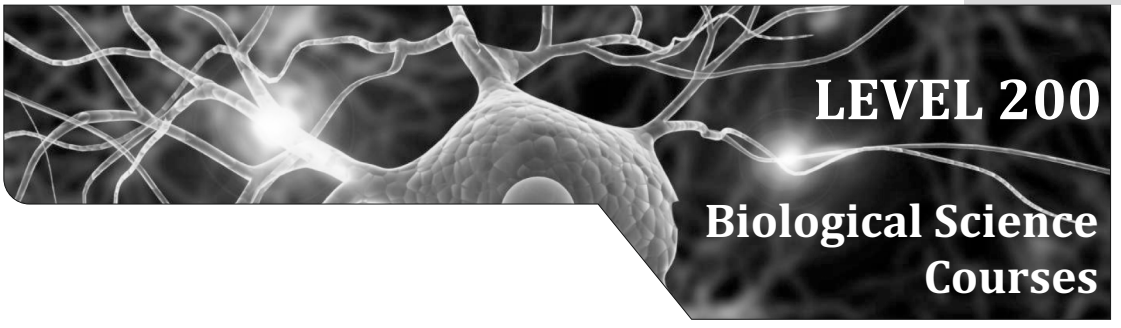
Electrophoresis: theory and hypothesis, SDS-PAGE, Western Blot, 2D gel electrophoresis.
Mass spectrometry and Protein identification: principles and theory, application in Proteomics.

Colorimetry : ITC, DSC, determination of protein stability, analysis of binding Properties.
Surface Plasmon resonance: Techniques and its use in biology.

Optical spectroscopy: absorption, fluorescence, FT-IR, Raman and other techniques.
FACS: principles and application.

Imaging: Electron microscopy, Confocal microscopy, Atomic force microscopy, In vivo imaging.
NMR: 1D NMR, 2D NMR and application in structural biology.

X-Ray crystallography: Basic theory and its application in structural biology.



BIO-IICB-2-2802: Biology Of Macromolecules: 2-0-0-2

Protein Nucleic acid interactions.

Synthesis and degradation of macromolecules.

The folding process and structural background.

Modular structures, protein flexibility, domain motions, domainswapping; and large macromolecular complexes.

Enzyme activity, receptor binding and regulation, binding specificity, catalysis and cooperativity in enzymes and receptors .

Methods for the determination of macromolecules structure and interaction.

Macromolecular function in transcription, translation, signaling and other fields of cell biology, integration and control mechanisms.

Structure and evolution of important protein motifs and folds. [e.g. Coiled-coil proteins, helical bundles, signaling domains (sh2, sh2, pdz etc).

Immunoglobulin-like proteins, kinases, TIM barrels, DNA/RNA binding motifs.

Principles of macromolecular engineering .

The most important metabolic pathways and regulation .

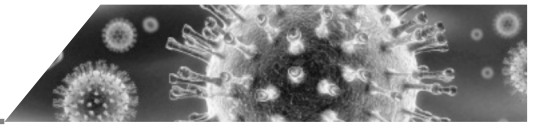
Relation between sequence, structure and function Biological structure databases .

Computer modeling of secondary and tertiary structure of proteins and nucleic acid based on sequence data. Enzyme/receptor-based drugs-rational drug design.

BIO-IICB-2-2804: Protein Science & Proteomics: 2-0-0-2

Protein Science:
Basic building blocks of protein and their composition, chemical behavior, properties.
Peptide bond, geometry and parameters; Backbone geometry and parameters, side chain geometry and parameters, Ramachandran plot.
Primary, secondary, tertiary and quaternary structures.
Protein structure stabilizing forces hydrogen bond, electrostatic bond or salt bridges; hydrophobic forces.
Protein folding, dynamics and thermodynamics.
Protein: from gene to function.
Protein and diseases. Some important proteins in cellular functions.

Proteomics:
Protein cloning, expression and purification.
Protein chromatography systems and purification procedures HPLC, FPLC etc.
Bioinformatics of protein sequences sequence analysis, comparison, alignment etc.
Mass spectrometry introduction to mass spectroscopy, gel mass spectroscopy, LC-MS, LC-MS-MS, MALDI-TOF .
Protein NMR, FTIR Raman, CD.
Protein crystallography.



BIO-IICB-2-2807: Molecular and Cellular Immunology : 2-0-0-2

History of immunological ideas and cellular components of immune system.

Transplantation antigens: structure, function, genetics, transplantation.

Phagocytosis and antigen presentation, Fc receptor and scavenger receptor mediated phagocytosis, markers to follow phagocytosis, presentation of endogenous and exogenous antigens, cross-presentation.

