

## **Chem 29101 Section 02**

### **Introduction to Laboratory Research**

**Instructor:**

Email:

Office Hours: By email appointment only

**Co-Instructor:**

**Goal of the course:** Chemistry 29101 section 02 is a 1 credit course designed to expose you, as an undergraduate student, to the multiple facets of laboratory research available at Hunter College. This is NOT an actual laboratory research course. The semester will consist of a combination of research seminars presented by the research-active faculty at Hunter College and a discussion of a variety of research based topics including ethics, safety and record keeping. Students will also work on a team project to develop a scientific problem that can be addressed using cutting edge technology such as 3D printing and scanning.

**Learning Outcomes:** At the end of this course students should be able to:

- 1) Identify a specific research question
- 2) Choose appropriate methods for testing/analyzing a research question
- 3) Present on a research plan
- 4) Describe how 3d printing allows for research not possible with traditional methods

**Text:** All required reading materials will be made available to students via blackboard. This is no text for this course.

**Blackboard:** All materials will be disseminated using Blackboard. For those of you who are new to this system: Instructions on how to access the course website on Blackboard can be found at: <http://bb.hunter.cuny.edu>. The Blackboard website is an excellent tool and will contain all course announcements, materials and assignments. Students should check the Blackboard website regularly to check for announcements, course assignments and to communicate with your classmates using the course discussion board.

**Grade in the course:** Your course grade will be based on your attendance and active participation in the class as well as the completion of both a midterm presentation and a final written report of a 3D team project.

**3D Team Project:** The transition from experiencing and studying the world in 3 dimensions of space to describing and analyzing data in a traditional 2 dimensional research platform (articles, books, flat projections) limits both the reach and the relevance of many analytical projects. As 21<sup>st</sup> century technology advances, 3-D printing is fast becoming “mainstream machinery” and has already been used to produce objects that range from basic industrial building blocks to the most intricate of artworks. In fact, 3D printing technology has been hailed as having the potential to revolutionize the way we produce materials from textiles to molecules. Despite this promise, incorporating 3-D printing into scientific research projects remains somewhat of a mystery in academia. Working in teams of 4-5 students, each group will work on a research project that ties together the opportunities for novel and integrative research approaches represented by 3-D analysis of the world through 3-D production of replicate and novel objects.

**3-D printing programs you will need to learn to complete team project:**

Blender:

Open source 3D modeling software. There are tons of tutorials on YouTube that can get you started.

<http://www.blender.org/download/>

Hunter College, CUNY

Makerware:

Prepares models for printing (slicing, scaffolding/rafts, placement, etc.)

<http://www.makerbot.com/makerware/>

ReplicatorG:

Community-developed open source software to prepare models and control the printer. Gives you more control and flexibility than makerware (at the code level).

<http://replicat.org/>

123D Design:

<http://www.123dapp.com/design>

This is the software used for doing the actual printing (the stuff that turns the 3D files into code for the printer):

<https://code.google.com/p/replicatorg/downloads/list?can=2&q=0040>

The homepage (which gives some insight into the actual printing process) is here:

<http://replicat.org>

And here is the link for Autodesk's education portal:

<http://www.autodesk.com/education/free-software/all>

With a \*.edu address, students and faculty can use \*almost\* any piece of software that Autodesk makes. While not all of it is available for the Mac (and none of it for Linux, as far as I know), there is a selection of software for the Mac that allows for the create of 3D structures. Two popular items are: Autodesk Inventor (Windows only), and Fusion 360 (maybe easier to learn).

One caveat is that Fusion 360 requires a (broadband) internet connection.

Autodesk also offers a series of 3D-printing-specific apps, which can be found here:

<http://www.123dapp.com/apps-for-3d-printing>

*Download these programs and start learning to use them.*

**Midterm presentation:** The midterm presentation will be in the form of a group PowerPoint presentation to be delivered in the classroom. Your group should consist of 4 to 5 students and the presentation may be no more than 10 minutes in length. The time limit on each presentation will be strictly enforced so it is important that you plan what you are going to say carefully. Every member in the group must be part of the presentation. Each group will present on the 3D research topic they are investigating. Why they chose the topic and highlight why 3D printing will provide an aspect to the research question not possible to examine using traditional research methods. More information about this assignment will be made available over the course of the semester. In addition to an in-class presentation your PowerPoint file must also be uploaded electronically into the Blackboard system to share with your classmates.

**Final Written report:** At the end of the semester you will be required to write a 3 page written report describing in more detail the 3D project your team worked on during the semester. This report must identify a specific research question being pursued, methods for testing/analyzing the question, and materials that

could be made with the 3D printer and scanner to investigate the questions. It must have an abstract, introduction, research and discussion sections as well as primary references cited and a reference list. We will discuss this assignment in more detail as the semester progresses. This report must be submitted electronically via email and by posting on Blackboard by midnight May 12, 2015.

The final activity of this class will be to develop a display of your 3D research for the Hunter Main Campus Library showcase. Details will be provided in class.

### Tentative Class Schedule

	<b>Topic to be covered in class</b>
	Welcome and Introduction, What is scientific research?
	Research Norms & What is 3D printing?
	Team Discussion of 3D seminar/projects
	<a href="#">Research Resource Guides</a> - Library visit with Mason Brown (HE114)
	<b>3D printing presentation- Hunter</b>
	<b>On-line Lab safety training</b>
	Faculty Seminar – Hunter College
	<b>3D printing presentation – Chemistry - Hunter/Belfer</b>
	<b>On-line Responsible Conduct of research training</b>
	<b>Practice MIDTERM PRESENTATIONS of 3D project (peer review)</b>
	<b>MIDTERM PRESENTATIONS of 3D project</b> <b>4:30-7:10pm &amp; 7:10-9:40pm</b>
	Team Discussion of 3D seminar/projects/research opportunities
	<b>No Class</b>
	<b>Final written report due –No Class</b>