University of Wisconsin-Whitewater

Curriculum Proposal Form #3

## New Course

**Effective Term:**

**Subject Area - Course Number:** **CHEMISTRY 458 Cross-listing:** **Biology 458**

(See Note #1 below)

**Course Title:** (Limited to 65 characters) Research in Biochemistry

**25-Character Abbreviation:** Research in Biochemistry

**Sponsor(s):** Catherine Chan and Christopher Veldkamp

**Department(s):** Biological Sciences and Chemistry

**College(s):**

# **Consultation took place**: NA Yes (list departments and attach consultation sheet)

Departments:

**Programs Affected:** **N/A**

**Is paperwork complete for those programs?** (Use "Form 2" for Catalog & Academic Report updates)

NA  Yes  will be at future meeting

**Prerequisites:** Biol 120 or Biol 141 (or equivalent) with a ‘C’ or better and Chem 251, or consent of instructor. Corequisite: Chem 454 or Biol/Chem 456.

**Grade Basis:**  Conventional Letter  S/NC or Pass/Fail

**Course will be offered:**  Part of Load  Above Load

On Campus  Off Campus - Location

**College:**  **Dept/Area(s):** Biological Sciences and Chemistry

**Instructor:** Catherine Chan or Christopher Veldkamp

*Note: If the course is dual-listed, instructor must be a member of Grad Faculty.*

**Check if the Course is to Meet Any of the Following:**

Technological Literacy Requirement  Writing Requirement

Diversity  General Education Option:

Note: For the Gen Ed option, the proposal should address how this course relates to specific core courses, meets the goals of General Education in providing breadth, and incorporates scholarship in the appropriate field relating to women and gender.

**Credit/Contact Hours:** (per semester)

Total lab hours: 96 Total lecture hours: 0

Number of credits: 2 Total contact hours: 96

**Can course be taken more than once for credit? (Repeatability)**

No  Yes If "Yes", answer the following questions:

No of times in major:       No of credits in major:

No of times in degree:       No of credits in degree:

Proposal Information: ([***Procedures for form #3***](http://acadaff.uww.edu/UCC/Curriculum_Handbook_09/Procedures_form3.docx))

**Course justification:**

The Chemistry department is changing its curricular to meet new guidelines issued by the American Chemical Society (ACS). Specifically, we propose to expand the current one semester Biochemistry course (Biol/Chem 456) to two separate courses, Biochemistry of Macromolecules and Biochemistry of Metabolism and Signaling. The Biochemistry of Macromolecules course, Chem 454, explores fundamental biochemistry concepts, and is a required course for all Chemistry majors whereas Biol/Chem 456 focuses on the biochemistry of metabolism and signaling (pending approval by the College and University Curricular Committees). The target audience of Biol/Chem 456 is Chemistry majors with a Biochemistry emphasis, students interested in postgraduate education in Biochemistry (and related fields), and Biology majors with a pre-professional or allied health field focus. The laboratory component of the former Biol/Chem 456 is no longer linked to the lecture component but instead, is proposed to be offered as a stand-alone biochemistry laboratory course, Biol/Chem 458. Therefore, Biol/Chem 458 now serves as the lab course that is associated with either Chem 454 or Biol/Chem 456. It is also designed to be an upper level Biochemistry course that is part of the curriculum of the Biochemistry emphasis currently in the final stages of consideration by the Chemistry Department.

Biol/Chem 458 explores fundamental biochemistry concepts in a laboratory setting and teaches biochemical research methods through guided original research projects done by student research teams consisting of 3-5 members (pending approval by the College and University Curricular Committees). One of the main goals of this course is to introduce students to fundamental biochemical concepts, while helping students see the connection between chemistry and biology in a laboratory setting. In addition, this lab course seeks to bridge the gap between the undergraduate teaching lab experience and what is expected of team members who conduct real-world original research in either an academic, medical or industrial setting. Through guided original research, this course emulates a real-world research experience where researchers are expected to provide rationale for research funding, work as a team, revise experimental design according to preliminary results, and practice impeccable record-keeping and communication skills. These guided original research projects will help students transition from accumulating scientific concepts in their classes to using those concepts to solve real life research problems.

