

Integrated Science Laboratory I

COS 2984, CRN 98015, Integrated Science Curriculum I

ISL Fall 2011

When: Tuesdays 3:30 pm-6:30 pm and Thursdays 2:00 pm-5:00 pm

Where: Fralin Life Science Institute Laboratory 005

Instructors:

Prof. Timothy E. Long
Department of Chemistry
2108 Hahn Hall
telong@vt.edu

Dr. Adam E. Smith
Department of Chemistry
242 ICTAS II
aesmith1@vt.edu

Dr. Harumi Shimada-Beltran
College of Science
242 ICTAS II
harumish@vt.edu

Help Sessions: Tuesdays 2:30 pm-3:30 pm and Thursdays 5 pm-6 pm at the Fralin Life Science Institute Laboratory 005. If you would like to schedule a personal appointment, please contact your instructors via email.

Course Description

The Integrated Science laboratory (ISL) will offer a unique opportunity to experience an interdisciplinary laboratory in a team-oriented, project-based setting. This experience will prepare the student for research positions in academic, industrial, and government laboratories. We will conduct multiple-week research projects using state-of-the-art instrumentation with the integration of complementary lecture concepts. Each module will integrate fundamental concepts from physics, chemistry, biology, statistics, and mathematics to solve complex scientific questions. The course is divided into 4 Modules:

1. Tools of Scientific Research
2. Gene Delivery
3. Solar Energy
4. Kinetics

The ISL is not a typical freshman laboratory experience. As in a “real” research project, correct answers are not always known prior to performing an experiment. For each module, we will propose hypotheses and formulate experiments intended to test these hypotheses. Often, at the conclusion of the experiments, we will find that we need to reevaluate our initial hypotheses and redesign future experiments. In this laboratory experience, your instructors are facilitators. We will not have the answers to every question and will be learning alongside you.

The ISL is a pilot course and is intended to provide you with a unique, research-based laboratory experience while investigating the same concepts examined in introductory chemistry, biology, and physics laboratory course. Your constant feedback and input is vital to help us improve the course and

the future modules. Please let us know of any suggestions you have to help ensure an enjoyable laboratory experience for everyone.

Learning Outcomes

If WE (you and us) are successful, upon completion of this course YOU will:

- Refine your observational skills
- Analyze and interpret experimental data
- Represent data graphically and interpret the results
- Learn to design experiments to test research hypotheses
- Compile a set of basic experimental and laboratory techniques
- Work efficiently in teams
- Improve your communication skills (both written and oral)
- Develop an interdisciplinary way of thinking
- Learn how to access reliable literature resources

Assessment

- Laboratory performance 30%
- Laboratory notebook 10%
- Prelab assignments 10%
- Reports 30%
- Capstone paper/presentation 20%

Grades

A= 90- 100

B= 80-89

C=70-79

D=60-69

F<60

Participation and Performance

Your participation and performance in the lab will be 30% of your grade. This portion of your grade will also encompass your level of engagement during the prelab discussions, your preparedness for lab, and your involvement in the lab experiments. We expect you to come to lab prepared for each day's experiments in order to ensure you gain the appropriate understanding in a safe and timely manner.

Assignments, Prelabs and Reports

All assignments, prelabs, and reports must be submitted at the beginning of lab on the due date. If you think there is an error with grading and would like any of your assignments, prelabs, or reports to be regraded, you must contact the instructors within 1 week of the assignment being returned to you. Extra credit is possible for lab reports which are resubmitted within 1 week of being returned to you and will be regraded for up to 90%.

Capstone Project

At the end of the course each team will participate in a capstone project. Each team must prepare a 15 minute oral presentation of their project and each team member must participate in the oral presentation. A final written report will be prepared by each student. Please check the lab website on Scholar for details on the format of the presentation and final paper.

Bonus Points

Bonus points can be obtained by reading a scientific paper relevant to any of the lab module topics chosen from a peer-reviewed journal and writing a small report. You can find more information on the course Scholar website.

