DE LA SALLE UNIVERSITY   
**College of Science**

Biology Department

**LBYBIOJ –** Fundamentals in Cell and Molecular Biology Techniques *Co-requisite*: *CELLBIO1*

*Prerequisite: ZOOLONE/LBYBIO1 or ZOOLFUN/LBYBIO8, BOTAONE/LBYBIOA or BOTAFUN/LBYBION and BIOCHEM*

**Instructor: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Contact Details: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Consultation Hours: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class Schedule and Room: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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| **Course Description** |

Fundamentals in Cell and Molecular Biology Techniques is a one-unit laboratory course that supplements the CELLBIO1 lecture course. It provides students with hands-on exposure to various techniques employed in basic cell and molecular biology. The theoretical background behind the techniques and their applications are covered in the course.

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| **Learning Outcomes** |

On completion of this course, the student is expected to present the following learning outcomes in line with the Expected Lasallian Graduate Attributes (ELGA)

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| **ELGA** | **Learning Outcome** |
| Critical and Creative Thinker  Effective Communicator  Lifelong Learner  Service-Driven Citizen | On completion of the course, the student is expected to be able to: discuss the theoretical framework behind the laboratory techniques routinely performed in cell and molecular biology studies; perform the assay procedures independently; provide examples of specific biological problems where techniques learned in the course have potential and practical applications. |

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| **Final Course Output** |

As evidence of attaining the above learning outcomes, the student is required to submit the following during the indicated dates of the term.

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| **Learning Outcome** | **Required Output** | **Due Date (Week #)** |
| On completion of the course, the student is expected to be able to: discuss the theoretical framework behind the laboratory techniques routinely performed in cell and molecular biology studies; perform the assay procedures independently; provide examples of specific biological problems where techniques learned in the course have potential and practical applications. | Pre-lab Journal | 2 working days prior to lab meeting |
| Final Report | 3 working days after performance of lab exercise |

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| **Rubric for Assessment** |

**Pre- Laboratory Report (20 points)**

| **CRITERIA** | **Excellent** | **Good** | **Satisfactory** | **Needs Improvement** |
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| **Format and Experiment Details**  **(2 points)** | **2 POINTS**   * All required components are present in the appropriate format | **1.5 POINTS**   * Most components of the required format followed | **1 POINT**   * An attempt to follow the required format | **0 POINT**   * No evidence of required format followed |
| **Introduction**  **(5 points)** | **5 POINTS**   * Provides the reader with necessary information to understand the experiment * Gives appropriate information to previous studies that has an impact on the current study * Gives a description of the study system and why it is appropriate to use it to answer hypothesis | **3 – 4 POINTS**   * Contains some superfluous information * Missing some needed background information * Gives a description of the study system with some comment on its appropriate use | **1 – 2 POINTS**   * Missing one or two components needed for the background information * Gives a description of the study system | **0 POINT**   * Copied the introduction written in the laboratory manual |
| **Objectives**  **(3 points)** | **3 POINTS**   * Well written and reflects the objectives of the whole experiment * Written in complete sentences | **2 POINTS**   * Objectives written in phrase forms | **1 POINT**   * Paraphrased the objectives written in the laboratory manual | **0 POINT**   * Copied the objectives written in the laboratory manual |
| **Materials and Methods**  **(6 points)** | **5 – 6 POINTS**   * Materials incorporated in a step by step flow chart with diagram | **3 – 4 POINTS**   * Materials incorporated in flow chart without diagram | **1 – 2 POINTS**   * Materials written and methods written in sentence form | **0 POINT**   * Materials and methods copied verbatim from the laboratory manual |
| **Data Tables and Graphs**  **(4 points)** | **4 POINTS**   * Complete tables and graphs needed for all the data of the experiment | **2 – 3 POINTS**   * Mislabeled parts of the complete tables and graphs needed for all the data of the experiment | **1 POINT**   * Lacks tables and graphs needed for all the data of the experiment | **0 POINT**   * Without tables and graphs needed for all the data of the experiment |

