Graduate Course (56: 115:527) on:

Bionanotechnology: Discovery, Assembly, Function, and Application

Time: 6 pm – 8:50 pm

Location: BSB 107

Instructor: Jinglin Fu, Ph.D.; Assistant Professor in Biochemistry, Center for Computational and Integrative Biology, Department of Chemistry.

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Office Hour: 12:20 – 1:20 pm , Wednesday

**Summary** Bionanotechnology is an emerging field that applies the fundamentals of nanotechnology to solving relevant biological and chemical problems and refining new methods and tools for medicine and energy. Nanotechnology refers to the revolutionary technology that manipulates matter with matter with at least one dimension sized from 1 to 100 nanometers. Molecular structures exhibit unique properties at this scale where the quantum phenomenon starts to play an important role as compared to bulk materials. Bionanotechnology describes the overlapping multidisciplinary activities that evolves photonics, chemistry, biology, biophysics, nano-medicine, and engineering converge.

 The new course will expose students to this emerging field which has broad applications in biomaterials, medicine and energy. Student will learn: (1) the fundamentals of nanotechnology; (2) DNA Nanotechnology and Design; (3) Peptide Nanotechnology; (4) Protein Nanotechnology; (5) Virus Nanotechnology; (6) Bacteria Nanotechnology; (7) Super-resolution imaging of biomolecular nanostructures.

**Learning Goals:** Through literature studies and class discussion, students will learn the essential and emerging topics of “Bionanotechnology”, including (1) the fundamentals of nanotechnology; (2) DNA Nanotechnology and Design; (3) Peptide Nanotechnology; (4) Protein Nanotechnology; (5) Virus Nanotechnology; (6) Bacteria Nanotechnology; (7) Super-resolution imaging of biomolecular nanostructures.

Students will also learn computational design of DNA and protein nanostructures.

Students should also be able to perform a literature search of selected topics.

**Course Materials:** The course will introduce most advanced studies in the fields of bionanotechnology. They are journal articles, designed softwares and lecture notes. Announcement, syllabus, quiz and lecture PPTs will be posted on the sakai:

<https://sakai.rutgers.edu/>

**Assessments and Grading:**

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|  | Undergraduates/Graduates |
| Pre-lecture quiz | 20 % |
| Projects | 30 % |
| Presentation | 30% |
| Term paper | 20% |
| Total | 100% |

**Pre-lecture quizzes** are used to help students to review and prepare the contents that are going to be discussed in the coming week. Quiz question will be posted on the sakai 48 hours prior the lecture. Students are required to complete the quizzes questions and submit the printed copy to the instructor on every **Thursday** lecture. **Fail to submit the quiz on time will result in the loss of points no matter what is the excuse.**

**Projects** are computational design of DNA nanostructures. They can be on class or take home.

**Presentations** are required by every student. Each student will present two or three times during the semester. The instructor will assign the articles to students.

**Term paper** is required for graduate students. Each graduate student needs to schedule an appointment with the instructor to discuss the topic of the term papers. **The term paper is around 6-page, 12-font size, and single space. Minimum 20 references must be cited.**

**Cheating is strictly prohibited from the class:** If a cheating case is confirmed (either in exams or term paper), it will be reported to the Dean and result immediate failure of the class.

**Academic Plagiarism:** You cannot copy verbatim from any source, including other individuals in the term paper. Any infractions to this rule are considered as academic plagiarism. You must cite any references that you have used in preparing your term papers.

**Absences from class:** If student has an emergency that prevent him or her from taking the exam, Dr. Fu must be notified **48-hour in advance**. Valid excuses include medical emergency (physician’s approval of absence), family funeral, and other compelling circumstances. Proofs must be submitted to the instructor for validating the excuse**. Moe than two unexcused absence will result in the fail of the class.**

**Schedule of Topics, Material Covered and Exams:**

 Note: Times are ***just an estimate***. The actual pace of the course may be slightly different. **The exams, however, will occur on the dates shown**. Note that the reading and assigned quizzes are due on every Tuesday before the lecture on the subject.

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| **Date** | **Lecture Topic** |
| 9/7 | Course Intro, Nanotechnology |
| 9/14  | DNA Origami/LEGO: Presentation-1 |
| 9/21 | DNA-based nano-materials: Presenation-1 |
| 9/28 | Biomimetic Nanosystem and Nanorobots: Presentation-1 |
| 10/5 | Project 1: TIAMAT |
| 10/12 | Project 2: Cadnano |
| 10/19 | Project 3: Pymol |
| 10/26 |  Peptide/Protein Nanotechnology: Presentation-2 |
| 11/2 | Virus-like Nanoparticles: Presentation-2 |
| 11/9 |  Bacteria Nanowires: Presentation -2 |
| 11/16 | Peptide microarray/Nanomedicine: Presenation-3 |
| **11/21** | Thursday schedule? Presention-3 |
| 11/30 | Super-resolved imaging for Nanostructure: Presentation-3 |
| 12/7 | Discussion: Future of nanotechnology |
| 12/13 | Last day of class, due of term paper  |
| (Final Discussion on the Bionanotech) | **No Final Exam** |