

Faculty Development
Plan Name

Broad Career goals

1. To excel at teaching, mentoring, and scholarship.
2. To solve difficult problems in science.

Long-term themes of my scholarship program:

1. Extensive collaboration with researchers from a broad range of fields with and outside BYU
2. Extensive involvement of undergraduate students in cutting-edge research
3. Research aimed at solving difficult and important problems in protein science, medicine, energy, and materials science.

Specific scientific interests (*not a comprehensive list*)

1. Increasing the success rate and complexity of targets amenable to X-ray crystallography through generalizable protein engineering strategies.
2. Re-engineering radical SAM and other enzymes toward novel substrates and chemical reactions.
3. Modulating intracellular signaling, cell behavior, and developmental cell fates using designed proteins.
4. Time-resolved crystallography and trapping enzymatic reaction intermediates by crystallography.
5. Using microorganisms to bio-pattern/assemble micro-scale and macro-scale materials.
6. Virus particle design and modification.
7. Virus receptor ligand redesign and grafting.
8. Alternative carbon fixation pathways.

Current topics of research (will change and evolve as time goes on):

1. Development of polymer-forming crystallization chaperones to increase the success rate of, broaden the applicability of, and decrease the cost and labor to determine atomic-level protein structures
2. Structural enzymology and evolution of radical SAM enzymes
3. Computational design of radical SAM enzymes to accept new substrates and catalyze new reactions

Personal Assessment

Strengths

1. Creative approaches to solve problems
2. Commitment to self-improvement
3. Experience in computational protein modeling and design
4. Experience in experimental protein characterization and evolution
5. Experience in protein X-ray crystallography
6. Experience with anaerobic technique and enzymology

7. Experience in molecular cloning and library generation
8. Experience with grant application preparation
9. Experience in a broad range of life-science fields

Weaknesses

1. Limited publication record
2. Limited involvement in professional societies and conferences
3. No prior external funding
4. Limited foundation in physical chemistry
5. Limited foundation in synthetic chemistry
6. Limited foundation in physical theory underlying X-ray crystallography
7. Limited foundation in Cryo-electron microscopy
8. Insufficient knowledge of new developments in my fields of interest
9. Insufficient mastery of time management
10. Insufficient typing skills

Plan to accomplish broad career goals

Teaching

1. *Fall 2017*: Participate in workshops aimed at improving teaching techniques (Done)
2. *Fall 2017*: Guest-teach relevant courses taught by colleagues (Done)
3. *Winter 2018*: Finish developing CHEM 481 course (Done)
4. *Winter 2018*: Teach CHEM 481 course and fine-tune (Done)
5. *Winter 2018*: Invite student feedback of teaching effectiveness mid-semester and make corresponding improvements (Done)
6. *Winter 2018*: Utilize "Students Consulting on Teaching" program through CTL. Have my teaching observed mid-semester. Also have SCOT consultants solicit feedback from students and make corresponding improvements (Not done, do in Fall 2018 and possibly Winter 2019)
7. *Summer 2018*: Finish developing CHEM 489 course.
8. *Fall 2018*: Teach CHEM 489 course and fine-tune.
9. *Fall 2018*: Invite student feedback of teaching effectiveness mid-semester and make corresponding improvements.
10. *Winter 2019*: Teach CHEM 481 course again with improvements from Winter 2018.

Mentoring

1. *Fall 2017*: Identify and recruit graduate students and undergraduates to setup lab and generate preliminary data (Done)
2. *Winter 2018*: Train 1 graduate student and at least 3 undergraduates (Done, had 1 graduate student and 3 undergraduate students)
3. *Spring/Summer 2018*: Potentially recruit and train 2-3 more undergraduates (In process: have 1 graduate student, 1 Talmage intern, and 3 undergraduate students)
4. *Fall 2018*: Recruit and train 2-3 more graduate students (In process: have 2 incoming graduate students interested in joining the lab, possibly more)

