Course Proposal Outline

1. **Course Title:** Chemical Biology

2. **Course Proposed for:** Graduate Program course.

3. **New Course, Replacement of Existing course, or Revision of existing course:** New Course.

4. **Course Summary:** Chemical biology is a scientific discipline spanning the fields of chemistry, biology, and physics. It involves the application of chemical techniques, tools, and analyses, and often compounds produced through synthetic chemistry, to the study and manipulation of biological systems. The course teaches topics including an introduction to chemical biology, bio-orthogonal ligand reactions, small molecule inhibitors for protein-protein interactions and epigenetics, chemoproteomics, sensors for living cells, and state-of-the-art imaging techniques. The course content emphasizes applications of chemical tools in solving biological and biomedical problems.

5. **Goals and Learning Objectives for Course:** The goal of this course is to provide an introductory overview of chemical biology to graduate students. The objective is on completion of the course, students will have general knowledge about the available chemical biology tools and be able to (1) describe bio-orthogonal ligation reactions; (2) describe modulation of protein-protein interactions and epigenetics by small molecules; (3) describe the typical process of chemoproteomics; (4) know the different strategies for sensor development; and (5) understand the advantages and disadvantages of different imaging techniques.

6. **Course Description:**
   6.A. **Specific needs the course will meet:** The course will provide an introduction to chemical biology. There are currently no chemical biology courses offered at BCM.
   6.B. **Audience:** Pharmacology students and students from all programs of BCM
   6.C. **Core or elective:** Required for students of the Pharmacology program.
   6.D. **Credits:** 2 credit hours
   6.E. **Term(s) Offered:** 5th term
   6.F. **Day(s) of the week:** Thursday
   6.G. **Start time – Stop time:** 2 pm to 4 pm
   6.H. **Location:** N501
   6.I. **Enrollment limitation:** minimum 3 and maximum 12 students
   6.J. **Prerequisites:** none

7. **Potential for subject matter or scheduling overlap with existing courses:** None
   Lecture 2 does not overlap with content covered in “GS-GS-518 Macromolecules: Structure and Interactions,” which is listed as covering interactions of macromolecules with each other and small ligands. In GS-GS-518, lectures mainly cover protein-protein interactions and protein-ligand interactions from a biochemical perspective.
point-of-view, including binding thermodynamics and kinetics. In our proposed lecture 2, we will cover how to design and use small molecules to disrupt protein-protein interactions. This is a very useful strategy to interrogate the functions/consequences of protein-protein interactions.

Lecture 6 on state-of-the-art imaging techniques does not overlap with the content of “GS-CB-426 Integrated Microscopy”. In GS-CB-426, it covers fluorescence-based microscopy (i.e., brightfield, DIC, phase contrast, deconvolution, confocal, live cell imaging), fluorescence-based molecular tools (i.e., FRET, FRAP, fluorescent proteins), transmission electron microscopy, super-resolution microscopy (i.e., SIM, STORM), and specialized automated high throughput microscopy and image analysis. In Lecture 6, we will cover Total Internal Reflection Fluorescence (TIRF) single molecule imaging, fluorescence correlation spectroscopy (FCS), single molecule FRET imaging, and fluorescence lifetime imaging (FLIM). In fact, the topics covered in lecture 6 are complementary to GS-CB-426.

8. Detailed lecture/lab outline: The schedule (below) has a brief description of each lecture. Complete lecture notes are posted in BCM Blackboard.

<table>
<thead>
<tr>
<th>Meeting Number Date</th>
<th>Type</th>
<th>Title</th>
<th>Instructor</th>
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<tbody>
<tr>
<td>Thursday May 25</td>
<td>Lecture 1</td>
<td>Introduction to Chemical Biology</td>
<td>Jin Wang</td>
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<td>Bio-orthogonal Ligation Reactions</td>
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<tr>
<td>Thursday June 1</td>
<td>Lecture 2</td>
<td>Modulation of Protein-Protein Interactions (PPIs) by Small Molecules</td>
<td>Hongbing Huang</td>
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<td>Thursday June 8</td>
<td>Lecture 3</td>
<td>Modulation of Epigenetics by Small Molecules</td>
<td>Yongcheng Song</td>
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<tr>
<td>Thursday June 15</td>
<td>Lecture 4</td>
<td>Chemoproteomics Enabled Drug Discovery</td>
<td>Damian Young</td>
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<tr>
<td>Thursday June 22</td>
<td>Lecture 5</td>
<td>Sensors for Living Cells</td>
<td>Jin Wang</td>
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<td>Thursday June 29</td>
<td>Lecture 6</td>
<td>State-of-the-Art Imaging Techniques</td>
<td>Allan Ferreon</td>
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<td>Thursday July 6</td>
<td>Lecture 7</td>
<td>Student Presentation</td>
<td>Jin Wang</td>
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<tr>
<td>Thursday July 13</td>
<td>Lecture 8</td>
<td>Student Presentation</td>
<td>Jin Wang</td>
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<td>Final Exam</td>
<td>Final Exam</td>
<td>Final Exam</td>
<td>Jin Wang</td>
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<td>July 20</td>
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9. **Grading Criteria:** Letter Grade, A, B, C and F
   - 20 points based on attendance (3 points for lectures 1-6, 2 points for lecture 7)
   - 30 points based on the presentation.
   For the presentation, students will choose a chemical biology paper and critically analyze the experimental results and conclusions. Each student will have 10 minutes for presentation and 5 minutes for Q&As. Students will be graded based on the following criteria:
   - Define the question to be addressed (5 pt)
   - How were the experiments designed to address the question (10 pt)
   - Any pitfalls in the study or any other experiments should be conducted to backup the conclusion or any follow-up study you would propose (5 pt)
   - Questions and answers (10 pt)

   50 points based on the final exam.

   Grading criteria:
   - 85-100 points equal to “A”
   - 70-84 points equal to “B”
   - 60-69 points equal to “C”
   - below 60 equal to “F”

10. **Materials Required for Course.**
    A. **Required or Recommended Textbook:** None
    B. **Required or Recommended Software:** None

11. **How the course will be evaluated each year:** course matters are discussed and reported in the Departmental faculty meeting. Feedback of student’s evaluation (from Grad School) is considered.

12. **Instructors:**
   - Jin Wang, Ph.D.
   - Hongbing Huang, Ph.D.
   - Yongcheng Song, Ph.D.
   - Damian Young, Ph.D.
   - Allan Ferreon, Ph.D.

13. **Course Coordinator(s):**
   - Jin Wang (course director)
     Email: wangj@bcm.edu
     Phone: 713 798 6875
     Office: N520.05
   - Kim Tran (course administrator).
     Email: kimt@bcm.edu
     Phone: 713 798 4457
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