Safety

Safety for all students is extremely important. Some chemicals used during this course are potentially dangerous and can cause injury to yourself and others. Therefore, you must wear proper lab attire. Required attire includes: Safety goggles; lab coat; shoes or sneakers - no open toe or open back shoes or sandals. If you do not have the correct safety attire you will be sent home. This is considered an unexcused absence and no makeup lab will be provided. As soon as anyone starts an experiment in the lab, all safety attire must be worn. You may not take off your goggles during the experimental period.

Attendance

Attendance to the labs is mandatory. Absences for illness, school sponsored events (sporting events, club socials, etc.), family emergencies, and unforeseeable conflicts are generally excused. Illnesses require documentation from Schiffert Health Center or other health care providers. Special circumstances will be addressed on an individual basis.

Honor code

Students are encouraged to discuss issues, troubleshoot, and collaborate with team members and between teams. The Honor Code at Virginia Tech applies to all written assignments (i.e., lab reports, lab notebooks, final paper, etc...). The Virginia Tech Honor Pledge is: **"I have neither given nor received unauthorized assistance on this assignment"** and should appear on ALL written work. Definitions for cheating, plagiarism, falsification, academic sabotage, and misconduct in research and teaching may be found by selecting the corresponding title found at the University website. Remember sometimes you might not be aware of conducting plagiarism!! Paraphrasing is also plagiarism. Be sure to read about this topic!

Special Needs

If you have any special needs including learning disabilities or athletic obligations please set up an appointment within the first two weeks of classes. Any learning disabilities or athletic obligations will require the appropriate university documentation.

Class Website

Consult the Scholar website to routinely obtain announcements, handouts, and a detailed syllabus with learning outcomes for the individual modules.

Tentative Course Schedule

Date	Module
8/23	Tools of Scientific Research Welcoming, Safety, Literature Searching, Technical Writing
8/25	Tools of Scientific Research Statistical Design of Experiments
8/30	Tools of Scientific Research Matlab
9/1	Tools of Scientific Research Matlab
9/6	Tools of Scientific Research Common Laboratory Instruments
9/8	Gene Delivery Vector Synthesis
9/13	Gene Delivery Vector Purification
9/15	Gene Delivery Binding, Gel Electrophoresis, and Dynamic Light Scattering
9/20	Gene Delivery Group A - pKa Determination Group B - Transfection of COS7 Cells
9/22	Gene Delivery Group A - Competitive Heparin Binding Assay Group B - Protein and Luciferase assays
9/27	Gene Delivery Group A - Transfection of COS7 cells Group B - pKa Determination
9/29	Gene Delivery Group A - Protein and Luciferase assays Group B - Competitive Heparin Binding Assay
10/4	Gene Delivery Summary and Data Review
10/6	Kinetics Wiimote Physics - Changing Motion; Force, Mass, and Acceleration
10/11	Kinetics Wiimote Physics - Newton's Second Law; Conservation of Momentum
10/13	Kinetics Wiimote Physics - Simple Harmonic Motion; Rotational Motion; Conservation of Energy
10/18	Kinetics 2-D Projectile Motion
10/20	Kinetics Iodine Clock Reaction
10/25	Kinetics Michael Reaction with <i>in situ</i> FTIR Spectroscopy
10/27	Kinetics Michael Reaction with <i>in situ</i> FTIR Spectroscopy
11/1	Kinetics Summary and Data Review
11/3	Solar Energy Isolation of Chloroplasts
	Solar Energy Quantitative determination of chlorophyll using spectroscopy
	Solar Energy Rate of Photosynthesis in chloroplasts
11/8	Solar Energy Rate of Photosynthesis in leaf disks
	Solar Energy Starch as product of Photosynthesis. Design of experiments
11/10	Solar Energy Photosynthesis experiments
11/15	Solar Energy Photosynthesis experiments and computer modeling
11/17	Solar Energy Photovoltaic cells
11/22	NO LAB
11/24	NO LAB
11/29	Solar Energy Photovoltaic cells
12/1	Solar Energy Summary and Data Review
12/6	Capstone Event

The calendar is tentative and modifications will be made depending on the lab modules.