**Biotechnology Applications of Cell and Mol Biology**
**BIOL 4541, SPRING Semester 2017**
**TWR 3:00 pm – 5:30 pm; ASCL-126 (aka La Kretz Hall)**

**Instructor**

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website: https://moodle-2016-2017.calstatela.edu/
Moodle course name: SPRING 2017 BIOL 4541-01

**Prerequisites**: BIOL 4170 and one of these (BIOL 3400 or MICR 3300 or CHEM 4310) or instructor consent.

**A Laboratory Manuel** written by Drs. Xu and Ernst will be provided to all students. No other textbooks are required.

**Recommended Textbook:** High Throughput Screening in Drug Discovery, by J. Hüser. Wiley-VCH, Weinheim, Germany. ISBN-13: 978-3-527-31283-2.

**Additional Reference Books:** An Introduction to Molecular Biotechnology, M. Wink (ed), Wiley-VCH, Weinheim, Germany. ISBN-13: 978-3-527-31412-6.

**Student Learning Objectives: After taking this course, the students will be able to:**

- Demonstrate ability to work in a multidisciplinary team environment;
- Demonstrate ability to become familiar with principles and practices of multiple disciplines;
- Apply principles of chemical genomics to the drug discovery;
- Apply laboratory robotics to the drug discovery processes;
- Self-report a gain in confidence in leading a phrase of the drug discovery process (as a taskforce leader);
- Evaluate and critique primary research literature relevant in biotechnology;
- Analyze, synthesize, interpret experimental results and report them to an audience;
- Evaluate a case and design strategies to fill a technical gap as a team in a case study;
- Produce and present a case-study presentation as a team to an audience;

**Attendance**

Attendance is mandatory. Each student has two allowances for excused or emergent (documentable) absences during the entire quarter but is responsible for making up lost lab work or data or assignments.

**Grading: 500 points total**

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|---|---|
| Online quizzes (10 pts per quiz) | 100 |
| Lab notebooks/Exercise planning | 50 |
| Web-based DNA analysis homework | 50 |
| Written report of primary research paper | 50 |
| Attendance/Participation during group lab exercises (including peer evaluation) | 50 |
| Group-based Case study | 100 |
| Team presentation (including peer evaluation) | 100 |

Final grades will be based on % of achievable points obtained:
Total points earned / 500 points x 100 = % achieved

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|---|---|---|---|---|
| | B+: 88-89% | C+: 78-79% | D+: 68-69% | F: ≤ 59% |
| A: ≥92% | B: 82-87% | C: 72-77% | D: 62-67% | |
| A-: 90-91% | B-: 80-81% | C-: 70-71% | D-: 60-61% | |

In borderline cases (passing/ non-passing or grade levels), course attendance and active participation may be considered for the final outcome.

**Web-based DNA analysis homework.**

The students will be assigned a homework involving retrieving, analyzing and comparing a bacterial gene sequence using web-based analysis tools (worth 50 points). Detailed assignment with instructions will be handed out later**.** Homework report handed-in late will result in deduction of report points (10% deduction per day after due date).

**Scientific literature search and written report.**

The writing exercise will be worth 50 points and will consist of a summary report that explains a primary research paper related to HTS/drug discovery. The reference to the paper will be assigned to each student on week 3. It is the responsibility of the student to find the paper via PubMed or library and print it out. The student will study the paper in detail and perform a background literature search to obtain at least two additional references (papers) published before and cited by this paper. The report shall cover the following four sections with clear subtitles: the **Background** of the research (why do it), major **Methods** used (how), **Results** obtained (what happened), **Conclusions** (significance to the field), **Your critique** (of what the authors did well and where they could improve), and **References (naturally including the main reference)**. The report should follow routine rules relative to the format of species names and gene names. The explanation should be clear enough that a fellow classmate could read it and understand it. The report should be no more than 5 typed pages with double spacing between lines. Fonts of Times New Roman or Arial with 12 point size are to be used. The written reports are due after Thursday class on week 7. Reports handed-in late will result in deduction of final report points (10% deduction per day after due date).