**Relationship to program assessment objectives:**

The American Chemical Society (ACS) lists ‘Biochemistry’ as one of the five foundation areas that ACS-approved Chemistry Departments must offer students who are graduating with a Chemistry degree. The Chemistry department proposes to offer this Biochemistry laboratory course to complement the biochemistry lecture courses, Chem 454 and Biol/Chem 456.

**Budgetary impact:**

Minimal. Dr. Catherine Chan has a joint appointment between the Departments of Chemistry and Biological Sciences and has been teaching the current one semester Biochemistry course (lecture and laboratory combined). The hiring of Dr. Christopher Veldkamp, who joined the Chemistry Department in Fall 2009, fulfills the additional staff requirement necessary for teaching this course. The Chemistry Department already offers a biochemistry teaching laboratory as part of the current course curriculum of Biochemistry. No additional staff or equipment needs are anticipated to offer this course.

**Course description:** (50 word limit)

A laboratory course that teaches biochemical research techniques through guided original research projects.

Prereq: Biol 120 or Biol 141 (or equivalent) with a ‘C’ or better and Chem 251. Corequisite: Chem 454 or Biol/Chem 456.

**If dual listed, list graduate level requirements for the following:**

1. **Content** (e.g., What are additional presentation/project requirements?)   
N/A

2. **Intensity** (e.g., How are the processes and standards of evaluation different for graduates and undergraduates? )   
N/A

3. **Self-Directed** (e.g., How are research expectations differ for graduates and undergraduates?)   
N/A

**Course Objectives and tentative course syllabus** with [mandatory information](http://www.uww.edu/acadaff/UCC/Mandatory_Info_Course_Syllabi.docx)(paste syllabus below):

**Biochemistry Lab (BIOL/CHEM 458)**

**Instructor**: Dr. Catherine Chan/ Dr. Christopher Veldkamp

**Office**: Upham Hall 209//Upham Hall 257

**Phone**: 262-472-5133/262-472-5267

**E-mail**: chanc@uww.edu/ veldkamc@uww.edu

**Class Time:** T & R 2:15 PM – 5:15 PM

**Where:** UH262

**Credits:** 2

**Prerequisite:**

Students must have a 'C' or better in Biol 120 or Biol 141 (or pass a higher level Biology course) and Chem 251. You must also be currently enrolled in or have passed Chem 454 or Biol/Chem456.

**Course Materials:**

Text – Fundamentals of Biochemistry: Life at the Molecular Level

Voet, Voet & Pratt 4th edition.

Students should provide their own scientific calculators.

**Course Objective:**

Biochemistry is the study of chemical reactions as pertained to biological systems. This is a field of intense research with numerous industrial, medical and agricultural applications. One of the main goals of this course is to introduce students to fundamental biochemical concepts, and to help them see the connection between chemistry and biology in a laboratory setting. In addition, this lab seeks to bridge the gap between the undergraduate teaching lab experience and what is expected of team members that conduct real-world original research in either an academic, medical or industrial setting. Through guided original research, this course emulates a real-world research experience where researchers are expected to provide rationale for research funding, work as a team, revise experimental design according to preliminary results and practice impeccable record-keeping and communication skills. These guided original research projects will help students transition from accumulating scientific concepts in their classes to using those concept to solve real life research problems. Laboratory periods will be split between discussion about biochemical laboratory techniques and using these techniques as a part of the guided research projects.

**Tentative schedule:**

|  |  |  |
| --- | --- | --- |
| Week | Assignments | Topic |
| 1 |  | Introduction to the course and guided original research projects. Form groups and pick research projects. |
| 2 |  | Review of primary literature relating to the research projects, database searching of primary literature, and group discussion |
| 3 |  | Overview of techniques. |
| 4 |  | Designing experiments, ordering supplies and grant writing. Group discussion. |
| 5 | Grant Proposal | Mock grant proposal outlining the groups’ research goals |
| 6 |  | Guided Research |
| 7 |  | Guided Research |
| 8 |  | Guided Research/ Research in progress report or talk due |
| 9 |  | Guided Research |
| 10 |  | Guided Research |
| 11 |  | Guided Research/ Research in progress report or talk due |
| 12 |  | Guided Research |
| 13 |  | Guided Research |
| 14 |  | Guided Research/ Research in progress report or talk due |
| 15 | Final Paper  Final Presentation | Formal paper in the style of a scientific publication  Poster presentation and/or oral presentation |

**Guided Research Projects:**

These research projects are not meant to be completed in one semester. Your group will be one of many to work on these projects over many semesters. It is imperative that you keep good notes and observations, as your successors will need this information. Additionally, given your findings the goals of the project may be restated or adjusted as needed.

