

## **Sabbatical Proposal Fall 2020**

### **General Chemistry M01A Laboratory Development**

**Robert N. Keil, Ph.D., Chemistry Department, Moorpark College**

#### **Instructor Sabbatical Leave Status**

Full-Time Hire Date: August 1997

Previous Sabbaticals: 0

#### **I. Background**

General Chemistry M01A is a required course for most science majors, and often the first experience many incoming students have with a college-level science course. Moorpark College offers around 15 sections per semester, enrolling 400+ students. The class is in very high demand with most sections having a completely full waitlist. This 5-unit course satisfies CSU-GE and ICETC general education requirements for physical science, has an updated Course Outline of Record (COR), and has been mapped to and approved by the C-ID system as fully transferable. The course consists of 4 units of lecture and 1 unit (3 hours) of laboratory practice.

Since I arrived 22 years ago, the lab sequence for General Chemistry has remained almost unchanged. About a dozen years ago, the lab manual was rewritten and put into an easily publishable form, but the actual content of the labs remained the same. Many of the labs reflect an older style of lab work, in which students follow a “cookbook” procedure. They follow a set of instructions and rarely are asked to think about what would happen if they varied the procedure, and they are never asked to devise their own procedure. The labs are written so that each student fills out an individual report, yet they work as partners, without any clear division of labor or roles specified. This often results in one person doing most of the work while the weaker student copies down data and answers. For the writeup section, they are asked to fill in numbers on a page that resembles a tax form, calculate a value, and then compare it to the correct or accepted value.

The current labs do not build several critical skills that are needed for science such as planning to solve problems, flexibility and adaptability, and effective work in small groups. For example, our capstone lab (Experiment #15) that used to be a multi-week exercise in structure determination of an unknown chemical. Students conducted tests, used the results of those tests to deduce the compound’s identity and then wrote up a report, which helped with critical thinking and writing skills. But in the last few years, write-ups and full

analysis of the experiment from previous students have become easily available online, which greatly reduces the effectiveness of the lesson. The lab has gone from an exercise in deduction and chemical thinking to one in which they conduct a few experiments, and then repeat answers obtained by previous classes. This is just one example of an experiment that could be targeted for serious renovation and re-writing.

Over the last few years, we acquired a full set of Vernier sensor packages that allow automated data collection, as well as 15 classroom computers to analyze that data. The sensor packages have been well-received by faculty once they tried them, and they open up a lot of new possibilities for data collection, processing and analysis. However, usage is inconsistent between classes due to the lack of written procedures that let every instructor know how to use the equipment.

## **II. Purpose of the Sabbatical Project**

I am proposing a sabbatical leave to both develop new labs for our General Chemistry (M01A) courses, as well as compiling a set of lab manuals and lab schedules from other community colleges so we can evaluate our program in relation to others around the state and country.

My primary goal is to research, select, test and write four new lab procedures, and add them to our on-line departmental lab manual. I would like to focus both on revising some existing labs to emphasize a discovery-based format, and also on developing new labs that address topics not currently covered in our lab curriculum. Possible new topics include polymer science (through the recycling of plastics), biomolecules (through the analysis of foods), and environmental science (through analysis of trace metals in water samples).

My secondary goal would be to make the lab manual and schedules for at least a dozen other community colleges available for my colleagues, so that they can compare what other colleges, Cal State, and UC schools are doing in their labs. Ensuring that our labs are similar in both content and pedagogy to our transfer institutions is crucial to guarantee transferability in the future.

### **Proposed timeline:**

**August 2020:** Identify five to six prospective candidate labs to develop. Typical sources are the *Journal of Chemical Education*, *The Chemical Educator*, other schools' lab manuals, and suggestions from fellow faculty. Consult with fellow faculty to confirm interest in new lab topics. Also, emailing schools for copies of their lab manuals.

**September/October 2020:** Compile lists of materials needed, order any needed supplies, conduct test runs in the stockroom area or open lab rooms. Modify procedures until they give stable and reproducible results. Present preliminary results to other faculty and ask for feedback. Select best four candidates.

**November 2020:** Write up student guides to the labs, recruit students from honors section or Chemistry Club to conduct test runs. Rewrite and improve as needed. Consult with stockroom staff to ensure that additional costs are small relative to replaced labs. Research and prepare summary of any known chemical hazards posed by new chemicals.

**December 2020:** Finish writeups of four candidate labs, present them to faculty and ask for final feedback. If time allows, run pilot tests with single lab sections. Post modified labs to departmental site for use in Fall 2022. Ensure any needed chemicals and supplies would be ordered for Fall 2022 semester. Finish creating an online and/or physical library of lab manuals. Write a summary of how Moorpark's lab structure compares to those of transfer schools.

This timeline is flexible enough to allow the expansion of the number of labs if possible, but should be realistic enough to accomplish in one semester. Most material costs would be low, as the labs would be chosen with cost in mind, using mostly equipment and supplies already in stock.

