

SCHOOL OF COMPUTATIONAL AND INTEGRATIVE SCIENCES

The **School of Computational and Integrative Sciences**, Jawaharlal Nehru University, presently houses the **Center for Computational Biology and Bioinformatics**, a Center of Excellence of the Department of Biotechnology, Govt. of India. Additionally SCIS has initiated the **Center for Complex Systems**, introduced and supported in the XII Plan by the UGC. The overriding objective of the School is to develop and apply computational methods in different disciplines. This mission is reflected in the diverse faculty profile of the school which comprises researchers from fields as varied as Genomics, Computational Biology, Plant Biology, Complex Systems, Bioenergy, Statistical Data Analysis and Modeling, Theoretical and Computational Chemistry, Petri nets and Graph Theory, Mathematical Biology, Computational Radio Frequency and Microwave, Antenna applications for Biomedical application.

PROGRAMMES OF STUDY

Teaching and research programs in **Computational and Systems Biology** involve the research, development, and application of computational tools and approaches for expanding the use of biological, agricultural, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, or visualize such data. In addition, research programs involve the development and application of data analytical and theoretical methods, mathematical modeling and computational simulation techniques to the study of biological, behavioral, and social systems. The School has initiated a program in **Complex Systems** which will study the behavior of mathematical, physical, living and social systems, identify patterns that underlie these inter-related systems, and examine properties such as emergence, evolution, network, structure and dynamics of these systems in a competitive environment.

The School runs a vibrant Ph.D. program, with research in different areas of Computational Biology and Complex Systems.

Some of the frontier areas of research conducted at the School are:

Computational Genomics and Next Generation Sequencing
Plant Biology: Genomics and Epigenomics of Abiotic Stress and Development
Application of Omics Technologies and Crop Genetics to Feedstock Improvement for Biofuels
Cheminformatics and Drug Discovery
Genome-wide Application of Information Theory and Pattern Recognition Methods
Intelligent Systems and Machine Learning
DNA-Protein Interactions
Chromatic Conformational Dynamics
Biomechanics and Mathematical Modelling of the Cardiovascular System
Stochastic and Nonlinear Dynamics Applied to Biological Systems
Monte Carlo Simulation Techniques to Explore the Energy Landscape of Water Clusters and Biomolecules.
Development of a Bacterial Cell Model: diffusion and hydrodynamics.
Effect of Molecular Crowding on Biomolecular Systems.
Application of Graph Theory and Petri-Nets
Application of Network Theory in Social and Financial systems
Econophysics and Sociophysics- Application of Physics to Model Socio-Economic Systems

Wireless communication and Applications in Biology, including wearable/implantable devices as antennas/sensors
High Performance Computing and Cyberinfrastructure

SCIS offers **M.Sc. degree in Computational and Integrative Sciences** with a specialization in either **Computational Biology or Complex Systems**. The Computational Biology stream will have equivalence to the M.Sc. in Bioinformatics, while the Complex Systems stream will have equivalence to the M.Sc. in Physical Sciences.

The School also offers a program in data science through a **Post-Graduate Diploma in Big Data Analytics (PGBD)**, with specialization in Biological Big Data. This is a sponsored skill-development program of the Department of Biotechnology, and is aimed at training post graduates in the upcoming field of Big Data analytics for life sciences and health. Trained graduates from this program are expected to learn key technologies of data sciences, including big data collection and warehousing as well as machine learning, data integration and modeling technologies which can be applied in an academic and industry environment in the future.

The School has encouraged intake from multiple disciplines into all its programs of study, which will now be grouped with independently specified intake requirements as (1) Physical, Chemical Sciences and Mathematical Sciences (2) Computational Biology, Bioinformatics, Life Sciences/Biotechnology and (3) Information Technology/Engineering Sciences, to provide an optimal peer-group of analytical, domain and computational skills within each program.

The teaching and research programs are supported by good computational and communication infrastructure. Each student is provided with a Desktop/workstation, and the School manages a centralised facility for high-performance computers, consisting of computer clusters with multiprocessor nodes, large-memory nodes and GPUs to facilitate specialized research. The school takes pride in being among the country's best institutions in imparting high-value employability-related skills to its students such as in genomics data analytics, molecular simulations, data science and financial modelling and simulation.

ADMISSION TO PROGRAMMES OF STUDY

Admission to all programs of the school will be in two or three tracks based on discipline:

(1): Physical Sciences: Physics, Chemistry, Mathematics and related disciplines

(2): Computational Biology/Bioinformatics/Life Sciences: Life Sciences/Biotechnology with an aptitude in informatics; Bioinformatics and Computational Biology

(3): Engineering/Computer Sciences: Engineering disciplines, including Information Technology, with a stress on disciplines with computational data analytics.