Antibody structure, antigen-antibody interactions, binding site, affinity, avidity, Fc functions, molecular biology of immunoglobulins; B cell triggering: T cell-B cell Interactions, Antigen Presentation, MHC I,II

Humoral immune response and cytokines: signaling through B cell receptors, plasma cell differentiation, proinflammatory / antiinflammatory effects of cytokines, transcriptional control of cytokine synthesis.

Structure of lymphoid organs, ontogeny of lymphoid cells; complement system and disease : classical and alternative pathways of complement activation, complement regulation and deficiencies.

Immune response to parasitic infections : cell mediated immunity: delayed reactions, immunodeficiency; allergy, Arthus reaction, serum sickness, inflammation.

Autoimmunity: regulation of immune response and autoimmune diseases, immunity to virus.

BIO-IICB-2-2805: Cell Biology and Cell Signaling : 2-0-0-2

Cell growth and division, including cell cycle: phases of cell cycle, regulation of cell cycle, cell cycle check point, cell growth.

Intracellular sorting of proteins: nuclear import and export mechanism; organelle targeting; transport of protein to cell surface; soluble protein sorting.

Cell adhesion, cell junction and Extra Cellular Matrix: cell adhesion molecules; cell junction; Extracellular matrix; cell-cell recognition.

Cytoskeletal structure-function and related macromolecules: cytoskeletal proteins; role in vesicular movement; cellular morphology and cytoskeletal protein; drug modulating cytoskeletal protein.

Signal transduction pathways: extracellular signals; intracellular signals; 2nd messengers; signal transduction pathways .

Cell death and proliferation: programmed cell death; cell renewal system; mitochondria and apoptosis; ER-stress.

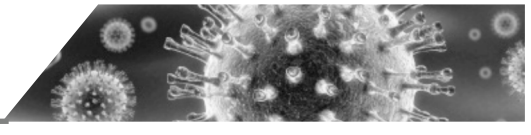
Cellular starvation, stress and Autophagy: oxidative and nitrosative stress; stress response; Autophagic vacuole turnover; cellular homeostasis.

Metabolic disorder and signaling aberrations: abnormal signaling in Cancer; signaling for diabetic complication angiogenesis; signaling for failure in diabetes.

CHE-IICB-2-004 : Advanced Analytical Chemistry : 2-0-0-2

Chemical Techniques: chromatography- general principles, classification of chromatographic techniques, normal and reversed phase, bonded phase, separation mechanisms, short-column chromatography, flash chromatography, vacuum liquid chromatography (VLC), medium pressure liquid chromatography, high pressure liquid chromatography (HPLC), TLC, HPTLC. X-RD analysis and its applications.

Basic Principles of Mass Spectrometry: methods of ionization (EI, CI, FAB/LSIMS, ESI, MALDI,DART, DESI) and high resolution MS; application of MS in structure elucidation of organic molecules; basic principles and applications of GC-MS, LC-MS and high resolution MS.



CHE-IICB-2-203: Advanced Organic Chemistry : 2-0-0-2

Stereoselective C-C bond formation: nucleophilic addition to C=X (X=C, O, S, N), pericyclic reaction asymmetric induction in [3+2] and [2+2] cycloaddition, streoselective hydroformylation, streoselective carbene addition, chirality transfer in sigmatropic rearrangements.

Named Reactions and Rearrangements: Strecker, Mannich, Biginelli, Passerini, and Ugi reactions. Baker-Venkataramana, Curtius, Schmidt, Wolf, Hofmann, and Brook rearrangements.

Lactonization: Yamaguchi, Corey-Nicolaou, Heck, Masamune, Mitsunobu, and Yamamoto's Macrolactonizations. Mukaiyama Esterification.

Ring-closing metathesis (RCM) using Grubbs and Schrock catalyst, Buchwald-Hartwig C-N bond and C-O bond formations, BaylisHillman Reaction, Evans aldol reaction, Ugi-reaction, Click reaction, Corey-Bakshi-Shibata (CBS) reduction, Corey-Kim oxidation, Nozaki-Hiyama-Kishi Reaction, Payne rearrangement, Prins reaction, Japp-Klingmann reaction.

