

A Global Initiative of Academic Networks (GIAN) Course on
Latest Methods in Protein Crystallization and Structural Biology

11th December 2017 - 15th December 2017

Overview

Proteins, RNA and DNAs, as well as their complexes are biological macromolecules, which play an important role in guiding the biological activity. The crystallization of proteins and other biomolecules is challenging, due to the high sensitivity of proteins structure and function to pH, ionic strength and temperature. Production of high quality single, X-ray suitable, crystals for crystal structure analysis is till now considered to be the bottle neck in obtaining high resolution X-ray structure data and structures. Hence, understanding various parameters that initiate the nucleation and crystallization of proteins is essential to obtain high quality single crystals for structure analysis.

The main objective of the course is to provide the elementary information on protein crystallization and various details to be considered for beginners to perform protein crystallization. In this context also different and complementary advanced techniques to characterize protein purity and homogeneity will be presented, as well as all techniques and methods for diffraction data collection, data processing and to analyse the structural arrangement of proteins and other biomolecules will be presented. Particular the phase problem, methods for structural refinement will be also covered to motivate young researchers to perform X-ray structure analysis and to be trained for an effective interpretation of the scientific data.

The primary objectives

- Understanding of the fundamentals of proteins and its properties.
- Study of the protein crystallisation kinetics.
- To learn various macromolecular crystallization techniques.
- Understanding the basics of Dynamic Light Scattering Techniques (DLS).
- Optimization of crystallisation conditions using DLS techniques.
- Protein Structure analysis by X-ray diffraction
- Explaining the crystal symmetry and space groups.
- Approaches to solve the phase problem.
- Interpretation of electron densities and model building.
- Interpretation of protein structures and quality parameters

Course details	Date: 11 th December 2017 - 15 th December 2017(includes 18 hrs. of lectures and tutorials) Course Code: [176020B01]
Venue	Crystal Growth Centre, Anna University, Chennai, 600025, India
Modules	A: Basics of protein crystallization. B: Protein crystallization and scoring of set ups and crystals. C: Crystallization techniques, robotics & strategy. D: Protein crystals in the Pharmaceutical Industry. E: Principles and instrumentation of Dynamic Light Scattering (DLS). F: Applications of DLS in characterizing and as a tool to obtain high quality-crystals. F: Crystal geometry and lattice, cell dimensions and space groups. G: X-rays, X-ray source ,conventional X-ray sources, synchrotron radiation and free-electron-laser radiation sources H : Protein structure determination by X-ray diffraction I: Reconstruction of electron density, phase problem, basics of model building and refinement. J: Crystallography and the drug discovery process studying protein-ligand Z-interactions
No of Credits	One
You Should Attend If...	You are either a student (B.Tech/M.Sc/M.Tech/PhD/Medicine/MBBS/BDS), a post-doctoral fellow from any of these subjects or Faculty from reputed academic institutions and technical institutions. The participation of executives, engineers, and researchers from manufacturing, service and government organizations including R&D laboratories is also strongly encouraged.
Fees	Foreign Participants : US \$500 Faculty from academic institutions/Govt. research organizations: Rs. 2,000/ Students: B.Tech./M.Tech./M.Sc./M.Phil/M.S/Medicine/Pharma: Rs. 500/ Research scholars and Post-Doctoral Fellows.: Rs. 1000/ Industry/ Research Organizations: Rs.10000/ The participants will be provided with accommodation subject to the availability on payment basis.

The Faculty



Prof. Christian Betzel is heading the Laboratory for Structural Biology of Infection and Inflammation located on the DESY Campus. His main topic of research is structure function analysis of biomolecules with relevance to infection diseases applying X-ray crystallography as well as complementary biophysical methods. In part his investigations focused also in the field of crystallogenesis. For example, his group developed advanced dynamic light scattering methods to score and optimize the crystallization of biomolecules. Till now he supervised more than 35 PhD students and a same number of diploma and MSc students. He raised funds and projects applying at national agencies, as BMBF and DFG, as well as in collaboration with cooperating academic and industrial partners, European and international funding organizations.

[CV of Prof. Dr. Christian Betzel](#)



Prof.S.Narayana Kalkura is the Director of the Crystal Growth Centre, Anna University and his research interests are in the field of biomaterials and biomineralisation. He has more than 30 years of experience in the above fields and has published nearly 100 research articles in refereed international journals. Sixteen students have obtained doctoral degree under his supervision. He has handled many national and international research projects and is currently having Indo-DAAD and INDO-FRENCH (CEFIPRA) projects

[CV of Prof.Kalkura](#)

Course Coordinator

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<https://www.annauniv.edu/gian/course.html>

Latest Methods in Protein Crystallization and Structural Biology

Schedule (Ch. Betzel, as of 25.07.2017)

Monday, 11.12.2017

- 13:30-14:00 Inaugural function and course overview
- 14:00-15:00 Lecture 1 (1 h): Introduction Methods in Structural Biology
- 15:30-16:30 Lecture 2 (1 h): Proteins, Structure-Function & Dynamics

Tuesday, 12.12.2017

- 10:00-11:00 Lecture 3 (1 h): Principles of protein crystallization
- 11:30-12:30 Lecture 4 (1 h): Dynamic Light Scattering

- 14:00-15:00 Lecture 5 (1 h): Various macromolecular crystallization techniques
- 15:30-16:30 Lecture 6 (1 h): Optimizing protein crystallization conditions

- 17:00-18:00 Tutorial I (1 h): Applying Counter Diffusion for Protein Crystallization

Wednesday, 13.12.2017

- 10:00-11:00 Lecture 7 (1 h): Crystal Lattice and Symmetry
- 11:30-12:30 Lecture 8 (1 h): Crystal Symmetry and Braggs Law
- 14:00- 15:00 Lecture 9 (1 h): Crystal Symmetry and Reciprocal lattice

- 15:30-16:30 Tutorial II (1 h): Applying Vapour Diffusion for Protein Crystallization

Thursday, 14.12.2017

- 10:00-11:00 Lecture 10 (1 h): Crystals and Millers Indices
- 11.30-12.30 Lecture 11 (1 h): Principles of crystal handling for data diffraction data collection
- 14:00-15:00 Lecture 12 (1 h): Diffraction data collection, conventional and latest approaches

- 15.30-16:30 Tutorial III (1 h): Processing diffraction data

Friday, 15.12.2017

- 10:00-11:00 Lecture 13 (1 h): Solving the phase problem
- 11.30-12.30 Lecture 14 (1 h): 3D Model Building and Refinement

- 14:00-15:00 Tutorial IV (1 h): Solving the Phase Problem by Molecular Replacement

- 16:00-16:30 Valedictory function and course recapitulation

There will be time for questions and answers at the end of each session. During the tutorials, the participants will be especially encouraged to participate actively and to discuss their questions in more detail.