Research

1. *Fall 2018*: Identify potentially fundable research projects (Done)
2. *Fall 2018*: Purchase equipment and supplies and setup lab (Done)
3. *Winter 2018*: Purchase remaining equipment and supplies and complete setup of lab (Nearly complete)
4. *Spring/Summer 2018*: Generate preliminary data for 2 potentially fundable projects: (In process)
 - a. Development of covalent crystallization chaperones
 - b. Structural determination of hydrogenase maturase complexes
 - c. Identify collaborations within BYU that can potentially lead to grant applications
5. *Spring/Summer 2018*: Complete remaining experiments for PFL-AE VL paper.
6. *Fall 2018*: Generate preliminary data for 1 further potentially fundable project:
 - a. Development of radical SAM enzymes for new chemistries
7. *Fall 2018*: Identify further potentially fundable research projects

Publication

1. *Winter 2018*: Complete 1 manuscript from postdoctoral work and submit for publication: "The B12-Independent Glycerol Dehydratase Activating Enzyme from *Clostridium butyricum* produces 5'-Deoxyadenosine and not 5'-Deoxy-5'-(methylthio)adenosine" (Done)
2. *Winter/Spring/Summer 2018*: Complete 1 further manuscript from postdoctoral work and submit for publication: "A pyruvate formate-lyase activating enzyme variant computationally engineered for reproducible crystallize-ability reveals that cis-peptide bonds are strictly conserved in a subset of radical S-adenosylmethionine enzymes" (In process)
3. *Spring/Summer/Fall 2018*: Complete 2 more manuscripts from doctoral and postdoctoral work and submit for publication: "Structural basis of valence localization in radical SAM enzymes" and "Computational design of high-affinity, highly selective protein-based inhibitors of Mdm4 and Mdm2"
4. *Spring/Summer 2018*: Revise "Glycerol Dehydratase" manuscript.
5. *Fall 2018*: Prepare manuscripts for research results generated at BYU.
6. *Fall 2018*: Revise "cis-peptide" manuscript.
7. *Winter 2019*: Revise "valence localization" and "protein-based inhibitors" manuscripts.

Funding

1. *Fall 2017*: Participate in BYU workshops aimed at improving grant writing techniques (Done)
2. *Fall 2017*: Identify potential funding sources for research projects proposed (Done)
3. *Winter 2018*: Identify further potential funding sources for research projects proposed (Done)
4. *Winter 2018*: Participate in NSF CHE CAREER Award seminar in Alexandria, VA (Done)
5. *Spring/Summer 2018*: Participate in Research Development's grant writing boot camp (Done)

6. *Summer/Fall 2018*: Prepare grant applications based on preliminary data obtained at BYU (In process)
7. *Summer/Fall 2018*: Seek feedback from colleagues regarding grant applications
8. *Fall 2018*: Submit first grant applications
9. *Fall 2018*: Apply for a Mentoring environment grant to support graduate student work
10. *Summer/Fall 2018*: Prepare white papers of current research projects and send to previously-identified NIH and NSF program officers

Citizenship

1. *Spring/Summer 2018*: Identify and join relevant professional societies (Done)
2. *Spring/Summer 2018*: Identify and register for relevant professional conferences (Done)
3. *Spring/Summer 2018*: Submit abstracts for posters and talks based on existing work (Done)
4. *Spring/Summer 2018*: Attend and present at relevant conferences (In process)
5. *Winter/Spring/Summer/Fall 2018*: Continue service in BYU Chemistry and Biochemistry Graduate Recruiting Committee (In process)
6. *Summer/Fall 2018*: Offer to serve on grant review panels for the NSF and NIH (In process)
7. *Spring/Summer 2019*: Assume leadership of and expand the Biochem Camp summer program

Resources requested

1. Feedback about research project ideas
2. Feedback about grant applications
3. Feedback about teaching techniques

Goals for Next CHEM 481 class (Winter 2019)

1. Evenly weight all midterm exams at 150 points each.

Previously each successive midterm exam was worth an increasing number of points. This gave students a false sense of security early on since the midterm exams also became increasingly harder as the course progressed.