**Final Report (100 points)**

| **CRITERIA** | **Excellent** | **Good** | **Satisfactory** | **Needs Improvement** |
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| **Format and Experiment Details**  **(5 points)** | **5 POINTS**   * All components in the appropriate format * Author name displayed * Latin scientific name italicized with genus capitalized and species in lower case * Paragraphs well organized * Sections with logical organization of paragraphs (especially introduction, results and conclusions) * Few grammatical errors, typos and misspellings * Appropriate word selection * Correct use of scientific terms | **3 – 4 POINTS**   * Most components of the required format followed * Author name displayed * Most paragraphs well organized * Sections with logical organization of paragraphs (especially introduction, results and conclusions) * Several grammatical errors, typos, and misspelling may be present * Some misappropriate word useage errors (effect vs. affect) * Some misuse of scientific terms | **1 - 2 POINTS**   * An attempt made to follow required format * Author name displayed * Many paragraphs well organized * Several grammatical errors, typos, and misspelling may be present | **0 POINT**   * No evidence of required format or * Author name missing * Latin scientific name not italicized * Paper lacks well organized paragraphs * Sections do not contain information presented in a logical order * Many grammatical errors * Many misappropriate word usage errors (e.g., effect vs. affect) * Many misuses of scientific terms |
| **Title**  **(2 points)** | **2 POINTS**   * Is descriptive of question and work performed * Includes dependent variable, independent variable and organism studied | **1 POINT**   * Gives a general description of question and work performed * Missing one of the following: dependent variable, independent variable and organism studied | | **0 POINT**   * Missing two of the following: dependent variable, independent variable and organism studied |
| **Abstract**  **(10 points)** | **7 – 10 POINTS**   * States clearly question being asked * Gives hypothesis being tested * Highlights most important findings with enough information to understand experiments * States major findings and conclusions * Is a concise summary of question and findings | **4 – 6 POINTS**   * Is missing one component of good abstract * Abstract is not well organized or concise | **1 – 3 POINTS**   * Is missing two components of a good abstract * Does not give an overview that leads directly to the reader being able to state the major findings of the study | **0 POINT**   * Is missing three or more components of a good abstract * Is not written in a scientific style * Includes references in abstract |
| **Introduction and Objectives**  **(8 points)** | **6 – 8 POINTS**   * Provides the reader with the necessary information to understand the study * Gives appropriate information to previous studies * Gives a description of the specific purpose of the study, a description of the hypothesis being tested and a brief summary of the experimental strategy | **3 – 5 POINTS**   * Contains some superfluous information * Is missing some needed background information * Gives too much information--more like a summary * Has all the components of a good introduction but some parts may be difficult to understand | **1 – 2 POINTS**   * Is missing one or two components of a good introduction * Contains significant superfluous information | **0 POINT**   * Is missing needed information to understand the present study or is * Is missing a description of the specific purpose of the study, a description of the hypothesis being tested and a brief summary of the experimental strategy being used at the end of the introduction |
| **Materials and Methods**  **(10 points)** | **8 – 10 POINTS**   * Is written in paragraph form * Describes how the experiment was performed with sufficient detail to enable another scientist to repeat the experiment and obtain the same results * Presents easy-to-follow steps which are logical and adequately detailed without including standard procedures that all scientist know how to do * Specific chemicals and equipment are mentioned along with their source (not as a list) | **4 – 7 POINTS**   * Is written in paragraph form * Describes how the experiment was performed with sufficient detail to enable another scientist to repeat the experiment and obtain the same results * Most steps are understandable but some lack detail or are confusing * Most specific chemicals and equipment are mentioned along with their source (not as a list) | **1 – 3 POINTS**   * Is written in paragraph form * Describes how the experiment was performed with some critical details are lacking * Most steps are understandable but some lack detail or are confusing * Most specific chemicals and equipment are mentioned along with their source (not as a list) | **0 POINT**   * Is lacking several critical details so that it is impossible to repeat the experiments described * Many steps are missing in describing steps in an experiment * Chemicals and equipment are in a list * or are not described |
| **Results**  **(20 points)** | **16 – 20 POINTS**   * All tables and figures have appropriate legends * All tables and figures are described in the narrative text | **10 – 15 POINTS**   * All tables and figures have appropriate legends * All tables and figures are described in the narrative text | **5 – 9 POINTS**   * Most of the tables and figures have appropriate legends * Most tables and figures are described in the narrative text | **1 – 4 POINTS**   * Data in tables or figures not described in narrative form |
| **Discussions**  **(30 points)** | **21 – 30 POINTS**   * All pertinent data is described * Raw unprocessed data is absent * Results presented as both narrative text and in figures and tables * Data presented in a logical manner to enable the reader to draw conclusions * Important data is highlighted * No conclusions are present | **10 – 20 POINTS**   * All pertinent data is described * Raw unprocessed data is absent * Most results presented as both narrative text and in figures and tables * Most data presented in a logical manner to enable the reader to draw conclusions * Most important data is highlighted | **5 – 9 POINTS**   * Most pertinent data is described * Raw unprocessed data is absent * Most results presented as both narrative text and in figures and tables * Most data presented in a logical manner to enable the reader to draw conclusions * Most important data is highlighted | **1 – 4 POINTS**   * Raw unprocessed data is present * Some results presented as both narrative text and in figures and tables * Data not clearly presented * Important data not highlighted |
| **Conclusion and Recommendations**  **(10 points)** | **8 – 10 POINTS**   * Question and hypothesis restated * Conclusions are stated clearly with explicit reference to the data that support a conclusion * Argument for conclusions well organized * Importance of conclusions discussed * Conclusions related to other studies and put into a context of current knowledge * Clear differentiation between speculations and conclusions * Final paragraph states the major finding of the study (the take home message) | **4 – 7 POINTS**   * Conclusions are stated clearly with explicit reference to the data that support a conclusion * Argument for conclusions is generally well organized * Importance of conclusions discussed * Conclusions related to other studies and put into a context of current knowledge * Final paragraph states the major finding of the study (the take home message) | **1 – 3 POINTS**   * Conclusions are stated clearly with reference to the data that support a conclusion * Argument for the conclusions can be understood but difficult to follow * Final paragraph states the major finding of the study (the take home message) | **0 POINT**   * Conclusions are stated but without sufficient reference to the results that support it. * Lacking several of the characters of a good discussion |
| **References**  **(5 points)** | **4 – 5 POINTS**   * All cited sources present * No references not cited in the body present * In the required format * References all highly relevant | **3 POINTS**   * All cited sources present * In required format * References relevant and appropriate | **2 POINTS**   * Most cited sources present * Generally in required format * References relevant and appropriate | **1 POINT**   * Many sources absent * Inappropriate format * References not most relevant/appropriate to study |

