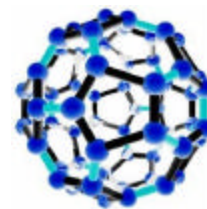




# Chemical Nanotechnology

| <i>Date</i>                | <i>Topic</i>  | <i>Assigned Readings</i>  |
|----------------------------|---|---|
| Th 1/15                    | Introduction to the Course and Readings; Pretest;<br>Brief History of <i>Nanoscience</i> and <i>Nanotechnology</i>        | Syllabus & Course Information   |
| Tu 1/20                    | Nanostructures by Inference: Tools of the Trade<br>&<br>Discussion Topic: Drexler and Feynman Readings                    | Feynman Lectures (Handout)<br>Drexler, Chapter 1- 3<br>Wilson, 1.1- 2.7, 2.9, 2.10      |
| Th 1/22<br><b>PS#1 Due</b> | Self-Assembly: Order from Chaos<br>&<br>Discussion Topic: National Nanotechnology Initiative (NNI)                        | Pre- NNI (Andrews Handout)<br>NNI (NSET Handout)<br>Wilson, 2.11, 6.3, 2.12             |
| Tu 1/27                    | Nanobiometrics: Nature Shows the Way<br>&<br>Discussion Topic: Building Small   | Drexler, Chapter 4- 5<br>Wilson, 6.1- 6.8   |
| Th 1/29<br><b>PS#2 Due</b> | Molecular Machines: Synthetic Mimics<br>&<br>Discussion Topic: Michael Crichton's <i>Prey</i> , Intro- 139                | <b>Crichton, Intro- 139</b><br>Wilson, 5.1- 5.15  |
| Tu 2/3                     | Nanoparticle Materials: Colloids Reborn<br>&<br>Discussion Topic: Smalley vs. Drexler Debate                              | Drexler, Chapter 6,10<br>Wilson, 3.1- 3.11  |
| Th 2/5<br><b>PS#3 Due</b>  | Laboratory Exercise #1 (Due 2/24):<br>Preparation of Magnetic Nanoparticles   | Lab #1 (Handout)  |
| Tu 2/10                    | Review and Begin Exam #1 (Due 2/12)   |   |
| Th 2/12                    | Nanoelectronics: Pushing Moore's Law<br>&<br>Discussion Topic: Chips of the Future  | Reed/Tour & Lieber Handouts<br>Wilson, 8.1- 8.10  |
| Tu 2/17                    | Group IV: Buckyballs , Nanotubes , and Nanowires<br>&<br>Discussion Topic: Nanomedicine                                   | Alivisatos Handout<br>Drexler, Chapter 7- 9<br>Wilson, 4.1- 4.9                         |
| Th 2/19<br><b>PS#4 Due</b> | Future Directions: What's Next?<br>&<br>Discussion Topic: Michael Crichton's <i>Prey</i> , 139- 335                       | <b>Crichton, 139- 335</b><br>Wilson, 9.1- 9.11  |
| Tu 2/24                    | Nanodreams and Nightmares<br>&<br>Discussion Topic: Hopes and Consequences of Nanotech                                    | <i>Blood Music</i> and <i>Dogged Persistence</i><br>Drexler 11-12<br>Wilson, 10.1- 10.9 |
| Th 2/26                    | Review and Begin Exam#2 (Due 3/2)   |   |
| Tu 3/2<br><b>PDft Due</b>  | Laboratory Exercise #2 (Due 3/19):<br>Preparation of Metallic and Semiconductor Nanoparticles                             | Lab #2 (Handout)  |
| Th 3/4                     | Course Evaluation; Nanotech on TV Day; Pizza and Soda<br>&<br>Discussion Topic: Michael Crichton's <i>Prey</i> , 335- 502 | <b>Crichton, 335- 502</b><br>Drexler, 13- 15  |

## COURSE INFORMATION

**INSTRUCTOR:**

Lon Porter  
313 New Science Building  
☎ 361-6284, ✉ PORTERL@WABASH.EDU  
Office Hours, 11-12 TTh or anytime my door is open

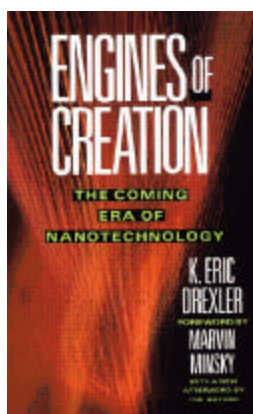
**MEETINGS:** Lectures/Discussions – 9:45-11:00 am TTh in NSB 319  
Laboratory – As noted above, 9:45-11:00 am in NSB 315