Your group will choose from a list of projects provided by the instructor. An example list of projects is found below. The aspect of the project your group will work on is entirely up to the group. Perhaps your group is interested in molecular biology and decides focus on a more immature project and uses techniques like PCR and cloning in order to generate plasmids needed for heterologous protein expression. Perhaps your group is interested in protein expression and purification and chooses a project where the plasmids for protein expression have already been made. Or perhaps your group wishes to look at protein structure and chooses a project where purified protein is already available. During the first weeks of class your group must think about these things. Many of the projects would allow you to focus on the techniques your group would like to learn.

Example Project 1: Chemokine structural genomics. Structural genomics is a field that has come about after the sequencing of the human genome. Now that the entire human genome is sequenced, the question becomes what do all the proteins those genes code for look like? Chemokines are a large family of ~ 50 secreted proteins that have numerous roles in the immune system and in disease states. The three dimensional structure of some family members are know but not all. This project will involve either cloning of chemokine genes into plasmids for heterologeous protein expression or protein expression and purification of previously cloned chemokines followed by structural studies.

Example Project 2: Biomimetic Chemical Reactions. Carbonic anhydrase is one of the fastest enzyme enzymes/catalysts known. It catalyzes the conversion of carbon dioxide and water to bicarbonate and a proton or the reverse reaction. Theoretically this enzyme could be a part of a scheme to “trap CO2”, but proteins are not the most stable of molecules. The active site of carbonic anhydrase contains three histidines and zinc cation. Students will attempt to recreate the active site of cabonic anyhydrase and determine if their biomimetic compounds mimic the reaction catalyzed by carbonic anhydrase using standard enzyme assays.

Example Project 3: Proteins are often composed of domains, which are thought to be stable structures or stand alone units that make up a larger protein. The first PDZ domain in Par 3 from *Drosophila melangaster* has all the markings of a stable PDZ domain, but is only partially structured and exchanges between multiple conformations. Students will investigate why the first PDZ domain is unstable using structural methods and seek to identify any PDZ ligands or binding partners that might stabilize the structure. PDZ1 from Par 3 protein has been produced recombinantly. PDZ ligands fused to GST will be produce recombinantly and purified using standard or affinity based protein purification methods. Pulldown assays will assess binding and structural assays will assess PDZ1 domain stability.

Example Project 4: Recombinant proteins are often produced as fusion proteins, for example a protein of interest may be produced with green fluorescent protein (GFP), a reporter protein, attached to its N or C terminus. Students will clone a gene of interest into a GFP (reporter)-linked expression construct. Once cloning is done, students will express the reporter construct and follow its expression via GFP fluorescence and purify the protein through conventional protein purification methods. Students will use fluorescence methods to confirm that the GFP does not affect the structure of the protein of interest.

**Techniques that may be used during research:**

|  |
| --- |
| Polymerase Chain Reaction |
| Agarose gel electrophoresis |
| Restriction Endonuclease Digestions |
| DNA extraction and purification from agarose gels |
| Gene cloning and ligation |
| Recombinant protein expression testing and optimization |
| Large scale protein expression |
| Protein purification techniques |
| SDS-PAGE |
| Western blotting |
| Pull-down assays |
| UV-Vis spectroscopy and proteins |
| Fluorescence spectroscopy and proteins |
| Enzyme assays |
| Differential scanning calorimetry |
| Protein NMR spectroscopy |
| Protein structure |
|  |
|  |

**Course policies**:

**A. Attendance**

* Attendance is mandatory. Any missed class must be excused due to reasons 1-3 below.
* In the event of inclement weather, students are responsible as described in the UWW undergraduate catalog.

**B. Discussions**

* Participation in class discussions promotes active learning and is an integral part of this course. Students are expected to come prepared to be an active participant in class.

**C. Announcements**

- Occasionally, the instructor may provide additional instructions for an upcoming lab or

assignment shortly prior to class time. These announcements will be posted on the course web site

news page and whenever possible, the instructor will also attempt to contact all students in the

course via e-mail. It is advised that students regularly check their university issued e-mail accounts

(e-mail will only be sent to uww accounts) and/ or the course web site for updates.

