MACTLAC

MIDWESTERN ASSOCIATION OF CHEMISTRY TEACHERS IN LIBERAL ARTS COLLEGES

2016 Annual Meeting Report
The 64th Meeting of MACTLAC
Reimagining Chemistry: Innovations in Undergraduate Chemistry Curricula
College of Saint Benedict, St. Joseph, MN
October 7-8, 2017

General Session 1, Friday Afternoon, 1:00 PM

Anna McKenna opened the 2016 Annual Meeting by welcoming everyone to the College of Saint Benedict (CSB). Anna then introduced the President of the College, Dr. Mary Hinton. Dr. Hinton welcomed every one to CSB, and went on to describe the College and their partnership with St. John's University. She then described how the Chemistry Departments at the two institutions have totally revamped their chemistry curriculum in a very innovation fashion, which would be the focus of this year's meeting. She closed by thanking all those in attendance for their support of science education at liberal arts colleges. After Dr. Hinton's welcome, Anna introduced the first speaker.

Plenary Address

Evidence-Based Approaches to Curriculum Reform and Assessment
Dr. Melanie Cooper, Lappan-Phillips Chair of Chemical Education
Michigan State University, East Lansing, MI.

Dr. Cooper began her talk with the question: "Why don't students learn what we teach them?" The most common answer is to blame the student, but she believes there is a superior answer that involves thinking about ways to better engage students in their own learning. Dr. Cooper thinks there are five ways to do this: using active learning strategies; using affective techniques that target motivation, expectations, and values; using cognitive techniques; using appropriately designed classrooms; and having an appropriately designed curriculum. Of these five ways, Dr. Cooper believes that curriculum design is really the crux of the matter. Dr. Cooper then presented evidence to support this hypothesis.

One piece of evidence came through her teaching of Lewis structures, where students should be able to predict physical properties based on their structures. She interviewed "good" general chemistry students by asking them to do this, but very few could do it in a rational way. The problems students encountered were grouped into representation problems, terminology issues, phase change misunderstandings, personal reasons, instructional reasons, and "more means more" (more carbons means higher boiling point, for example). Dr. Cooper said that this showed a curriculum issue since all of these students used the first four methods described in the first paragraph.

To predict physical properties from Lewis structures, the usual curricular process goes from molecular formula to Lewis structure, and then from structure to electron geometry and molecular geometry, bond polarity and molecular polarity, and finally to property predictions. She believes that no beginning student can do this from memory, and as a result, they don't really know what

they are doing: they can draw the structures, but they can't use them. Thus, if they can't use Lewis structures to predict properties, why teach them how to draw Lewis structures?

Dr. Cooper then presented another general chemistry example that involved hydrogen bonding to demonstrate the need for good curriculum design. She asked students to draw structures that showed hydrogen bonding, dipole-dipole interactions, and London forces. Most students draw the intermolecular force as intramolecular forces, and only 1 student out of 97 drew all three structures correctly. When she checked with the student's instructors, these were being presented correctly as intermolecular forces. Thus, the curriculum is again at fault as students are good at answering these questions, but they don't really understand what they mean.

One of the issues in curriculum design that Dr. Cooper thinks is important is that experts organize their information into frameworks that are different from beginning students. Experts use fragments of information to form bigger frameworks. Students, on the other hand, take the fragments and simply add them to an every growing pile of fragments and don't integrate them into expert frameworks. So, MSU embarked on a multi-year plan to revamp their general chemistry curriculum based on the report "A Framework for K-12 Science Education". To ensure that this new curriculum worked, her group had to design new assessments to determine whether it did or not. Designing the assessments was easy, but making them usable in a class of 450 students was a bit more daunting problem.

Dr. Cooper then briefly described their new general chemistry curriculum: CLUE (Chemistry, Life, the University, and Everything). A typical class uses review homework from beSocratic (their homework system), lecture, and modeling core concepts. Students are getting better grades, and they are scoring above average on ACS conceptual exams. She also described various other assessment results that suggest that CLUE students do have more expert like frameworks than non-Clue students. For instance, the intermolecular forces problems described above disappear by the end of CLUE General Chemistry, whereas for non-CLUE students this problem persisted all the way into their forth year.

Dr. Cooper finished her talk by describing her current research, which involves how changing a prompt question can have a huge impact on student response. With the right prompt questions, students can (and will) give very sophisticated answers. For example, changing the way chemical reactions are presented can have a large impact on understanding.

General Session 2, Friday Evening, 7:00 PM

Plenary Address

Examples of Academic-Industry Collaborations at an Undergraduate Institution
Dr. J. Thomas Ippoliti, Professor of Chemistry
University of St. Thomas
St. Paul, MN

Dr. Ippoliti began his talk by describing how to start an industry-academic collaboration. First and foremost, the guiding principle for such collaborations should always be educational for the undergraduate student and provide them with a good experience. How Dr. Ippolitit found such collaborations have been by word of mouth, networking with friends from graduate school and post-docs, and from former students now working in industry.