CHE-IICB-2-226: Green Chemistry : 2-0-0-2

Basic principles and applications of green chemistry: basic understanding, scope and interdisciplinary nature of green chemistry; environmental factors, carbon credit, energy efficiency and atom economy, designing green synthesis, green reagents, green catalysts, phase transfer catalysis in green synthesis, microwave-induced green synthesis ultrasound-assisted green synthesis, aqueous phase reactions, ionic liquid and water as green reaction media, enzyme mediated reactions

CHE-IICB-3-219: Advances in Nanoscience and Nanotechnology : 2-0-0-2

Importance of materials, properties at nano scales, advantages & disadvantages, application in comparison with bulk materials, processing of nanomaterials- basic fabrication techniques and various chemico physical methods, nano particles preparation and characterization.

Nano tubes: introduction, single walled, multi-walled nanotubes, synthetic procedures (solid & gaseous carbon source based production techniques etc.), growth mechanism of carbon nanotubes properties of carbon nano tubes characterization applications, nano composites-introduction-synthesis procedures-various systems (metal-polymer, metal-ceramics and polymer-ceramics).

Applications of nanomaterials.

LEVEL 300 :
Advanced Level courses
Total: 4 Credits

BIO-IICB-3-2801 (1 credit) is compulsory for all students. Additional 3 credits are to be taken from other 300 level courses.

BIO-IICB-3-2801: Seminar & Critical Appraisal: 1-0-0-1

[*compulsory course for both Biology & Chemistry students*]

This course will be based on current literature survey and its critical appreciation.

BIO-IICB-3-2802: Cancer Biology : 2-0-0-2

Cancer Immunology: the immunological status of adaptive and innate immune cells in cancer, cellular interactions between immune and cancer cells in tumor progression or rejection, immunological mechanisms, regulation and function involved in host responses to tumors, anti-tumor immunity, cancer-induced immune tolerance, immunosuppression, dysregulation of the immune system and poorer outcome in the disease.

Cancer stem cells : Origin/Hypothesis/Concept ; signaling pathways in cancer stem cells.
Cell signaling in cancer : description of major classes of cell signaling: cell death signaling, cell survival signaling and developmental/ stem cell signaling; signal networking and chemotharapy.

Oncogenesis and epigenetics in cancer : Oncogenes and their regulation in signaling aberration; acetylation/methylation in DNA and histones; silencing/de-silencing of gene expression.

Metabolic Engineering in cancer; metagenomics and cancer.

Cancer biomarkers and diagnosis : selection of clinical specimens, recent advancement for identification of biomarkers through different approaches like genomics, proteomics and glycomics in combination with molecular pathology with potential clinical value; application of biomarkers for cancer staging and personalization of therapy at the time of diagnosis to improve patient care.

Cancer drug discovery : identification of lead molecules, target identification in cancer cells; combined approaches (in vitro, in vivo and in silico) for validation, various steps involved towards successful drug discovery; immunotherapeutic approaches e.g. cancer vaccines, monoclonal antibodies, adoptive immune cell transfer etc. and combination strategies to treat malignancies.

Angiogenesis and metastasis &

Project writing.

BIO-IICB-3-2803: Cell and Tissue Engineering : 1-0-0-1

Introduction: Cell & Tissues : definition of cells, tissues and organs .

Tissue culture: propagation of somatic cells.
Stem cells : source, biology and therapeutics.
Biology of blood and artificial blood , Biology of skin and artificial skin.

Biomaterials: source and usage.
Hybrid cells: theory and instrumentation.
Tissue transplantation.

Biomolecules: angiogenic factors, growth factors.
Mouse genetics: Transgenics, Knock-out

BIO-IICB-3-2807: Eukaryotic Gene Regulatory Mechanisms : 2-0-0-2

In each module the study material will consist of a few original research articles covering some of the latest developments in the field, to be chosen by the instructors for open discussion in the class. Discussion may include one or more of the following topics. Students are expected to brush up their post graduate knowledge of these topics before attending the lectures.

Chromatin Structures and Epigenetics: nucleosome assembly and the modification of nucleosomes and of DNA/ the assembly of chromatin into higher order structures/ different aspects of heritable patterning of gene expression and the biological importance of epigenomes/ mechanisms of inheritance as well as imprinting, X inactivation and the role of RNA in establishing silent chromatin/ the impact of chromatin structure on differentiation, cell plasticity and development.

Transcriptional Regulation and Gene Expression: regulatory interplay between transcription factors: regulatory DNA sequences (promoters, enhancers, locus control regions) /general transcription machinery/transcription factors: cell-specific and ubiquitous regulatory factors/ mechanistic aspects of transcription activation / chromatin, histones, DNA methylation /gene regulatory networks /transcription factors in health and disease/ transcription factors as the final integrators of signaling cascades.