### **III. Value of Sabbatical Project to Moorpark College and to VCCCD**

The mission statement of Moorpark College is "With a 'students first' philosophy, Moorpark College empowers its diverse community of learners to complete their goals for academic transfer, basic skills, and career education. Moorpark College integrates instruction and student services, collaborates with industry and educational partners, and promotes a global perspective." The district's mission is that it "provides students, in its diverse community, with access to comprehensive quality educational opportunities that support student learning and student success."

Time in a lab is critical to creating a positive impression of science courses. Putting resources and time into improving student experience is the definition of putting "students first." Creating more connections

through team building and discussion of shared data improves a sense of class community which aids retention in classes. In short, improving the lab experiments is exactly what offering comprehensive quality educational opportunities is about.

In department meetings, full-time faculty agree that many of our labs have serious problems. Some are too short, some are repetitive, and some cover concepts that are obscure. There is widespread agreement that an update is long overdue. Updating the labs to cover more relevant concepts and techniques will energize faculty and make the lab section a more lively environment. It is also my hope that once faculty see improvement in the labs, they will support further development and revisions of lab procedures, and perhaps be inspired to create additional new labs for other courses that also need updating.

#### **IV. Benefit to the candidate**

I have been teaching a combination of organic, introductory, and general chemistry courses at Moorpark College for 22 years, and have been department chair for the last eight years. As my time as chair comes to an end, I am looking forward to devoting my energies in new directions to serve the department. When I first arrived at Moorpark, I was asked to teach Organic Chemistry, but found there was no lab manual, no lab schedule, or even a record of what labs had been taught the previous year. The experience of writing and developing over 20 labs for that class has taught me a lot about how students respond to small changes in instructions, how to modify labs to improve their outcomes, and how much time it takes to develop a new lab procedure. I very much enjoy designing and planning new experiences for students, and feel a great deal of satisfaction when someone says at the end of the day that they enjoyed a lab.

#### **V. Conclusion**

Based on discussions with my colleagues, I believe revising the lab curriculum will be of great benefit to the students, and that my goal is reasonable, useful, and achievable in a semester. Thank you for your consideration.

Sincerely,

Robert Keil, Ph.D.  
Professor of Chemistry, Moorpark College  
rkeil@vcccd.edu

October 31, 2019

Members of the sabbatical committee,

I am writing this letter in support of Prof. Keil's 2021 sabbatical proposal to create new four or more labs for our General Chemistry M01A course. Our current lab schedule has several labs that are antiquated, ineffective or otherwise need overhauling. In addition, there is a need to create that labs that address other topics and use different pedagogy such as discovery-based learning, group work, and computerized data collection. I believe that his proposal is of reasonable scope to accomplish in a semester and would be of great value to the chemistry department.

Steve Joiner, Ph.D.

Moorpark College, Chemistry Department



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805 378 1400

30 October 2019

Re: Letter of Support for Professor Robert Keil's 2021 Sabbatical Proposal

Dear Committee:

I am writing this letter in support of my colleague and chair Dr. Robert Keil's 2021 sabbatical proposal to significantly improve the laboratory curriculum of CHEM M01A by specifically creating four new experiments. He is very qualified to create new labs based on his vast experience, academic training which includes postdoctoral fellowship, intimate knowledge of our typical Moorpark College CHEM M01A student. Dr. Keil also has the creativity that he can use to design new labs that would address how we can improve our student's critical thinking and laboratory writing skills.

I teach 3 large sections (about 9 lab sections) every year and I can attest to the need to revise our antiquated experiments. In addition, there is a need to create that labs that address other topics and use different pedagogy such as discovery-based learning, group work, and computerized data collection.

I fully support Dr. Keil's 2021 sabbatical proposal and I am confident that he has a reasonable scope that he is able to accomplish in a semester and would be of great value to our chemistry students.

Sincerely,

Vincent Mark B. Crisostomo, PhD  
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October 31, 2019

To the VCCCD Sabbatical Committee,

I am writing this letter in support of Prof. Keil's 2021 sabbatical proposal to create four or more new labs for our CHEM M01A (General Chemistry I) course.

Our current lab schedule has several labs that are antiquated, ineffective or otherwise need overhauling. In addition, there is a need to create labs that address other topics and use different pedagogy such as discovery-based learning, group work, and computerized data collection. We have computers with Excel and LoggerPro software, which utilizes our Vernier Software & Technology equipment, and the labs should reflect that modernization.

There are several experiments which myself and other faculty often trade out for something that teaches a similar concept or utilize the time for a worksheet or alternative activity where Rob has actually taken the time to test out the issues in his own class to try and resolve the problems with the written procedure. A sabbatical would allow more time for him to work on these efforts.

Having used the CHEM M07A & M07B (Organic Chemistry) lab manuals that Rob has developed many of the experiments for, I am confident in his ability to write labs at an appropriate level for CHEM M01A. I believe that his proposal is of reasonable scope to accomplish in a semester and would be of great value to the Chemistry Department.

Sincerely,

Jennifer Mallory  
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