2. Evenly space the midterm exams and the final exam.

Previously, the midterm exams covered different numbers of lectures and amounts of material. This resulted in some midterm exams covering an overly large body of material and placing a heavy studying burden in the students.

3. Increase the difficulty of the final and midterm exams.

The average total grade my previous section of CHEM 481 was 90%, well above the target grade guideline of 84%. Before allowing students to replace their lowest midterm exam score with their final exam score, the average total grade was 87%, still above the grade guideline. This data indicates that the average student in this course is capable of tackling significantly more difficult exams.

4. Limit the length of the final and midterm exams to 8 pages.

Previously, the successive midterm and final exams were 9, 12, 14, 7, and 8 pages long, respectively. The 14-page exam took students an average of 5 hours to complete, negatively impacting their performance. This necessitated giving students the option to replace their lowest midterm exam score with their final exam score, an option that will not be made available in future sections of this course.

5. Provide “Dr. Moody’s class notes” for all lectures.

About half way through the previous section of the course, at student request, I began posting my raw teaching notes on Learning suite. Students reported that this greatly enhanced their understanding and retention of the material.

6. Round final grade percentages to whole numbers.

Previously, I only rounded up if a student was on the borderline between a C+ and a B- or between a B+ and an A-. Many students that were on the borderline between an A- and an A (some of whom were very close to an A) wondered why their grades were not rounded up as well. Rounding final grade percentages to whole numbers elegantly and simply solves this problem, as students within a half point of the next letter grade will be automatically bumped up to that grade.

7. Emphasize early on the need for students to learn the course material by drawing connections rather than rote memorization.

Previously, the common student study strategy of rote memorization fell apart at the 3rd midterm due to the enormous amount of material in that exam. This material could be far better understood and retained by recognizing patterns and connections between the various concepts.

8. Increase the number of in-class demonstrations.

The previous time I taught CHEM 481, I did 3 in-class practical demonstrations. I have ideas for further in-class demonstrations that will provide students real-life examples of key principles taught in the class.

9. Invite a SCOT student consultant to collect feedback from the students in my absence.

Biochemistry

Winter 2019, CHEM 481, Section 001

8:00 – 8:50 a.m. MWF, Room: **TBD**

Instructor: Dr. James Moody

Office: C-201 BNSN, Phone 801-422-6272

E-mail: jdmood@chem.byu.edu (Email will get you a much faster response than sending a message via Learning Suite.)

Office Hours: **TBD**

TAs: **TBD**

Description: CHEM 481 is a mid-level biochemistry course for students in biological and chemical sciences who contemplate pursuing advanced degrees, including dental, medical, physician's assistant, and pharmacy schools. Topics include protein structure and function and the chemistry, mechanisms, logic, and regulation of cellular metabolism. The specific topics in this course are chosen to prepare you to perform well on the MCAT but will also benefit students taking the DAT and the Biochemistry GRE subject test.

Objective: By the end of this course, you will possess a framework for understanding and making use of biochemical information. You will learn about the molecules and enzymes involved in cellular metabolism, how biochemical transformations and metabolic pathways operate and interact in the body, and the logic behind their operation and interaction. The reason that professional schools require you to take biochemistry is so that you'll have a strong foundation of biochemical understanding upon which to build new knowledge and make intelligent decisions in your careers. To that end, I'll ask you to apply the knowledge you have gained in new and completely unfamiliar contexts.

Text: *Lehninger Principles of Biochemistry*, seventh Edition, Nelson and Cox. This is available from the BYU bookstore either as an eBook or as loose-leaf sheets. An older edition of the textbook is okay, but you will be responsible for coordinating your text with the 7th edition.