Some examples of his by word of mouth collaborations are: Vision-Easy to synthesize photochromic compounds, Martrex to synthesize isotopically labelled molecules, Chromatic Technologies Inc. to make thermochromatic molecules, Imation to develop and synthesize dye for

blu-ray DVDs, and Medisyn to make new antibiotics. With the Vision-Easy collaboration, it started with a phone call from Frank Hughes in 1992, where Frank asked, "Can you make a photochrome?" Vision-Easy was at that time purchasing photochromic lenses from Transition Lens, but they wanted to be able to make their own. The chemistry behind the photochromic dye is that when it is exposed to UV light, the molecule undergoes a reversible rearrangement. The dyes used by Transition Lens at the time were spirooxazine (a red dye) and Photo L (a yellow dye), which where under patent. Because of those patents, they added a cyclopentane ring to both dyes to avoid infringement. The resulting dyes had a long fade time, but unfotunately a red color. Since Vision-Easy wanted a gray colored dye (which Transition Lens was achieving by mixing their red and yellow dyes together), Dr. Ippoliti's group worked to make a blue colored dye that when mixed with their long fade red dye would achieve the same result. Today, photochromic lens technology has changed to the point that only one dye is needed: the dye absorbs across the visible spectrum, and thus looks gray when exposed to UV light.

Dr. Ippoliti also described another by word of mouth project: Chromic Technologies needed to make thermochromic compounds, which they wanted to use as indicators for a variety of purposes like beer labels that change color to indicate coldness. The chemistry behind the indicators is two part: a dye is imbedded in an ink that contains a developer (a wax). At high temperatures the dye is physically too far away from the developer to change color due to the ink's thermal expansion. When chilled, the ink contracts, moving the dye closer to the developer, causing the dye to change color via proton transfer with the developer. To make for a more intense color change, Dr. Ippoliti's group had to make the dye more hydrophobic so that it would better dissolve in the developer.

For networking collaborations, Dr. Ippoliti listed several examples: ExxonMobil to synthesize structure directing agents, Bayer to make a paint that would cure more slowly, Bostik to make a diaper compound that would change color when wet, but not when exposed to high humidity, Boston Scientific to make new drug eluting coatings for stents, and Bioamber to make new fine chemicals based on succinnic acid. Dr. Ippoliti went on to described the ExxonMobil collaboration in detail. Structure directing agents are zeolites, which are useful catalysts for separation and storage. They can be made in all different shapes and sizes, so the cage where the separation and storage catalysis takes place can be made to fit individual needs. Diammonium salts are used to make the holes in the zeolites, which are later burned off to generate the space in the zeolite.

Dr. Ippoliti next listed a few collaborations that arose with former students: HBFuller to make new catalysts for powder coatings, Gel-Pak to make new adhesives, Hypoguard, Inc. to make chromogentic enzyme substrates, and Medtronic to make polyurethane model compounds. Dr. Ippoliti then described the chemistry for the chromogentic enzyme substates. Urine test strips are used to detect the presence of urinary tract infections. Since the patent had expired on the original test strips, his group focused on a way to make the chromogenic compound efficiently. They designed a four step process, two of which had to be done in the absence of O_2.

Dr. Ippoliti next described several things to consider when doing industry collaborations, like intellectual property (IP), payments, and performance benchmarks. Dr. Ippoliti emphasized that you must check with your in house counsel to deal with all of IP and other contractual issues. Industry collaborations work best if your institution is willing to assign IP rights away, for example. In terms of other contract details, Dr. Ippoliti advised that they should include a monthly minimum payment (say ~$3,000/month) plus the cost of chemicals and other supplies, have a 3 month minimum length, and separate consulting fees. He also advised that you should retain publishing rights, and that you shouldn't promise too many deliverables, as those can hamstring your work.

Dr. Ippoliti closed his talk by briefly describing several of the instruments that industrial collaborators have bought for his research lab, and by describing several spin-off projects that he has incorporated into his teaching.

General Session 3, Saturday Morning, 9:30 AM

Plenary Address

Designing a New Curriculum at CSB/SJU
Dr. Chris Schaller, Professor of Chemistry
College of Saint Benedict/St. John's University
St. Joseph and Collegeville, NM

Dr. Schaller began his talk by thanking the Association for inviting him to speak. He also thanked those that organized the meeting and those that attended.

He next reviewed the American Chemical Society's Committee on Professional Training (CPT) guidelines from 2008, which was the basis for their new curriculum, and which was published in the *Journal of Chemical Education* (*J. Chem. Ed.*, 2014, **91**, 321-328). Their new curriculum is less siloed and much more blended, and does so by breaking the traditional approach into three basic areas: structure, reactivity, and quantitation. Dr. Schaller then described in detail the various courses in their new curriculum (see the *J. Chem. Ed.* article for specific details), as well as their texts and student resources.