**D. Assignments**

* The schedule of assignments is included in this syllabus. Students must turn their work in on the scheduled day. Missed work will be recorded as ZERO except for the following reasons:

**(1) Religious Beliefs Accommodation**

Board of Regents policy states that students’ sincerely held religious beliefs shall be reasonably accommodated with respect to scheduling all examinations and other academic requirements. Students must notify the instructor, within the first three weeks of the beginning of classes of the specific days or dates on which they will request accommodation from an examination or academic requirement. For additional information, please refer to the University Bulletin and the Timetable; “Accommodation of Religious Beliefs”.

**(2) Absence for University Sponsored Events**

University policy adopted by Faculty Senate and the Whitewater Student Government states that students will not be academically penalized for missing classes in order to participate in university-sanctioned events. They will be provided an opportunity to make up any work that is missed; and if class attendance is a requirement, missing a class in order to participate in a university-sponsored event will not be counted as an absence. A university-sanctioned event is defined to be any intercollegiate athletic contest or other such event as determined by the Provost. Activity sponsors are responsible for obtaining the Provost’s prior approval of an event as being university sanctioned and for providing an official list of participants. Students are responsible for notifying their instructors as soon as possible (at least one week in advance) of their participation in such events.

**(3) You are very sick on the day of a due date**

Students must contact the instructor PRIOR to class time on/ before the day of the work’s due date AND must present a doctor’s note to the instructor explaining your absence at the beginning of the next class period (or the first session that the student starts attending class again). The doctor's note does not need to include medical details but must specify: (1) The date the student received care in the medical facility (2) The duration in which the student is deemed unfit to attend class. If you are unable to attend class for an extended period of time, please notify the instructor to discuss possible options for making-up missed assignments/ exams.

* If the student meets one of the three criteria given above, at the discretion of the instructor, he/ she may be asked to make up the work at another time. Otherwise, the remaining grades will be averaged to provide a score.
* You must PROPERLY NOTIFY the instructor of your intent and reason to miss any class, due date or presentation following the procedures outlined above; otherwise your request may not be honored even if your reason is legitimate

**Grading:**

* Final grade for the entire semester will be based on students’ performance in the following categories:

**(1) Participation**

200 points. Scientific research is performed as a group. Participation in class discussions and in your group is essential for success of the research projects. You will be graded according to your level of active participation throughout the semester.

**(2) Research/grant proposal**

200 points. All scientific research requires funding. If your future involves working in academic lab or in industry you will be asked to justify the cost of your salary and your research. This aspect of one’s future employment is so importance that most graduate schools require students write a mock research/grant proposal as a part of a Ph.D. qualifying examination. Your group will write a miniature, mock grant proposal on your assigned research project following either the National Science Foundation or the National Institutes of Health guidelines.

**(3) Laboratory Notebook**

200 points. Your group will keep a proper laboratory notebook. The original research projects you work on this semester may be continued in subsequent semesters. The laboratory notebook will be graded on the basis of whether or not future class members can continue your work. Because of the importance of the laboratory notebook to the success of future students expect to obtain all or none of these points base on the quality of your groups notebook. Every week the group’s lab notebook will be turned in for evaluation.

**(4) Formal Paper and Research in Progress Reports**

200 points. The formal paper and progress reports will summarize the progress your research group made throughout the semester. The formal report will follow the style of one of the major biochemistry journals.

**(5) Poster presentation/Formal presentation and Research in Progress Talks**

200 points. Your group will be assigned to present either a poster or a formal scientific talk or both. This will follow the format of a scientific conference. Additionally, groups may be required to make research in progress talks instead of research in progress reports.

- If a student does not agree with the points received for a particular evaluation, a written appeal that clearly indicates the reason(s) for disagreement must be submitted by 5 PM the day following the graded exam/ assignment has been returned. The entire exam/ assignment will be re-graded and returned to the student within a week. No appeals will be considered during class time and no verbal explanations will be provided. Excessive/ frivolous requests for re-grading will be penalized 25% of the value of the exam/ assignment.

- Total possible points for the course: 200 points – participation, 200 points – research/grant proposal, 200 points – laboratory notebook, 200 points – formal paper and 200 points – presentations. Total 1000 points.

