

SEMESTER I

LSM4242 PROTEIN ENGINEERING

Prerequisite: LSM2232 or LSM3231

Workload: 26 lecture hours + 24 hours of tutorial and discussions

Course description:

This module will familiarize students with the technologies that can be used to produce and engineer various proteins for basic biological research and biotechnology applications. The fundamental principles for manipulating protein production as desired and the common expression systems will be presented. The emphasis will be on the experimental strategies and approaches to improve protein properties and to create novel enzymatic activities. The topics include gene expression and protein production systems, uses of gene fusions for protein production and purification, directed molecular evolution and DNA shuffling, and engineering of proteins and enzymes for improved or novel properties, as well as genome editing. Some specific examples in protein engineering will be highlighted.

S/N	Topics	Lecture Hours
1.	<ul style="list-style-type: none"> • Introduction • Prokaryotic and eukaryotic systems for protein production • Strong and regulatable promoters • Uses of cleavable fusion proteins for affinity purification 	4 h (Pan SQ)
2.	<ul style="list-style-type: none"> • Cell-free in-vitro translation systems • Site-directed mutagenesis 	2 h (Pan SQ)
3.	<ul style="list-style-type: none"> • Directed molecular evolution • Phage display • In vitro display technologies 	4 h (Pan SQ)
4.	<ul style="list-style-type: none"> • Strategies and approaches to enhance biological properties of proteins and enzymes • Increasing protein solubility • Increasing enzymatic activity, stability and specificity • Modifying cofactor requirements • Engineering of regulatable enzymes • Incorporation of unnatural amino acids 	4 h (Pan SQ) 2 h (Song J)
5.	<ul style="list-style-type: none"> • Protein and peptide design and engineering 	4 h (Song J)
6.	<ul style="list-style-type: none"> • Specific examples of protein engineering <ul style="list-style-type: none"> ○ Microbial, plant and animal cells as bioreactors ○ Therapeutic proteins ○ Industrial enzymes • Genome editing 	6 h (Pan SQ)
Total Lectures: 26 hrs		
Tutorials and discussions: 24 hrs		
Total hours:		50h

TEXT BOOKS (Reference):

Protein Engineering: a practical approach / edited by Anthony R. Rees, Michael J.E. Sternberg, and Ronald Wetzel. Oxford ; New York : IRL Press at Oxford University Press , c1992

Protein Engineering and design / edited by Paul R. Carey. San Diego, Calif. : Academic Press , c1996

Protein Engineering: Principles and Practice

Jeffrey L. Cleland, Charles S. Craik. John Wiley & Sons. 1996

PRESENTATION/DISCUSSION/TUTORIALS: 24 hours.

These will be conducted on the following general topics.

Production of proteins and enzymes;

Development of improved or novel proteins and enzymes;

Industrial proteins and enzymes.

MODE OF ASSESSMENT:

50% CA (based on presentations and CA tests), 50% Final Exam (closed-book)

MODULE CO-ORDINATOR:

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