MOPH 738 – Nanomedicine
Fall 2010
Revised 8-11-2010

Course Title: Nanomedicine
Course Number: MOPH 738, PHCO 738, Chem 921.101
Credit Hours: 3 credit hours
Course Number: 11049

Course Director: Rudy Juliano(Pharmacy)
Co-Director: Russ Mumper (Pharmacy)
Co-Director: Joe DeSimone (Chemistry)

Schedule: Tuesdays and Thursdays; 4:00 - 5:15 pm (75 minutes for each class)
Location: School of Pharmacy, Beard Hall 102

Number of Students: Due to the course requirement of the Research Proposal and Oral Presentation, the course will be limited to 25 students.

Prerequisites: Completion of undergraduate major in physical, chemical, or biological sciences or permission of course director. Advanced undergraduate students with appropriate background will be considered with permission of course director.

Course Offered: Fall, every other year

Course Description: This course offers an introduction to the interdisciplinary field of nanomedicine for students with physical, chemical or biological sciences background. This course will emphasize emerging nanotechnologies and biomedical applications including nanomaterials, nanoengineering, nanotechnology-based drug delivery systems, nano-based imaging and diagnostic systems, nanotoxicology, and translating nanomedicines into clinical investigation.

Faculty:
Nancy Allbritton (Chemistry) nlallbri@unc.edu
Hongyu An (Radiology) HongyuAn@med.unc.edu
Moo Cho (Pharmacy) mjcho@email.unc.edu
Paul Dayton (Biomedical Engineering) padayton@bme.unc.edu
Joe DeSimone (Chemistry) desimone@unc.edu
Leaf Huang (Pharmacy) leafh@email.unc.edu
Mike Jay (Pharmacy) mjay@email.unc.edu
Rudy Juliano (Pharmacy) arjay@med.unc.edu
Wenbin Lin (Chemistry) wlin@email.unc.edu
Rihe Liu (Pharmacy) rliu@email.unc.edu
Russell Mumper (Pharmacy) mumper@email.unc.edu
Michael Ramsey (Chemistry) jmramsey@unc.edu
Susan Wohler Sunnarborg (Biochemistry) susan_sunnarborg@med.unc.edu
Richard Superfine (Physics) rsuper@physics.unc.edu
Andrew Wang (Medicine) andrew_wang@med.unc.edu
Xiao Xiao (Pharmacy) xxiao@email.unc.edu
Hong Yuan (BRIC) yuanh@med.unc.edu
Bill Zamboni (Pharmacy) zamboni@email.unc.edu

Otto Zhou (Physics) zhou@physics.unc.edu

Course Topics (Class No. – Date) Instructor

Part I: Introduction to the Course and Introduction to Nanomedicine **(Class 1 – Tues, Aug 24) Mumper or Juliano**

Part II: Nanomaterials, Nanofabrication, and Nanoengineering

Part II will serve as an introduction to nanomaterials and nanotechnology and will cover materials used to make nanoparticles, different methods to engineer nanoparticles, properties, applications, cost, advantages and limitations, and other issues.

Lipid-based (liposomes, micelles, solid lipid nanoparticles) **(Class 2 – Thur, Aug 26) Mumper**
Magnetic-based particles and their delivery for biomedical applications **(Class 3 – Tues, Aug 31) Wenbin Lin**
Inorganic nanoparticles including quantum dots **(Class 4 – Thur, Sept 2) Superfine**
Carbon-based (fullerenes, buckyballs and carbon nanotubes) **(Class 5 – Tues, Sept 7) Zhou**
Self-assembled polycoacervates **(Class 6 – Thur, Sept 9) Huang**
Pharmacokinetics and biodistribution and fate **(Class 7 – Tues, Sept 14) Zamboni**

Part III: Nanotechnology in Drug Delivery

Part III will cover nanotechnology-based drug delivery systems and various issues involved.