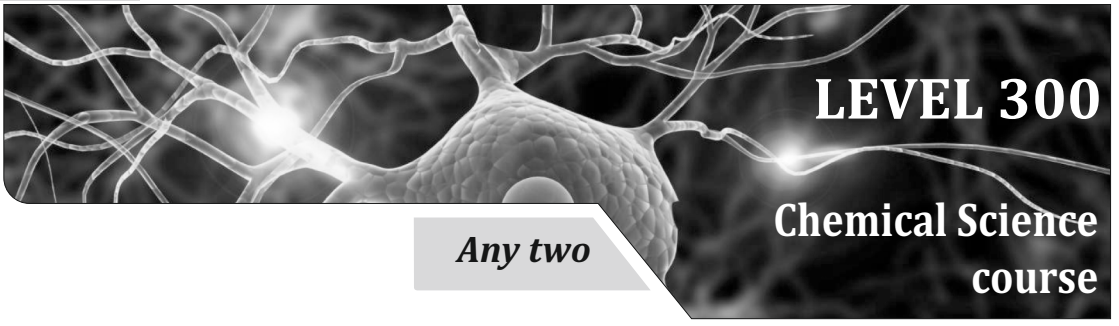
Structure, Processing, Trafficking and Function of RNA: chemistry and structure of RNA/ major lectures of cellular RNAs (mRNAs, tRNAs, rRNAs, snRNAs, and the newly discovered small regulatory RNAs/pre-mRNA processing with emphasis on splicing and polyadenylation/ biogenesis of tRNA and rRNA/biochemistry and function of RNA interference (RNAi) and microRNAs/ RNA trafficking in the cell/ RNA quality control and RNA degradation/regulated mRNA translation during development/ RNA-protein interactions and major lectures of ribonucleoprotein particles;RNA granules and bodies /evolution of RNAs: the RNA world.

Translational Control and Post-translational Protein Modification: the translational control: codons and frame shifting, attenuation, phosphorylation, and transformation/the role of translational control in the regulation of cell growth and differentiation.

BIO-IICB-3-2808: Chemical Biology: 1-0-0-1

[Both Biology and Chemistry students can opt this course]

An overview of Chemical Biology.
Protein-protein interactions and its inhibitors.
Ligands for protein surfaces.
Ligands for Nucleic Acid surfaces.
Chemical Genetics.
Synthetic and semi synthetic proteins.
Applications of chemical biology, enzyme based biosensors, catalytic antibody.



CHE-IICB-3-356: Natural Products and Drug Discovery :2-0-0-2

Occurance, isolation, chemistry and biosynthesis of mono-, sesqui- and di-terpenoids, flavonoids and alkaloids.

Free radicals and Antioxidants: important free radicals in living systems, sources, chemistry and reactivity of important free radicals in biological systems, natural antioxidants of different classes. In vitro Methods: free radical determination by ESR methods, impact of singlet and triplet oxygen (importance of reactive oxygen species) in radical formation in biological systems.

Steroids & Saponins: sources, biological significance and structure elucidation of saponins; and of steroids ergosterol, stigmasterol, β- sitosterol and diosgenin, squalene biosynthesis.

CHE-IICB-3-312: Supramolecular Chemistry: 1-0-0-1

Classical and non-classical H-bonding, importance of non-covalent interactions in molecular recognition, introduction of QSAR, drug - receptor interactions, physiochemical empirical and non-empirical parameters, 2D-QSAR approaches, 3D-QSAR approaches, 4D-QSAR and higher approaches, statistical methods in modeling, model validation, application of QSAR in drug discovery.

CHE-IICB-3-313: Total Synthesis: 2-0-0-2

General concepts on various types of cycloaddition reactions, application of cycloaddition reactions in the synthesis of chiral compounds and industrially important molecules.
Synthesis of complex organic molecules planning and execution; concepts of retrosynthetic analysis; total synthesis of natural products: retrosynthesis, disconnection, synthons, linear and convergent synthesis.

Course Content for 2019 and the selection of Teachers have been decided by the Academic Affairs Committee.
The contents of the course catalogue have been developed by the team HRG CSIR-IICB.

Academic Affairs Committee:

Dr. Uday Bandyopadhyay, Chairperson, AAC
Dr. Snehasikta Swarnakar
Dr. Sib Sankar Roy
Dr. Suvendra Nath Bhattacharyya
Dr. Chinmay Chowdhury
Dr. Krishnananda Chattopadhyay
Dr. Jayati Sengupta
Dr. Sanjay Dutta
Dr. Partha Chakrabarti
Dr. Siddhartha Majumdar, Convenor

AcSIR Coordinator for CSIR-IICB : Dr. Sanjay Dutta

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