The use of the word "Track" in this document is solely for the purpose of grouping disciplines for the purpose of admission to various programs. All programs are interdisciplinary, and students, after registration, may choose to work in areas independent of their prior training based on their aptitude and interest.

The School of Computational and Integrative Sciences offers the following three academic programmes for the current year: (a) **M. Sc. in Computational and Integrative Sciences**, admission to which will be offered in **two tracks** - (1) Analytical Sciences encompassing the Physical Sciences

and Engineering/Computer Sciences listed above and (2) *Computational Biology/Bioinformatics/Life Sciences*; (b) **Post-Graduate Diploma in Big Data Analytics** and (c) **PhD. programs** will have admission specified for each of the **three tracks** above.

POST-GRADUATE PROGRAMME

(i) M.Sc. programme in Computational and Integrative Sciences

The M.Sc. program allows for a specialisation either in Computational Biology or Complex Systems, the latter with equivalence to an M.Sc. in Physical Sciences.

The course work leading to the award of a M.Sc. in Computational and Integrative Sciences shall be for a period of four semesters (two monsoon and two winter semesters) with a compulsory requirement for submission of a research-based dissertation at the end of the fourth semester. A student will need to earn a minimum of 72 credits, including 9 credits for the dissertation.

(ii) Post-Graduate Diploma in Big Data Analytics

(With a specialization in Biological Big Data)

1. The curricular work leading to the award of Post-Graduate Diploma shall be spread over a period of two semesters - one Monsoon Semester and one Winter Semester with a provision of a project report to be submitted by student latest by July 21 at the end of the Winter Semester.
2. A student will have to earn a minimum of 21 credits including 6 credits for project at the end of one year in order to be eligible for the award of Post-Graduate Diploma.

(iii) Ph.D. program in Computational Biology and Bioinformatics, Complex Systems

All candidates for this programme would have to qualify a written examination with at least 50% as the qualifying marks. Candidates short-listed from the written examination would be finally selected based on the performance in the viva-voce.

M.Sc. Programme

Sl. No.	Name of Centre	Sub. Code & Sub. Code Number	Eligibility
1	School of Computational and Integrative Sciences (SC&IS)	Computational and Integrative Sciences-CISM (232)	A minimum of 55% marks in Bachelor's degree in any branch of Basic and Applied Science or Technology, including medicine and engineering disciplines. Candidates would be selected through an entrance examination followed by an interview of short-listed candidates.

Post-Graduate Diploma in Big Data Analytics (PGDE)

Sl. No.	Name of Centre	Sub. Code & Sub. Code Number	Eligibility	Additional information
1	School of Computational and Integrative Sciences (SC&IS)	Post-Graduate Diploma in Big Data Analytics – PGDE (184)	M.Sc./B.Tech in Physics/ Chemistry/ Mathematics/Computer Science/ Statistics/ Operations research/Life Sciences/ Biotechnology/Bioinformatics/related disciplines in engineering, physical, and biological sciences. Minimum of 55% in the qualifying degree.	P.G. holders of AYUSH related subjects are also eligible to apply.

Ph.D.

Sl. No.	Name of Centre	Sub. Code & Sub. Code Number	Eligibility
1	School of Computational and Integrative Sciences (SC&IS)	Computational Biology and Bioinformatics-CBBH (903)	<p>M.Sc./B.E./B.Tech in Physics/ Chemistry/ Mathematics/Computer Science/ Statistics/ Operations research/Life Sciences/ Biotechnology/Bioinformatics/engineering and related disciplines with minimum of 55% in the qualifying degree or equivalent Grade 'B' in UGC 7-point scale (or an equivalent Grade in a point scale wherever Grading system is followed).</p> <p align="center">OR</p> <p>Obtained 2 years M.Phil. degree or equivalent with at least 55% marks in the related field like science, engineering, medical and pharmaceutical science from a recognized University/Institution (with dissertation/seminar/Viva) or one year M.Phil. degree with 55% marks in the related field like science, engineering, medical and pharmaceutical science with additional one year research experience of a recognized University/Institution, and one publication and with minimum of 55% in the M.Sc./B.E./B.Tech in relevant field or equivalent Grade 'B' in UGC 7-point scale (or an equivalent Grade in a point scale wherever Grading system is followed).</p> <p align="center">OR</p> <p>Candidates with Advanced Diploma (after M.Sc. degree with at least 55% marks) in Bioinformatics are also eligible.</p> <p>Note: (M.Phil/Equivalent qualified candidates) Only those candidates in science/Engineering branch shall be considered for admission to this category of the Ph.D. program.</p> <p>Relaxation to SC/ST/OBC (Non creamy layer)/Differently abled as per the UGC Regulations 2016</p>