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Meeting times and Course location: Mon/Wed 1-2.40 (Biol 4241_21); Mon/Wed 3-4.40 (Biol 4241_22); Mon/Wed 4.40-5.30, Th 12.20-2 (Biol 4241_23, 6241_81); DH 5534, online

Course Description:
The goal of the Cell Biology laboratory is to learn the research process, through the application of hands-on skills and scientific method to a research project. The research project involves examining the direct or cellular effects of an agent on oxidants, enzyme activity, cell viability, cell toxicity, apoptosis, membrane damage, lipid peroxidation, total protein content; and the expression of a target gene at the promoter, mRNA, and protein levels. The hands on skills include preparing stock solutions and dilutions; generation of reactive oxygen or nitrogen species; enzyme activity inhibition kinetics; cell seeding, maintaining, trypsinizing, dosing, harvesting, and freezing; cellular assays; co-transfection of promoter-reporter plasmids or siRNA followed by reporter assays; RNA isolation, quantitation, gel electrophoresis, Northern blotting, and reverse-transcriptase real time polymerase chain reaction; and ELISA, immunocytochemistry, and Western blotting

Course Objectives or Goals:
(1) To know the concepts, and hands on skills in molecular cell biology
(2) To apply the scientific process as rationale/hypothesis, method, results (data collection, analysis and representation), and discussion (interpretation, significance, and application).
(3) To communicate science, in written and oral formats

Course Outcomes:
(1) Concepts and hands-on skills in molecular cell biology
(2) Critical thinking and scientific analysis
(3) Information literacy, oral and written communication.

Experiments:
Inventory, Calibration
Stock solutions, Dilutions

Direct assays:
Antioxidant activity assays
Enzymes inhibition kinetics

Cellular/Molecular assays
Cell culture
Cell Seeding
Cell dosing
Harvesting
Cell counting
Cell viability
Cell toxicity
Apoptosis
Membrane damage
Protein content
Lipid peroxidation
Transfection of promoter-reporter plasmids or siRNA
Reporter assay
RNA isolation
RNA quantitation
Gel electrophoresis
Northern blotting
RT-qPCR
ELISA
Immunocytochemistry
Western blotting
Nitric oxide assay
Glutathione assay

Course Requirements: Course testing
(1) Individual reports on each experiment, and three comprehensive manuscripts
(2) Three exams to test knowledge of the molecular cell biology laboratory
(3) Comprehensive presentation of experiments

Required Material:

Course Grading:
Lecture + Lab (total 100%); Lab (40%)

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<th>Total weight</th>
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<tr>
<td>Three manuscripts</td>
<td>15</td>
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<tr>
<td>Three exams</td>
<td>15</td>
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<tr>
<td>Comprehensive presentation, written and oral</td>
<td>7 + 3</td>
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The 40 lab points will be added to 60 lecture points for the molecular cell biology grade (100%)

Grade scale (“A: 94%-100%; A-: 90%-93%; B+: 87%-89%; B: 84%-86%; B-: 80-83%; C+: 77-79%; C: 74%-76%; C-: 70-73%; D: 65%-69%; F: Below 65”)

Assessment Rubric: Lab Reports and manuscript
<table>
<thead>
<tr>
<th>Section</th>
<th>A (90-100%: EX) ACRN</th>
<th>B (80-89%:Good) ACRN</th>
<th>C (70-79%:Fair) ACRN</th>
<th>&lt;C (&lt;70%: Poor) ACRN</th>
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<tr>
<td>1. Introduction: Rationale, hypothesis (one sentence each in reports, comprehensive in manuscript – one paragraph in total for the rationale/background, and one for hypothesis)</td>
<td>Clear concise hypothesis and rationale (from journal article).</td>
<td>Hypothesis and rationale are present, but not clearly defined.</td>
<td>Hypothesis and rationale do not match.</td>
<td>General description.</td>
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<td>2a. Experimental plan/Method: Procedure in a paragraph in reports. One paragraph each with headings for each of the methods (sequentially) in the manuscript (copy from reports)</td>
<td>Well organized and detailed</td>
<td>Good, but incomplete</td>
<td>Deficient</td>
<td>Missing or poor.</td>
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<td>2b. Results (Data collection, representation, technical accuracy) One sentence, table, graph in reports. One paragraph each for each of the results (sequentially) with headings in the manuscript (copy from reports)</td>
<td>Data collected and represented perfectly. Technically accurate</td>
<td>Data collected and represented with some errors. Technically accurate</td>
<td>Data collected and represented incorrectly. Technically careless</td>
<td>No data or poor representation. Technically careless</td>
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<td>3a. Discussion: Conclusion, Interpretation/Application, Significance (One sentence each in reports; comprehensive in manuscript – one paragraph each in total for the conclusion, application, significance; and add one paragraph on the next step)</td>
<td>Sound conclusions from the data and communicates a logical path. Defines significance, application, and further advancement correctly</td>
<td>Logical path from the data to the conclusion. Mentions significance, application, and further steps that are not connected</td>
<td>Unclear path from the data to the conclusion. Poor connection of results with significance or application</td>
<td>Unjustified conclusions. Does not demonstrate understanding of results Does not demonstrate understanding scientific relevance</td>
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