Florida Institute of Technology

ADDING A NEW COURSE TO THE CURRICULUM

This course is available for student registration only after the approval process has been completed.

SUBJECT BIO COURSE NO. 4015 CREDIT HOURS 3 TERM TO BE ADDED TO THE FILE Fall 2009

CLASS HOURS LECTURE HOURS 30/term LAB HOURS 60/term CONTACT HOURS (CEU ONLY) 

DEPARTMENT Biological Sciences (e.g., Computer Sciences) SCHEDULE TYPE Lecture/Lab (e.g., Lecture, Lab or Special Project)

☐ COLLEGE OF AERONAUTICS-23 ☐ COLLEGE OF PSYCHOLOGY AND LIBERAL ARTS-25
☐ COLLEGE OF BUSINESS-24 ☒ COLLEGE OF SCIENCE-26
☐ COLLEGE OF ENGINEERING-01 ☐ UNIVERSITY COLLEGE EXTENDED STUDIES-27

COMPUTER TITLE Restricted to 25 characters, including spaces Protein Analysis

CATALOG TITLE Methods in Protein Analysis

CATALOG DESCRIPTION OF COURSE Limited to 350 characters, including spaces

Focuses on basic theories and techniques used for protein isolation and characterization. Covers chromatography, electrophoresis, spectrophotometry, ultracentrifugation, mass spectrometry, concentration analysis and protein over-expression in Eukaryotic and Prokaryotic systems. Includes purifying and characterizing proteins.

In addition, you may attach a course syllabus and/or more detailed description.

RESTRICTIONS ☒ Prerequisite BIO 4010 ☐ Corequisite Course Number
☐ Prerequisite Course Number ☐ Corequisite Course Number
☐ Prerequisite Course Number ☐ Corequisite Course Number

GRADES TO BE ISSUED ☒ A, B, C, D, F ☐ A, B, C, D, F, CEU
☐ CEU ☐ S, U
☐ P, F ☐ Other

ADDITIONAL RESTRICTION (e.g., Major, Class Level, Department Head Approval)

If this course replaces a course currently offered in BANNER, please indicate old course information

SUBJECT Alpha Prefix (e.g., CSE) COURSE NO. (e.g., 1301) 

APPROVALS: Upon completion of appropriate department approvals, submit form to Chair, Graduate Council, or Chair, Undergraduate Curriculum Committee for approval below and forward to Catalog Director.

Or

Originator Date Chair, Graduate Council Date

Department Head/Program Chair Date OR Chair, Undergraduate Curriculum Committee Date

Dean of Associate Dean Date

CATALOG DIRECTOR

These changes/additions have been made for the University/Extended Studies Catalog and entered into the BANNER term named above.

Catalog Director Date

REGISTRAR’S USE ONLY

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SCARRES Operator Init Date

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Course Name: Methods in Protein Analysis
Instructor: Shaohua Xu

Prerequisite: Biol 4010
Offered in the Spring Semester to juniors.
Reference Books: (1) Biophysical Chemistry; Part II: Techniques for the study of biological structure and function. By Cantor and Schimmel.
Scores: Two quizzes (5% each), Two exams (midterm 25%, final 35%), and 14 Lab (30%)

Course Description: This course focuses on basic theories and techniques used for protein isolation and characterization. It covers chromatography, electrophoresis, spectrophotometry, ultracentrifugation, mass spectrometry, concentration analysis, and protein overexpression in Eukaryotic and Prokaryotic systems. Students learn how to purify proteins from raw materials and characterize the isolated proteins.
| Overview of protein structure and function, aa property, importance of protein analysis |
| Calculation of concentration, M, N, %, Mw, Ionic concentration; serial dilution |
| Overview of solution and solute, acid-base equilibrium, dissociation and association constant, solubility product, osmolarity and balance, pH |
| Overview of general properties of proteins  
Protein solubility, stability, isoelectric point, and protein molecular weight calculation |
| Overview of protein purification, tissue selection, homogenizing, cell lysis, protein tracing, centrifugation and filtration techniques, enzyme inhibitors; salt out, chaotropic and kosmotropic salt; |
| Ion exchange chromatography, surface double layer, surface chemical potential |
| Size-exclusion chromatography |
| High Performance Liquid Chromatography (HPLC) and Fast Protein Liquid Chromatography (FPLC) |
| Protein overexpression by various vectors in Ecoli and Eukaryotic systems  
polyclonal antibody preparation and purification, immunoreaction, immunoprecipitation |
| Affinity chromatography, chaotropic effect, antibody column, Ni⁺-column, selection of molecules to be attached to the beads, and the chemistry of attachment |
| Spectroscopic Techniques  
The nature of light, electromagnetic spectrum, UV/Vis adsorption spectroscopy  
Fluorescence spectroscopy, CD/ORD, infrared spectroscopy |
| Mass Spectrometry |
| Protein purity analysis: Native gel electrophoresis, various staining methods |
| SDS-PAGE Isoelectric focusing and 2-dimensional electrophoresis |
| Western blot, ELISA |
| Hydrodynamic methods: Viscosity measurement |
| Protein oligomerization and aggregation analysis, ultracentrifugation |
| Protein hydrolysis, aa composition analysis, sequencing, |
| Buffer exchange, protein denaturation and renaturation, lyophilize and storage |
| Protein function assays: kinase assay, phosphorylase assay, protease digestion assay |
| Cellular immunotechniques: yeast two-hybrid system, co-immunoprecipitation, etc |
Methods in Protein Analysis (Lab):

To purify and characterize lysozymes from chicken eggs by ion-exchange chromatography.

Experiment 1: Familiar with lab equipments; Prepare buffer solutions.

Experiment 2: Pack and equilibrate a cation-exchange column

Experiment 3: Purify lysozyme from chicken egg by cation-exchange chromatography;

Experiment 4: Buffer exchange; finish previous experiment, OD measurement to identify tubes with lysozyme. Familiar with UV/Vis spectrophotometer

Experiment 5: Protein concentration assay; Lowry, BCA and OD280.

Experiment 6: Salt out proteins.

Experiment 7: Protein Purity Analysis: SDS-PAGE.

Experiment 8: Protein aggregation and analysis by centrifugation and by viscosity measurement.

Experiment 9: Protein conformational change, and chaotropic agent urea, NaSCN
Fluorospectrophotometer

Experiment 10: Protein conformation and pH or organic solvent

Experiment 11: Enzyme digestion experiment
Spectrophotometer

Experiment 12: Enzyme activity and urea

Experiment 13: Enzyme activity dependence on pH

Experiment 14: Protein stability experiment: Trypsin digestion of lysozyme in the presence and absence of urea

Experiment 15: Review experiments and discussion