

Molecular Understanding of Proteins
CHEM 761 / Special Topics: Biochemistry – Fall 2018
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From a random coil to a fully folded and functional protein - dynamics, function, and disease

Molecular understanding of proteins and their structures are essential in understanding biological activity and function of proteins. This course discusses why proteins form specific structures, protein-protein interactions, and why errors sometimes occur as well as protective strategies against errors when folding goes wrong. When folding goes wrong in cells, misfolded and/or aggregated proteins may arise unable to perform their functions and sometimes even contribute to neurodegenerative diseases via amyloid formation. Diseases like Alzheimer's, Parkinson's and Amyloid Lateral Sclerosis are very serious proteinopathies without a cure. In addition to lectures and practical exercises, the course includes projects, discussions and a mini-conference and aims at improving the students' ability to formulate and test scientific hypotheses.

Course Syllabus. This class will provide an in-depth knowledge for a better understanding of proteins biological function, and to be able to identify the role of the different steps in the folding process. It treats the interaction of proteins in the living cell at a molecular level as well as molecular mechanisms for protein diseases (proteinopathies). The course trains the ability to formulate and test hypotheses, laboratory techniques and computer-based methods and basic bioinformatics.

The course includes the following elements:

- 1) Theory and lectures
- 2) Computer Exercises - Introduction to Molecular graphics programs as PyMol and/or VMD and Molecular Dynamics (MD) simulations and a theoretical exam
- 3) A Project work ending with a poster presentation
- 4) Laboratory exercises
- 5) A final exam

Material. The book "Introduction to protein structure" by Brandén *et al* together with the computer graphics program PyMol and/or VMD.

Expected results from the course. After taken this class the student is expected to:

- ✓ understand the principles of protein structures and folding
- ✓ understand the interaction between proteins in the living cell and the relationship between proteins and protein diseases.
- ✓ be able to formulate and test hypotheses regarding relevant issues in protein research
- ✓ demonstrate proficiency in and understanding of the principles behind relevant laboratory techniques and computer-based methods for protein analysis

Lectures. The class will be taught with full size lectures, molecular graphics practice, Individual or group project-based poster presentation (mini conference), review of scientific papers, home exam, final exam, laboratory exercises on protein analysis.