Chemistries and approaches used to make functionalized nanoparticles **(Class 8 – Thur, Sept 16) Cho**
Biological Hurdles for Drug Delivery: Anatomy, physiology, and cell biology **(Class 9-10 – Tues, Sept 21 and Thurs, Sept 23) Juliano**
Existing cell-targeting ligands and ligand discovery **(Class 11 – Tues, Sept 28) Rihe Liu**
Viral-based gene and drug delivery systems **(Class 12 – Thur, Sept 30) Xiao Xiao**
Colloidal and dispersed systems; surface chemistry; characterization **(Class 13 – Tues, Oct 5) Mumper**
Top-down fabrication techniques for carriers in nanomedicine **(Class 14 – Thur, Oct 7) DeSimone**

Invited Guest Lecture **(Class 15 – Tues, Oct 12)**

Class discussion, review, and/or make-up lecture (Class 16 – Thurs, Oct 14) Juliano

Mid-term Exam covering 1st half of course (Class 17 – Tues, Oct 19) Juliano
Innovations in Nanomedicine proposal title and draft abstract due

Fall Break – October 20-24, 2010

Part IV: Nanotechnology in Imaging, Diagnostic, and Detection

Part IV will cover nanotechnology-based imaging, diagnostic, and detection systems

Nuclear Imaging systems: Planar, SPECT and PET **(Class 18 and 19 – Tues, Oct 26 and Thurs, Oct 28) Mike Jay**

Advanced MR imaging, optical imaging, and CT **(Class 20 – Tues, Nov 2) Hongyu An and Hong Yuan**

Ultrasound for Imaging & Therapy **(Class 21 – Thurs, Nov 4) Paul Dayton**

Nanoimaging systems **(Class 22 – Tues, Nov 9)** **Wenbin Lin**
Micro/nano fluidics, Diagnostics, and Biosensors I **(Class 23 – Thurs, Nov 11)** **Michael Ramsey**
Micro/nano fluidics, Diagnostics, and Biosensors II **(Class 24 – Tues, Nov 16)** **Nancy Allbritton**

Part V: Nanomedicine

Part IV will cover contemporary aspects of Nanomedicine including nanotoxicology and translating nanotechnology-systems into the clinic.

Nanotoxicology: systemic, cellular, and & genomic considerations **(Class 25 – Thurs, Nov 18)** **Mumper**
Transitioning nanomedicine into the clinic; FDA issues **(Class 26 – Tues, Nov 23)** **Wang**

Innovations in Nanomedicine proposals are due (Tues, Nov 23) **Juliano**
Thanksgiving Break – November 24-28

Final Powerpoint Presentations are due (Mon, Nov 29) **Juliano**

Part VI: Student's Oral Presentations of Research Proposals: "Innovations in Nanomedicine"
(Class 27-28 – Tues, Nov 30 and Thurs, Dec 2)

Final Exam covering 2nd half of course (Class 29 – Tues, Dec 7) **Juliano**

Note: in some cases there may be changes to the lecture schedule- these will be posted on Blackboard or disseminated by email.

Course Grading

Participation (attendance, Q&A, etc.)	100 points (20%)
Mid-Term Exam covering Class 1-16	90 points (18%)
Final Exam covering Class 18-26	60 points (12%)
Written Proposal	150 points (30%)
Oral Presentation of Proposal	100 points (20%)
Total	500 points

89.5 – 100%	H = High Pass
79.5 – 89.4%	P = Pass
69.5 – 79.4%	L = Low Pass
≤ 69.4%	F = Fail

Innovations in Nanomedicine: Research Proposal

Students will be required to apply knowledge learned in the course and in the literature to develop an innovative and scientifically significant research proposal that will be presented in class to fellow students and course instructors. The research topic may be of the student's choice and interest; however, it should not pertain to the student's current research or that of their major advisor.

The Research Proposal should be no more than **8 pages** and follow proposal guidelines. The proposal will have the following sections.

Page 1	Title Page with Author, Date, and Full Contact Information
Page 2	Author Biographical Sketch with previous degrees, training, and current program (<250 words)
Page 3	Research Proposal Abstract Page (<250 words)
Pages 4-11	Research Proposal (Sections A-D should not to exceed 8 pages)
	A. Background, Statement of the Problem, and Hypotheses
	B. Goals and Specific Aims
	C. Preliminary Data (from literature) *to Support Proposal*
	D. Research Methods and Approach *with Anticipated Results, Likely Problems, and Alternatives*
Page 12-	E. References Cited (no page limit)

Each proposal will be evaluated by at least three course faculty; the average of all scores will be the overall grade for the proposal

Innovations in Nanomedicine: Oral Presentation

15 minute Powerpoint presentations with 5 minutes for Questions and Answers

Each presentation will be evaluated by at least three course faculty; the average of all scores will be the overall grade for the presentation