

Syllabus

BE 4333/4334/5333-006 Nanobiomaterials

Spring 2016: Tue/Thu 12:30-1:50pm, ERB131

Instructor

Yi Hong, PhD

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Office hours: by appointment. The students can use email contact any time.

Course Description

The objective of this course is to provide engineering students with an in-depth description of the synthesis, fabrication, properties, and biomedical applications of nanobiomaterials. Topics include: introduction of biomaterials, introduction of nanobiomaterials, synthetic nanobiomaterials, biological nanobiomaterials (DNA nanomaterials, protein and peptide nanomaterials, etc), biofunctionalization of nanobiomaterials, use of nanobiomaterials in tissue engineering, drug delivery, gene delivery, cancer therapy, and bioimaging. Key advances from the recent literature will be reviewed to supplement specific lecture topics. Lab projects may be offered to students to obtain hands-on experience on nanobiomaterials processing and characterization.

Course Outcomes:

- 1) Students should be able to understand the basic principles and features of nanobiomaterials, identify and understand key structure-property-processing relationship of those materials;
- 2) Students should understand the roles of the nanobiomaterials play in the biomedical applications;
- 3) Students should be able to master the trend of nanobiomaterials and communicate with the people in the field;
- 4) Students will gain proficiency in scientific presentation and writing skills in the forms of a written project as well as oral presentations to the entire class.

Teaching Assistant

Jinglei Wu (jinglei.wu@mavs.uta.edu)

Textbooks

The materials adopted in the lectures were collected from a large volume of books, current literatures and presentations. Some books are recommended as following. Exams will be based on lecture notes. It is not necessary to buy the books.

- Introduction to Nanoscience and Nanotechnology. Chris Binns, Wiley, 2010
- Introduction to Nanoscience. S.M. Lindsay. Oxford, 2010
- Nanomaterials handbook. Edited by Yury Gogotsi. CRC press, Taylor & Francis Group, 2006

- Nanobiotechnology. Concept, Application and Perspectives. Edited by C.M. Niemeyer, C.A. Mirkin. WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim. 2004
- Nanoscale technology in biological systems. Edited by Ralph S. Greco, Fritz B. Prinz, R. Lane Smith. CRC press, 2005
- Biomaterials Science: An introduction to materials in medicine. Second edition, Edited by Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons. Elsevier Academic Press, 2004
- Nanotechnologies for the life sciences. Edited by Challa Kumar. Volume 2: Biological and Pharmaceutical and pharmaceutical nanomaterials. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006
- Nanotechnologies for the life sciences. Edited by Challa Kumar. Volume 1: Biofunctionalization of nanomaterials. Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim, 2006

Safety training required to work on the lab projects:

Hazardous communication training

www.uta.edu/training

Lecture notes

They will be uploaded to “**Blackboard**”. The class will be recorded by **Echo 360**, and I will send you the link later.

Homework, Exams and Grading

Grading policy:

Homework (reading report, 4 in total for graduate, and 4 in total for undergraduate)

30%

Quiz 1 and 2 (TBD)

30%

Presentation (Apr 28, May 3 and May 5)

15%

Final exam (research proposal for each group)

25%

The grading is set as “A” when the final score is above average; “B” when the score is average-1 to average-10; “C” from average-11 to average – 20. For example, if the average final score in the class is 85, the students whose score is $>$ or $=$ 85 will get A. **The graduate student and undergraduate student will be graded separately.**

Homework will be to write reading reports. The reading materials should cover the applications of nanobiomaterials in the following field: tissue engineering, drug delivery, gene therapy, bioimaging, and one report for each field. **Only research article is acceptable. No review article is involved.** You can also choose the reading materials from the other fields of applications relevant to nanobiomaterials. There are **4 reading reports** required (reports due is listed below) for 4 different biomedical application fields. Page limits are **2 pages for graduate student and 1 page for undergraduate student** for each report. The half should cover the background, method, results and discussion. Don’t just copy the sentences from the articles. You need to at least rephrase the sentence if you need to cite the sentences from the articles. The other half should cover your

review comments and any other thoughts. No tables or figures are included. Remember, a good reading report should let a reader, who is not in the field but has the least knowledge and background, understand what the article is talking about, what the significance of the research is, and what the overall development for the specific topic. I expect smart thoughts from your reports. The review comments and thoughts can be anything that you think during your reading, like if you were the researchers, how you will conduct the research; any defects or errors that you find from the articles, how you will improve it, what the future work is worth doing, etc. Smart thoughts can help you earn high points. Format: Arial/ Macintosh Helvetica, 11 point type, single space, 1-inch margin. Page limits: 2 pages only for graduate student and 1 page only for undergraduate students. Please date, name and number your report at each report along with your selected article. Submit your 4 homework on 9 Feb, 8 Mar, 5 Apr and 29 Apr, 2015, respectively. Both electric version and hard copy are acceptable, and please send it to Jinglei Wu on time.