Prerequisites: You must have completed a two-semester organic chemistry course. At BYU, CHEM 351 and 352 or CHEM 351M and 352M fulfill this prerequisite. You must also have completed a basic biology course. At BYU, PDBIO 120, MMBIO 121, or BIO 130 fulfill this prerequisite. Due to the way BYU AIM works, you'll have email me for an add code if you took CHEM 352M or MMBIO 121, even though these are valid prerequisites. If you seek an exception, please contact me to discuss.

Evaluation:

Examinations: Four midterm examinations are scheduled, each one worth 150 points. These will be given in the testing center. The final will be cumulative and will be worth a total of 200 points. If you are unable to take a scheduled exam because of illness or other serious problem, email me or leave a message at the phone number above **before** the scheduled exam. An in-depth exam study guide will be posted in Learning Suite to help guide your study. These 5 exams together are worth 80% of your total grade. Graded midterm exams will be returned to you and a key will be posted. Regrade requests will be considered for midterm exams but not for the final exam. If you identify a mistake on your exam, please write the questions number and why you deserve a regrade on the front cover sheet of the exam. Note that regrade requests resulting from a professor or TA mistake are usually granted, while requests resulting from a difference of opinion are usually not granted.

Homework: There will be 11 graded homework assignments posted in Learning Suite, worth 12 points each. These assignments will be given out to correlate with the subject material and are usually due about a week after they are made available. The homework assignments together are

worth 13.2% of the total grade. After each homework assignment is due, a key will be posted in Learning Suite. Late homework without a valid reason will be accepted up to the final exam for half credit.

iClicker Quizzes: Unannounced iClicker quizzes and polls will occur at random points during the semester. These quizzes will often occur at the beginning of class right after the opening prayer. You get credit for answering, whether you're right or wrong, and answers are anonymous. I will drop the lowest 25% of iClicker scores. Together these are worth 6.8% of the total grade. You must register your iClicker at <ctl-clicker.byu.edu> in order to receive credit.

Grading: The grade will be determined at the end of the semester based on total points. A small number of extra credit points will be awarded for completing TA and instructor evaluations. The grading scale will be as follows:

- A 94% and above
- A- 90-93%
- B+ 86-90%
- B 83-86%
- B- 80-83%
- C+ 76-80%
- C 73-76%
- C- 70-73%
- D+ 66-70%
- D 63-66%
- D- 60-63%
- F Below 60%

The target grade for this course is 84%. If the final class average is below 84%, I will curve the grades up to make the average equal to 84%. If the final class average is above 84%, I will not curve the grades down. Please note that percentage grades will be automatically rounded up to the nearest whole number prior to assigning letter grades. That means that if you earn a 79.5%, you will receive a B- for the course, but if you earn a 79.499% for the course, you will receive a C+ for the course.

Study recommendations:

Lecture: As you take CHEM 481, I will do everything I can to help you understand biochemistry, but ultimately, the responsibility for understanding the material lies with you. I will post reading recommendations on the schedule in Learning Suite. You should read these before the corresponding lecture. I will use PowerPoint slides, but only for those things that I cannot draw quickly on the whiteboard. The PowerPoint slides will be posted in Learning Suite but will largely consist of images already in your textbook. A good tip: If I'm taking the time to draw something on the board, I strongly recommend drawing it in your notes. Much of the information in biochemistry is visual. Drawing structures, mechanisms, and pathways is a good way to reinforce the material. Many test questions will ask you to draw something. I will post my lecture notes for each lecture to help you grasp anything you missed in lecture and to help folks you missed lecture. I encourage student participation in lecture. After drawing and talking for a bit, I'll ask if there are any questions. This is your chance to get clarification about things that are unclear to you. We'll be using iClickers in class to help me know how well you are understanding the material.

Homework: The homework assignments are intended to reinforce and expand on the topics we discuss in class. My goal is for you to be exposed to concepts at least three times, once in your reading, once in lecture, and once in your homework. Homework questions have the same style as exam questions but are intended to be more difficult than exam questions.