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| **Grading System** |

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| Pre-laboratory Reports in Journal Notebook 5%  Final Report and Laboratory Performance 25%  Quizzes 10%  Midterm Exam 25%  Comprehensive Final Exam 35%  **TOTAL 100%**    **Passing Grade 60%** | **Scale: %**  92-100 4.0  86-91 3.5  80-85 3.0  75-79 2.5  70-74 2.0  65-69 1.5  60-64 1.0  <60 0.0 |

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| **Learning Plan** |

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| **LEARNING OUTCOME** | **Laboratory Topics** | **WEEK** |
| On completion of the course, the student is expected to able to: discuss the theoretical framework behind the laboratory techniques routinely performed in cell and molecular biology studies; perform them independently, provide examples of specific biological problems where techniques learned in the course have potential and practical applications. | Orientation  1 Standard Curve Preparation for Determining Protein Content | 1 |
| 2 Cell Fractionation and Separation | 2 |
| 3 Marker Enzyme Assay | 3 |
| 4 SDS-Polyacrylamide Gel Electrophoresis | 4 |
| 5 SDS-Page Gel Image Analysis | 5 |
| 6 Protein Sequence Analysis and Homology Modeling of 3-Dimensional Structures | 6 |
| Post-Laboratory Discussion | 7 |
| **DEPARTMENTAL MIDTERM EXAMINATION** |  |
| 7 Transformation of *E. coli* HB101 Using Recombinant *gfp* | 8 – 9 |
| 8 Purification of Expressed Recombinant *gfp* by Hydrophobic Interaction Chromatography | 9 – 10 |
| 9 Colony PCR Amplification of *rgfp* Transformants | 11 |
| Agarose Gel Electrophoresis of Exercise 9  10 Antigen Detection and Identification by Enzyme-Linked Immunosorbent Assay | 12 |
| Post-Laboratory Discussion | 13 |
| **DEPARTMENTAL COMPREHENSIVE  FINAL EXAMINATION** | 14 |

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| **References** |

**Text/Materials**:

Hardin, J.U., Bertoni, G., Kleinsmith, L. 2012. Becker’s World of the Cell. 8th ed. Benjamin Cummings Publishing Co., USA.

Laboratory handouts

**Other References**

Karp, G. 2013. Cell and Molecular Biology: Concepts and Experiments. 7th edition. John Wiley and Sons, Inc.

Malacinski, G.M. 2006. Essentials of Molecular Biology. 4th edition. Jones and Bartlett Publishers.

Alberts, B., Johnson, D., Lewis, J., Raff, M. Roberts, K. & Walter P. 2008. Molecular Biology of the Cell. 5th ed, Garland Publishing, Inc., NY, London.

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| **Online Resources** |

[www.ncbi.nih.gov](http://www.ncbi.nih.gov).

[www.jcb.org](http://www.jcb.org)

[www.mit.edu:8001/esgbio](http://www.mit.edu:8001/esgbio)

[www.cellsalive.com](http://www.cellsalive.com)

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| **Class Requirements** |

Individual Requirements

1. Laboratory gown and closed shoes
2. Individual laboratory journal (format to be provided)

Group Requirements

1. 1 box of gloves (powderless)
2. 1 roll of aluminum foil
3. Paper towels
4. 70% isopropyl alcohol in spray bottle (scentless)
5. Lysol (scentless)
6. Permanent Fine Tip Markers
7. Scissors
8. Masking Tape (0.5 inch)
9. Lighter or match
10. Microwaveable containers
11. Resealable bag
12. Plastic box to contain all group requirements

Approved by:

DR. MARY JANE C. FLORES

Chair, Biology Department