There will be two quizzes. The quizzes will be based on lecture notes.

Students (each group) are also required to make a presentation (LCD, powerpoint) on the specified topic to the whole class. The oral presentation should be finished in the allotted time. A well-delivered presentation should be well-organized and understood by the listeners who are not in the field. Other students will question the presenters. Students will be divided into **10 groups (4 or 5 members, graduate and undergraduate students will be grouped separately without mixture)**. Each group will be given a research design topic as early as possible to ensure you have enough time to prepare the presentation and write the proposal. The presentation time will be 12 min plus 5 min Q &A.

The members in each group will be considered to equally contribute to the presentation and the proposal, so each member in the group should achieve the same credit.

The final exam will be to formulate a research proposal for the given topics used for presentation in the nanobiomaterials field (**8 pages** not including references, deadline is by **5 pm May 5th, 2016**). I will list some projects for the research proposals. For examples, a research project can be located on designing nanobiomaterials for cartilage tissue engineering or using nanobiomaterials to treat Parkinson disease, diabetes, brain cancer etc. Each group will be request to schedule at least one meeting with me to discuss the proposal.

Format of the research proposal: (Instruction of AHA predoctoral and postdoctoral fellowship application, www.americanheart.org)

For your research plan (and resubmission modifications and animal subjects sections if applicable) the following are AHA **requirements**:

no more than 15 characters per inch (cpi) or an average of no more than 15 cpi (cpi)

includes symbols, punctuation and spaces). Type the proposed research plan single-spaced.

3/4" margins should be used

60 lines per page are the maximum allowed (The average number of lines per page using the font and point size below will be approximately 50-55 lines.)

Windows Arial font style 12 point*

Macintosh Helvetica 12 point *

*Figures, charts, tables, graphics and legends may be smaller in size but must be clear and legible.

It is essential that the text of your research plan complies exactly with the Association's type specifications and page limits. Failure to comply may result in the administrative withdrawal of the application.

Users of other word processing programs must adjust settings appropriately and should measure text **after saving and printing as a PDF**. Type requirements should be checked using a standard measuring device (such as a ruler), rather than relying on the font selected for a particular word processing/printer combination. Type size specifications must be observed in the text of your research plan (and resubmission modifications, if applicable) or the application may be returned without review.

Before creating your Proposed Research Plan, and if incorporating any graphics into your plan, be sure to review the "Tips for Using Adobe Forms" <http://www.americanheart.org/presenter.jhtml?identifier=3002961>

After creating this word-processed document, number these pages consecutively; the applicant's name should appear in the lower right corner of each page. Convert it to a Portable Document Format (PDF) file and insert this PDF after the fellow's Sponsor packet pages or Resubmission Modifications, as appropriate.

No more than 8 consecutively numbered pages (including any diagrams, tables, graphics/images, etc.) will be accepted. (Appendices or enlarged sets of images should not be sent; if sent with paper sets, these pages will be counted toward the 10-page limit, usually resulting in administrative withdrawal.) **Applications with greater than 8 consecutive pages in the Proposed Research Plan (items 1-4 below) and/or not adhering to format requirements (characters per inch, etc.) may be administratively withdrawn.**

Suggested lengths are guidelines.

1. Specific Aims (1/2 page)

Provide a clear, concise summary of the aims of the work proposed and its relationship to your long-term goals. State the hypothesis to be tested.

2. Background and Significance (1 page)

Sketch the background leading to this application. Summarize important results outlined by others in the same field, critically evaluating existing knowledge. Identify gaps that this project is intended to fill.

State concisely the importance and relevance of the research to cardiovascular function or disease, stroke, or to related fundamental problems. Also, it is incumbent upon the applicant to make a clear link between the project and the mission of the AHA. The significance section will be assessed in terms of potential impact on the AHA mission; this will be factored into the overall priority score as noted in the peer review criteria.