**OVERVIEW:** Nanotechnology seems to be everywhere these days! Check the newspaper, surf the web, or look to recent sci-fi books and movies. The manipulation of matter on the nanometer scale has become a central focus from both fundamental and technological perspectives. Unique, unpredictable and highly intriguing physical, optical, and electrical phenomena can result from the confinement of matter into nanoscale features. As a result, the study and preparation of structures exhibiting such interesting and unusual phenomena has been termed nanotechnology or nanoscience, an exploding field still in its infancy. Much of the driving force for building tiny devices and features on the nanoscale is their importance for existing and emerging technologies such as nanoelectronics, nano/micro-electromechanical systems (N/MEMS), sensors, molecular computing, and diagnostics which communicate directly with cells, viruses and bacteria, quantum confinement effects, and a myriad of other applications. This half-semester course focuses on the science behind the “hype.” The course will revisit the origins of the field and spotlight the myriad of current advances. Additionally, we will consider the social, political, economical, and ethical ramifications of a “nanotech revolution.” In addition to lecture and discussion, students will participate in two laboratory exercises and perhaps a field trip to engage in nanotechnology first hand.

**READINGS:** In addition to the three required texts below, handouts will be provided throughout the course. You will be held responsible for all assigned readings.



Wilson et al.



Drexler



Crichton

**LECTURE NOTES:** There will be a handout for most lectures in Chem 171. I suggest that you acquire a three-ring binder and some paper (legal pad or spiral notebook) to be organized.

**PROBLEM SETS:** In Chemistry 171 you will be assigned four problem sets that are meant to test your knowledge and help you think more critically about the various lecture topics and materials from the readings. These problem sets are due at the beginning of class on the dates indicated above unless otherwise announced by Dr. Porter.

**LABORATORY EXERCISES:** In order supplement your lectures and readings, you will participate in two brief laboratory exercises. A formal report for each laboratory exercise is required. The format is very simple and rather painless. You are required to prepare a ~2 page, two-column report (similar in format to a JACS communication). The proper format will be posted on the course website, along with a MS Word Template. **Safety is no joking matter!** Reckless behavior in the laboratory will not be tolerated and points may be deducted for such. There is absolutely no drinking, eating, or smoking allowed in the lab. Each student is required to obtain approved safety goggles. Students lacking proper eye protection will be expelled from lab with no credit for the day's activity. Additionally, students under the influence of alcohol will not be allowed to enter the lab and will receive a "zero" for the day's activities.

**EXAMS:** Two exams will be given in this course on the dates noted above. Each exam will be handed out in class and a portion of the exam must be completed in class as indicated. The remainder is to be completed outside of class and submitted at the beginning of the next class meeting. This portion of the exam may be completed using your lecture notes, readings, the internet, and other references. You may **NOT** seek help from your fellow students!

**FINAL PAPER/SHORT STORY:** You will be responsible for the completion of an independent paper/short story topic. You will have some flexibility in the choice of the topic, but it and a preliminary outline must be approved (~ **beginning of Feb.**) by Dr. Porter before you begin writing. A preliminary draft or work in progress must be submitted in class on **Tuesday, March 2, 2004**. The final draft of your work must be completed and submitted no later than **Friday, March 26, 2004**. This due date is sufficient that you may elect to submit a rough draft for comments or consult Dr. Porter directly with any technical details or feedback.

**EXPECTATIONS:** This course will be taught at an *intermediate* level, somewhere between Chem 111 and the advanced subdisciplinary courses. You will be expected to read the appropriate assignments, and you will be expected to supplement this reading with material presented in lecture and discussion. There will be reading quizzes and problem sets to help you see if you really understand and can apply concepts from the text and lectures. If you are having difficulty, please come and talk to me. This half-semester course will go **very rapidly**, and you **MUST NOT** allow yourself to fall behind. I reserve the right to adjust the difficulty level of exams and problems sets to reflect your specific chemistry background.

#### COURSE POLICIES:

1. Make-up exams will be given only with a valid excuse.
2. Late problem sets will not be accepted without a valid excuse.
3. Reading quizzes cannot be retaken, thus your best **five** will count toward your grade.
4. Answer keys will be provided in class once assignments have been returned.

#### GRADING:

|   |              |
|---|--------------|
| Exams (2) .....                           | 30 %         |
| Problem Sets (4).....                     | 15 %         |
| Reading Quizzes (Best 5 of 7) .....       | 10 %         |
| Discussion .....                          | 15 %         |
| Laboratory Exercises and Reports (2)..... | 10 %         |
| Paper.....                                | 20 %         |
| <b>Total.....</b>                         | <b>100 %</b> |