* Percentage scale used for determining grades in this course:

Grade % Course grade

100 – 89.5 A

89.4 – 79.5 B

79.4 – 69.5 C

69.4 – 59.5 D

59.4 – 0 F

This scale will NOT be changed.

- In case a final grade % needs to be rounded off, the following guidelines will be used:

(1) If the second decimal place is 4 or less, the final grade % will be rounded down.

(2) If the second decimal place is 5 or more, the final grade % will be rounded up.

However, the instructor may also choose to take into consideration class participation and civility when rounding off a student's grade %.

**Dropping the course:**

It is the students’ responsibility to obtain, fill out and get the necessary signatures on official drop forms before the deadline.

**Additional notes:**

* The University of Wisconsin-Whitewater is dedicated to a safe, supportive and non-discriminatory learning environment. It is the responsibility of all undergraduates and graduate students to familiarize themselves with University policies regarding Special Accommodations, Misconduct, Religious Beliefs Accommodation, Discrimination and Absence for University Sponsored Events. (For details please refer to the Undergraduate and Graduate Timetables; the "Rights and Responsibilities" section of the Undergraduate Bulletin; the Academic Requirements and Policies and the Facilities and Services sections of the Graduate Bulletin; and the "Student Academic Disciplinary Procedures" [UWS Chapter 14]; and the "Student Nonacademic Disciplinary Procedures" [UWS Chapter 17]). These required syllabus contents were agreed upon by the actions of the Whitewater Student Government (S95- 96:09), Academic Staff Assembly, Faculty Senate (FS956-13 and FS989-11), Provost Prior, and Chancellor Greenhill (approved Nov. 17, 1998).
* If any student requires special accommodations, the instructor should be notified as soon as possible.
* **No class materials, including lecture outlines and exam questions/answers, can be posted on non-UWW web site(s) without the written permission of the instructor and the publisher.**

**Academic misconduct:**

The University of Wisconsin-Whitewater is dedicated to a safe, supportive and    non-discriminatory learning environment.  It is the responsibility of all undergraduate and graduate students to familiarize themselves with University policies regarding [Special Accommodations](http://www.uww.edu/StdRsces/csd/academic_index.php), [Academic Misconduct](http://www.uww.edu/Catalog/02-04/Legal/legal1.html#Misconduct), [Religious Beliefs Accommodation](http://www.uww.edu/Catalog/02-04/Legal/legal5.html), [Discrimination](http://www.uww.edu/Catalog/02-04/Legal/legal6.html) and [Absence for University Sponsored Events](http://www.uww.edu/Catalog/02-04/Legal/legal1.html#Misconduct) (for details please refer to the Schedule of Classes; the [“](http://www.uww.edu/www.uww.edu/Catalog/02-04/Legal/Legal1.html)[Rights and Responsibilities](http://www.uww.edu/Catalog/02-04/Legal/Legal1.html)[”](http://www.uww.edu/www.uww.edu/Catalog/02-04/Legal/Legal1.html) section of the [Undergraduate Catalog](http://www.uww.edu/Catalog); [the Academic Requirements](http://www.uww.edu/gradstudies/catalog0608/Gradpolicies.php#academicinformation) and Policies and the [Facilities and Services](http://www.uww.edu/gradstudies/catalog0608/Gradpolicies.php#facilitiesandservices) sections of the [Graduate Catalog](http://www.uww.edu/gradstudies/catalog0608/gradcat0608.php); and the “[Student Academic Disciplinary Procedures](http://www.uww.edu/stdhdbk/uwsystem.html) (UWS Chapter 14); and the “[Student Nonacademic Disciplinary Procedures](http://www.uww.edu/stdhdbk/uwsystem.html)" (UWS Chapter 17).

IF YOU CHEAT, YOU WILL FAIL! There are no exceptions or mitigating circumstance.

**Bibliography:** (Key or essential references only. Normally the bibliography should be no more than one or two pages in length.)

Fundamentals of Biochemistry: Life at the Molecular Level, Voet, Voet & Pratt 4th edition, and references therein.

Students will be expected to obtain information from public web sites such as http://www.ncbi.nlm.nih.gov/ and <http://portal.acs.org/portal/acs/corg/content> to help with literature review. Mock proposal preparation will follow guidelines established by public funding agencies such as the National Science Foundation (http://www.nsf.gov/funding/preparing/).