BME 625/725: Pharmaceutical Assay Development (3-0-3)

Instructor: Moo-Yeal Lee, Ph.D.
Office: SH 439
Office hours: Friday 3:00 – 5:00 pm
Lecture hours: Tuesday & Thursday, 6:00 – 7:15 pm
Prerequisite(s): Graduate standing in chemical and biomedical engineering, chemistry or permission of instructor.

Catalog Description
The need to screen a library of compounds faster and more efficiently becomes increasingly important in the pharmaceutical and biotechnology industries. This practical course will introduce the fundamental concepts of biochemical and cell-based assays commonly used in drug discovery processes. Emphasis for this course will be on conventional high-throughput screening (HTS) assays in an early stage of the drug discovery process. The overall objective of this course is to have students understand complex real-world assay development in drug discovery.

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Students will work on practical assay development projects selected from their own research topics, or from a number of different assays used in the pharmaceutical industries. The students are expected to identify critical needs for new assay development, explore existing assay platforms for problem solving, study the principles of the existing assays and analytical instrument used, propose a new/improved assay, and write standard operating protocols for the new/improved assay. The students are also expected to present their work to the class, and critically evaluate peer's work with regard to its significance, innovation, and approach for problem solving.

Course Materials:
1. Hand book of assay development in drug discovery, Lisa K. Minor, CRC press (2006)
2. Assay guidance manual, edited by G. Sitta Sittampalam, *et. al.*, Eli Lilly & company and the national center for advancing translational sciences (2004)
3. Assay development: fundamentals and practices, Ge Wu, Wiley (2010)
4. A practical guide to assay development and high-throughput screening in drug discovery, Taosheng Chen, CRC press (2010)
5. Literature – review and research articles

These books are only suggestions and there is no need to purchase them. The material covered in the course will be drawn from these books and other sources, and lecture notes will be provided to students.

Grading Policy:
Students are expected to attend lectures, participate in discussion, answer oral quizzes, complete assignments on time, take mid-term and final examinations, present student projects in the class, and submit progress and final reports on student projects. All scores on class attendance/participation, quizzes, exams, assignments, and student projects will be based on 100 points. The final score will be calculated by the percentage given below.

- Class attendance/participation: 10%
- Quiz: 10%
- Mid-term (20%) and final (20%) exam: 40%
- Student project: 30%
- Homework: 10%

Since this is a split level course, Master's and doctoral students will be graded separately. Doctoral students (BME725) are expected to submit more in-depth student project reports than Master's students (BME625). For example, doctoral students will submit standard operational procedures (SOPs) ranging from 10 – 15 pages whereas master's students will submit SOPs ranging from 7 – 10 pages, both SOPs including introduction, materials, analytical instruments, experimental procedures, statistical data analysis, and literature cited. The final grade will be determined by a grading guideline chosen by the instructor. The following grading guideline exemplifies the relationships between the final score calculated from the formula above and the letter grade assigned. Final grades will be balanced between the grading guideline and a student grade distribution.

- A: 90 - 100
- A-: 85 - 89
- B+: 80 - 84
- B: 75 - 79
- B-: 70 - 74
- C: 50 - 69

Topical Outline:

1. Drug discovery process and the role of biochemical and cell-based assays in the process
2. Basics of assay equipment and instrumentation for HTS
3. Biochemical assays
    a. Basics of enzymatic reactions
    b. Mechanism of action assays for enzymes
    c. Protease assays
    d. Assay development for protein kinase enzymes
    e. Inhibition of protein-protein interactions
    f. Receptor binding assays
    g. GTPγS binding assays
    h. Phospho-ERK assays
    i. Impedance-based technologies
    j. IP-3/IP-1 assays
    k. Immunoassay methods
4. Cell-based assays
    a. FLIPR™ assays for GPCR and ion channel targets
    b. Cell-based RNAi assay development for HTS
    c. Assay development guidelines for high content screening
    d. Nuclear factor kappa B (NF-κB) translocation assay for high content screening

    e. Ion channel screening
5. HTS assay validation
6. Data standardization and management
7. **Case study**: student project presentation