Office Hours: If you're having trouble understanding something, make use of the TA and professor office hours; we're here to help you succeed! Like all of your professors, I'm super busy, but I set apart time each week just for you. In past classes I've noticed that students who came to office

hours often did better in the course. I've also noticed that students who need the most help never come and talk to me. Don't let that be you! I'll also hold review sessions before the final exam and each of the midterms.

How to remember everything: Biochemistry may have more material than any course you've taken thus far in college! If you try to rote memorize your way through the class, it's going to be very rough and may blow up in your face. Everything in biochemistry is related. The trick to keeping track of the massive amounts of information we'll cover is to identify patterns and relationships and establish connections between concepts. In biochemistry, many concepts and themes will appear over and over again in slightly different contexts. I'll teach you tricks for keeping it all straight.

Feedback: I care what you think! If something is not working for you in the course, tell me about it. I often accommodate reasonable requests for modifications to the course.

Sexual Harassment: As required by Title IX of the Education Amendments of 1972, the university prohibits sex discrimination against any participant in its education programs or activities. Title IX also prohibits sexual harassment-including sexual violence-committed by or against students, university employees, and visitors to campus. As outlined in university policy, sexual harassment, dating violence, domestic violence, sexual assault, and stalking are considered forms of "Sexual Misconduct" prohibited by the university. University policy requires any university employee in a teaching, managerial, or supervisory role to report incidents of sexual misconduct that come to their attention through various forms including face-to-face conversation, a written class assignment or paper, class discussion, email, text, or social media post. If you encounter Sexual Misconduct, please contact the Title IX Coordinator at t9coordinator@byu.edu or 801-422-2130 or Ethics Point at <https://titleix.byu.edu/report> or 1-888-238-1062 (24-hours). Additional information about Title IX and resources available to you can be found at <http://titleix.byu.edu>.

Students with Disabilities: Brigham Young University is committed to providing a working and learning atmosphere that reasonably accommodates qualified persons with disabilities. If you have any disability which may impair your ability to complete this course successfully, please contact the University Accessibility Center (UAC), 2170 WSC or 801-422-2767. Reasonable academic accommodations are reviewed for all students who have qualified, documented disabilities. The UAC can also assess students for learning, attention, and emotional concerns. Services are coordinated with the student and instructor by the UAC. If you need assistance or if you feel you have been unlawfully discriminated against on the basis of disability, you may seek resolution using established grievance policy and procedures by contacting the Equal Employment Office at 801-422-5895, D-285 ASB.

Honor Code: In keeping with the principles of the BYU Honor Code, students are expected to be honest in all of their academic work. Academic honesty means, most fundamentally, that any work you present as your own must in fact be your own work and not that of another. Violations of this principle may result in a failing grade in the course and additional disciplinary action by the university. Note that the testing center has decades of experience catching cheaters and they are very good at it. A first instance of cheating will result in a failing grade for that exam or assignment. A second instance will result in a failing grade for the course. All instances of cheating are reported the honor code office. Students are also expected to adhere to the Dress and Grooming Standards. Adherence demonstrates respect for yourself and others and ensures an effective learning and working environment. It is the university's and my expectation that each student will abide by all Honor Code standards. Please call the Honor Code Office at 801-422-2847 if you have questions about those standards.

Inappropriate Use Of Course Materials: All course materials (e.g., outlines, handouts, syllabi, exams, quizzes, PowerPoint presentations, lectures, audio and video recordings, etc.) are proprietary. Students are prohibited from posting or selling any such course materials without the express written permission of the professor teaching this course. To do so is a violation of the Brigham Young University Honor Code.