**Case Study and Team Presentation**

Case study topics will be assigned to each group. Students of each group will work together to complete its case study and hand in the report. Finally, students of each group will collaboratively prepare and give the team presentation based on research of the assigned case study.

**General Information**

There will be no make-up lab sessions. You must provide your own lab coat, safety glasses, permanent markers. The University Academic Honesty Policy (http://www.calstatela.edu/academic/senate/handbook/ ) and the Drop/Incomplete Policy explained in the University General Catalogue will be strictly followed. Students are responsible for the prerequisites for this course and are encouraged to discuss any questions regarding the policies and prerequisites with the instructor. Students with disabilities: please contact the instructor to arrange appropriate accommodations.

**COURSE SCHEDULE**

| Week | STAGES AND ACTIVITIES | NOTES |
|---|---|---|
| **1** | Laboratory Orientation, Project Overview and Bioinformatics Basics (**Bioinformatics Module**). Students will form teams and learn project/team management skills. They will learn to access GenBank, retrieve sequences, understand ORF definition, and design primers. | |
| **2** | Molecular Cloning (**Molecular Biology Module**). Students will learn to grow bacteria, isolate genomic DNA, perform PCR, and perform agarose gel electrophoresis of PCR products. | |
| **3** | Molecular Cloning (**Molecular Biology Module**). Students will learn to purify PCR products, transform *E. coli* competent cells, streak a colony to assure independent clones, perform plasmid miniprep and perform restriction digest analysis to confirm appropriate size of cloned inserts. | |
| **4** | Protein Over-expression (**Biochemistry Module**). Students will learn to induce target protein over-expression, and perform polyacrylamide gel electrophoresis to verify protein over-expression. | |

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| **5** | Protein Purification (**Biochemistry Module**). Students will learn to purify His (histidine)-tagged proteins using nickel columns and to determine protein concentrations. | |
| **6** | Western blot analysis (**Biochemistry Module**). Students will learn to perform separation of proteins via electrophoresis and identification of specific protein using antibody-antigen interactions | |
| **7** | Cell-based Assays (**Cellular Profiling Module**). Students will learn to perform cellular profiling using BIOLOG's OmniLog system and understand physiological differences in bacterial species/strains. | |
| **8** | High Throughput Screening (**HTS Module**). Students will learn to screen a chemical library for cell growth inhibitors and operate HTS robotics. | |
| **9** | High Throughput Screening (**HTS Module**). Students will learn to screen a chemical library for cell growth inhibitors and operate HTS robotics. | |
| **10** | Screening Results Analyses with hit compounds (**Chemoinformatics Module**): students will learn to perform chemical structure analysis | |
| **11** | Tissue culture basics (**Tissue Culture Module**): students will learn basic techniques of mammalian cell culture | |
| **12** | Impact of Antibiotics on Mammalian Cell-lines (**Tissue Culture Module**). Students will learn to perform cytotoxicity assays. | |
| **13** | Team-based case studies (**Ideation Module**). Students from each project team will work together to "brain storm" ideas for assigned case studies and formulate plans for advance ideas to meet the unmet needs as part of the case study reports and presentations. Instructors will be available for feedback. | |
| **14** | Team Summary Reports and Team Presentation preparation (**Communication Module**). Students from each project team will work together to produce a summary report of their discovery and prepare PowerPoint slides to present to the whole class (Project/Team reporting skills). Team members will receive points based on evaluation by the instructor and fellow students from other teams. | |
| **15** | Team Summary Reports and Team Presentations (**Communication Module**). Students from each project team will work together to produce a summary report of their discovery and prepare PowerPoint slides to present to the whole class (Project/Team reporting skills). Team members will receive points based on evaluation by the instructor and fellow students from other teams. | |
| **Finals Week** | Team Summary Reports and Team Presentations (**Communication Module**). Continue if necessary | |