3. Research Design and Methods (approx. 6-7 pages)

Description of proposed tests, methods or procedures should be explicit, sufficiently detailed, and well defined to allow adequate evaluation of the approach to the problem. Describe any new methodology and its advantage over existing methodologies.

Clearly describe overall design of the study, with careful consideration to statistical aspects of the approach, the adequacy of controls, and number of observations, as well as how results will be analyzed. Include details of any collaborative arrangements that have been made.

Discuss the potential difficulties and limitations of the proposed procedures and alternative approaches to achieve the aims.

Note: If a proposed research project involves human subjects, the population sampled shall be inclusive of the general population, of relevance to the scientific question posed, without restriction in regard to gender, race, age, and socioeconomic status. Proposals that intentionally restrict the population sampled must include a compelling scientific rationale for such research design. Be sure to address this topic.

4. Ethical aspects of the proposed research (up to 1/2 page)

Describe any special consideration you have given to all ethical issues involved in your proposed investigations (biohazards or human subjects, etc.), identifying risks and management. Be sure to address this topic. If using animals, [go here for instructions](#). Discuss the nature of the informed consent that will be obtained if the research involves human subjects. If the proposed project involves no ethical questions, indicate "NONE".

End of text for the Research Plan (not to exceed 8 pages). It is the best for exact 8 pages.

Drop Policy: Students may drop or swap (adding and dropping a class concurrently) classes through self-service in MyMav from the beginning of the registration period through the late registration period. After the late registration period, students must see their academic advisor to drop a class or withdraw. Undeclared students must see an advisor in the University Advising Center. Drops can continue through a point two-thirds of the way through the term or session. It is the student's responsibility to officially withdraw if they do not plan to attend after registering. **Students will not be automatically dropped for non-attendance.** Repayment of certain types of financial aid

administered through the University may be required as the result of dropping classes or withdrawing. Contact the Financial Aid Office for more information.

Academic Integrity: It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents' Rule 50101, §2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." **Scholastic dishonesty is zero tolerance. If the dishonesty is found, it will be reported to the university.**

Student Support Services Available: The University of Texas at Arlington has established a variety of programs to help students meet the challenges of college life. Support to students includes advising, counseling, mentoring, tutoring, supplemental instruction, and writing assistance. For a complete list of academic support services, visit the Academic Assistance resource page of the Office of Student Success Programs, "<http://www.uta.edu/uac/studentsuccess/academic-assistance>". To help students address personal, academic and career concerns, individual counseling is also available. For more information, students are encouraged to contact Counseling Services "<http://www.counseling.uta.edu/>" at (817) 272-3671 or visit a counselor in 216 Davis Hall.

Electronic Communication Policy: The University of Texas at Arlington has adopted the University "MavMail" address as the sole official means of communication with students. MavMail is used to remind students of important deadlines, advertise events and activities, and permit the University to conduct official transactions exclusively by electronic means. For example, important information concerning registration, financial aid, payment of bills, and graduation are now sent to students through the MavMail system. All students are assigned a MavMail account. ***Students are responsible for checking their MavMail regularly.*** Information about activating and using MavMail is available at "<http://www.uta.edu/oit/email/>". There is no additional charge to students for using this account, and it remains active even after they graduate from UT Arlington. Students can access class information on website: "<ftp://students.uta.edu>".

Americans with Disabilities Act:

The University of Texas at Arlington is on record as being committed to both the spirit and letter of federal equal opportunity legislation; reference Public Law 92-112 - The Rehabilitation Act of 1973 as amended. With the passage of federal legislation entitled *Americans with Disabilities Act (ADA)*, pursuant to section 504 of the Rehabilitation Act, there is renewed focus on providing this population with the same opportunities enjoyed by all citizens. As a faculty member, I am required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty of their need

for accommodation and in providing authorized documentation through designated administrative channels. Information regarding specific diagnostic criteria and policies for obtaining academic accommodations can be found at www.uta.edu/disability. Also, you may visit the Office for Students with Disabilities in room 102 of University Hall or call them at (817) 272-3364.

**STATEMENT ON ETHICS, PROFESSIONALISM, AND CONDUCT
FOR ENGINEERING STUDENTS**

Students need to sign