Tentative Schedule:

Week	Date	Lecture	Lecture Topic, W2019
Week 1	7-Jan	1	Intro, Amino acids
	9-Jan	2	Amino acids, Water
	11-Jan	3	Acid/Base
Week 2	14-Jan	4	Acid/Base/Peptides
	16-Jan	5	Separations
	18-Jan	6	Structure
Week 3	21-Jan	---	MLK Day
	23-Jan	7	myoglobin/hemoglobin
	25-Jan	8	myoglobin/hemoglobin
Week 4	28-Jan	9	Carbohydrates
	30-Jan	10	Carbohydrates
	1-Feb	11	Carbohydrates
Week 5	4-Feb	12	Carbohydrates
	6-Feb	13	Lipids
	8-Feb	14	Lipids
Week 6	11-Feb	15	Lipids
	13-Feb	16	Enzymes
	15-Feb	17	Enzyme Examples
Week 7	18-Feb	---	President's Day
	19-Feb	18	Kinetics (Monday instruction)
	20-Feb	19	Kinetics
	22-Feb	20	Energetics
Week 8	25-Feb	21	Glycolysis
	27-Feb	22	Glycolysis
	1-Mar	23	Pyruvate dehydrogenase complex
Week 9	4-Mar	24	Fermentation
	6-Mar	25	Citric
	8-Mar	26	Citric
Week 10	11-Mar	27	Mitochondrial respiratory chain
	13-Mar	28	Mitochondrial respiratory chain
	15-Mar	---	Spring Day
Week 11	18-Mar	29	ATP Synthesis
	20-Mar	30	Feeder pathways for glycolysis
	22-Mar	31	Lipid Metabolism
Week 12	25-Mar	32	Lipid Metabolism
	27-Mar	33	Glycogen/Gluconeogenesis
	29-Mar	34	Gluconeogenesis/Ketone Bodies
Week 13	1-Apr	35	pentose phosphate
	3-Apr	36	Amino group Metabolism
	5-Apr	37	Urea cycle
Week 14	8-Apr	38	Amino Acid Metabolism
	10-Apr	39	Amino Acid Metabolism
	12-Apr	40	One-carbon metabolism
Week 15	15-Apr	41	Metabolic regulation
	17-Apr	42	Metabolic regulation
	19-Apr	---	Final Exams start

Scholarship Strategies Project

Long-term themes of my scholarship program:

1. Extensive collaboration with researchers from a broad range of fields both within and outside BYU
2. Extensive involvement of undergraduate students in cutting-edge research
3. Research aimed at solving difficult and important problems in protein science, medicine, energy, and materials science

Current topics of research (will change and evolve as time goes on):

1. Development of polymer-forming crystallization chaperones to increase the success rate of, broaden the applicability of, and decrease the cost and labor to determine atomic-level protein structures
2. Structural enzymology and evolution of radical SAM enzymes
3. Computational design of radical SAM enzymes to accept new substrates and catalyze new reactions

Specific scholarly goals to be achieved by February 2019:

1. Purchase remaining equipment and supplies and complete setup of lab
2. Generate preliminary data for 2 potentially fundable projects:
 - a. Development of covalent crystallization chaperones
 - b. Structural determination of hydrogenase maturase complexes
3. Complete remaining experiments for PFL-AE VL paper
4. Generate preliminary data for 1 further potentially fundable project:
 - a. Development of radical SAM enzymes for new chemistries
5. Complete 1 further manuscript from postdoctoral work and submit for publication: "A pyruvate formate-lyase activating enzyme variant computationally engineered for reproducible crystallize-ability reveals that cis-peptide bonds are strictly conserved in a subset of radical S-adenosylmethionine enzymes"
6. Complete 2 more manuscripts from doctoral and postdoctoral work and submit for publication: "Structural basis of valence localization in radical SAM enzymes" and "Computational design of high-affinity, highly selective protein-based inhibitors of Mdm4 and Mdm2"
7. Revise "Glycerol Dehydratase" manuscript.
8. Prepare manuscripts for research results generated at BYU.
9. Revise "cis-peptide" manuscript.
10. Revise "valence localization" and "protein-based inhibitors" manuscripts.

Specific new scholarly productivity strategies to be implemented by February 2019:

1. Set aside regular scheduled time each week (2 hours) to stay current in the literature and advancements in my field of expertise or in new related fields of expertise.
2. Read methods literature in new research areas to broaden tools available to my research program, such as in chemical cross-linking, mass spectrometry and cryo-electron microscopy.

3. Set aside regular scheduled time each morning (2 hours) for writing (manuscripts, grants, white papers, teaching materials, etc.) where I am unavailable to my students and colleagues. I will most likely need a workspace other than my office or lab for this.
4. Submit white papers on crystallization chaperones, hydrogenase maturase complexes, and radical SAM enzyme design projects to previously-identified NIH and NSF program officers.
5. Apply for a BYU Mentoring Environment Grant in the Fall of 2018.

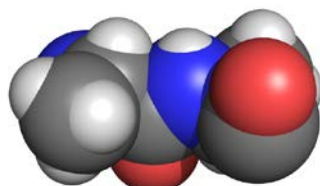
Evaluation

1. The reading and writing goals will be evaluated by tracking the number of hours each week dedicated to each activity.
2. The Mentoring Environment Grant and white paper goals will be either “done” or “not done” by February of 2019.

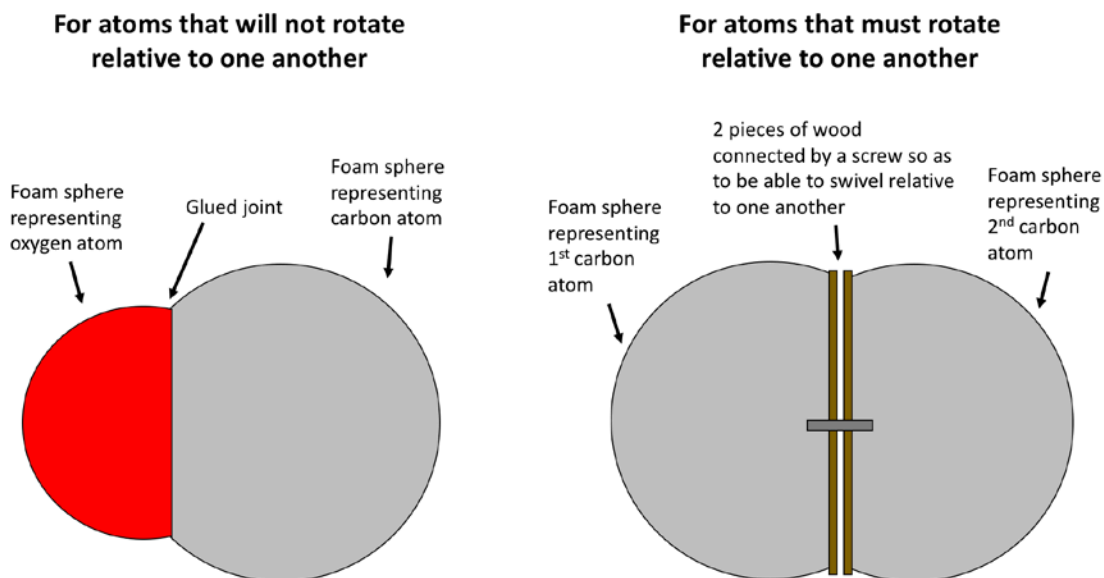
Teaching Grant Proposal

I find that students have a hard time visualizing how the space occupied by atoms in a protein influences the backbone structure of that protein. Common graphical representations of proteins use either a simple cartoon representation of the backbone structure or a stick representation of the bonds between adjoining atoms. These representations fail to represent the space occupied by the electron orbitals of these atoms. The electrical repulsion between the electron orbitals of nearby atoms help dictate protein shape. Currently available molecular models likewise do not accurately represent the space filled by the electron orbitals of atoms and are thus insufficient to demonstrate how these electron orbitals influence protein structure.

Having searched commercially available products in vain for a suitable model, I propose the creation of an accurate, true-scale space filling model of a protein peptide bond. This scale model would consist of 16 stiff foam spheres (of between 2.5 and 7 inches in diameter) attached to one another as seen below:

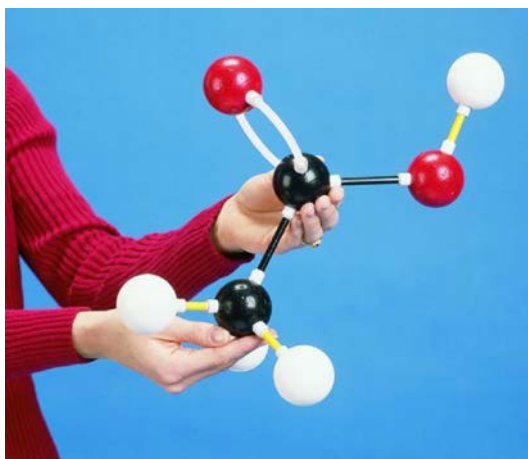


As the electron orbitals of atoms that are bonded to one another overlap, so too the foam spheres in this model would be cut and glued together to accurately represent this reality. Some atoms are able to rotate relative to one another. These rotatable bonds would be created by connecting 2 appropriately-sized circles of wood by a swivel joint at their centers and gluing the cut foam spheres to the outsides of each piece of wood, as seen below:



The sizes of the spheres, the overlap between them, and the position of spheres relative to one another will all be based on experimentally-determined values so as to result in an accurate model. The foam spheres will be spray-painted with colors conventionally associated with the different types of atoms in the model. This model will be approximately 21 inches wide, so as to be easily visible to students sitting far from the front of the room, but also small enough that the model can be passed around the room for up-close, hand's-on evaluation by the students. The swivel joints will allow portions of the model to be moveable so as to illustrate the movement of actual atoms in a protein peptide bond. I anticipate this model will cost approximately \$100 in materials and about 10 hours to produce.

This scale space filling model will greatly enhance students' ability to grasp the concepts of electron orbital overlap, bond rotation, electrical repulsion of nearby atoms, and the contribution of these principles on protein backbone structure. The new model will be used in conjunction with commercially available oversize ball and stick molecular models, as ball and stick models allow students to see bonds between atoms, a feature hard to discern in a space-filing model. The "Giant Size molecular model kit" from Sigma-Aldrich for \$285 is an appropriate large-size ball and stick model kit and is considerably superior to large size model kits currently available in the department. I propose to purchase this commercial ball and stick model kit (shown below) as well.



If the new scale space filling model serves well, future space filling models may be made that represent a longer stretch of protein backbone. These longer models can be used to teach students about how bond rotation and electrical repulsion influences common protein backbone structures such as helices, sheets, and turns.

Citizenship Project Proposal

Specific collaborative goals to be completed by December 2018:

1. Establish new collaborations with BYU colleagues within and outside the department of Chemistry and Biochemistry:
 - a. I currently have collaborative projects with Barry Willardson, Ken Christensen, and Josh Anderson
 - b. By December, my goal is to finish establishing collaborative projects with Joel Griffiths and JC Price.
 - c. *Longer term goals include establishing collaborations with Dario Mizrachi, Steve Castle, and Dan Ess.*
2. Assume leadership of and expand the “Biochem Camp” summer program (as part of my service in the Chemistry and Biochemistry Department Recruiting Committee). *This goal will actually be completed by the end of Summer 2019, but merits mention here, as the planning for next summer begins this year.*
3. Offer to serve on grant review panels for the NSF and NIH.
4. At the Protein Society Annual Symposium, identify at least 1 potential new collaborator.
5. Increase attendance in departmental seminars to at least 50%.
6. Invite and host 1 seminar speaker.

Evaluation:

Each of these goals will be either “done” or “not done” by December of 2018.