Since this is a radical change in the traditional chemistry curriculum, they had to develop teaching cohorts; team teaching strategies; writing common exams, questions, and workbooks; shared work strategies; and giving people jobs they were good at. They have also done assessment to learn how this curriculum has improved student performance. These included external reviews; student surveys before and after a class ("How strongly do you agree?" type of surveys, as well as other soft surveys); ASO (average student outcome (their course grade)) and DFW (D's, F's, or W's) data; enrollment data; ACS exams (which don't really match well with the new curriculum, so this assessment has its problems); MFAT (Major Field Assessment Test) and DUCK (Diagnostic for Undergraduate Chemical Knowledge), which are senior exit exams; and fates of graduates.

Dr. Schaller ended his talk by thanking everyone in the Department for their work on designing and implementing their new curriculum.

MACTLAC Business Meeting

1. The meeting was called to order at 8:37 AM by President Paris Barnes. He thanked the College of Saint Benedict/St. John's University and Ed McIntee and Anna McKenna for hosting and organizing this year's meeting, respectively. He complimented them on how well the meeting was organized, and the excellent quality of the meeting speakers. He thanked the attending graduate students, and asked them to be sure to check out the placement board for positions at small liberal arts schools. He lastly thanked all for attending and the Executive Council for running the Association.

2. The Treasurer's report for 2016 was presented by Mark Sinton. The Association's finances have continued to increase, so the Association is still on good financial footing. Mark mentioned that the reason for the increase in the Association's funds was due largely to host institutions not requesting full meeting reimbursements. He encouraged host institutions to do so, so as to spend down the Association's cash reserves. Otherwise, the Association will be subject to more onerous IRS reporting requirements. A motion to accept the Treasurer's report was made and seconded. The motion passed.

Year	2011	2012	2013	2014	2015	2016
Beginning Assets						
Checking	$5,631.52	$7,373.13	$8,100.58	$8,888.59	$10,298.66	$10,865.15
Savings	$0.00	$0.00	$0.00	$0.00	$0.00	
Total Beginning Assets	$5,631.52	$7,373.13	$8,100.58	$8,888.59	$10,298.66	$10,865.15
Income						
Dues	$420.00	$1,320.00	$470.00	$440.00	$720.00	$400.00
Annual Meeting	$4,280.11	$2,295.00	$2,110.00	$4,255.00	$2,090.00	
Interest	$14.34	$11.26	$11.31	$10.43	$11.16	$7.34
Other	$598.52	$60.00	$0.00	$0.00	$0.00	
Total Income	$5,312.97	$3,686.26	$2,591.31	$4,705.43	$2,821.16	$407.34
Expenses						
Postage, copying, website	$246.06	$147.16	$199.30	$143.14	$164.19	$13.80
Annual Meeting	$3,325.30	$2,811.65	$1,604.00	$3,152.22	$2,069.93	
Placement, Archives	$0.00	$0.00	$0.00	$0.00	$0.00	
Other	$0.00	$0.00	$0.00	$0.00	$20.55	
Total Expenses	$3,571.36	$2,958.81	$1,803.30	$3,295.36	$2,254.67	$13.80
Ending Assets	$7,373.13	$8,100.58	$8,888.59	$10,298.66	$10,865.15	$11,258.69
Asset Change	$1,741.61	$727.45	$788.01	$1,410.07	$566.49	$393.54

3. Secretary's Report for 2016 was presented by Mark Sinton. Mark pointed out that the number of members in arrears has been going down for last three years. Unfortunately, Mark then noted that just over 70% (181 of 258) of the Association's members are either in arrears or have Emeritus or Honorary status. Of these 181 members, 50 (19%) have Emeritus or Honorary status, and so are excused from paying dues, and 131 (51%) are one or more years in arrears. Mark noted that should the membership stand at the end of the year as indicated in this report, 56 members will be removed from the membership database for non-payment of their dues as per the Association's By-Laws. A motion to accept the Secretary's report was made and seconded. The motion passed.

	2011	2012	2013	2014	2015	2016
Beginning Membership	384	297	287	293	296	253
New Members	3	25	35	11	2	6
Members Removed	90	35	29	8	45	3
Ending Membership	297	287	293	296	253	258
Member Dues Breakdown						
Emeritus and Honorary members	43	47	47	49	47	50
Paid up members	86	65	67	70	64	77
In arrears members	168	175	179	166	142	131
Total Dues Paying Units	297	287	293	296	253	258
Member Dues by Year						
Paid up	86	65	67	70	64	77
One year behind	57	74	83	45	75	29
Two years behind	64	43	47	54	29	46
Three years behind	47	58	49	67	38	56

4. Brad Sturgeon presented the 2016 Archivist report. (Note: Brad was appointed as the new Archivist at the Friday morning meeting of the Executive Council, but the report below is from John Zimmerman, the previous Archivist. The questions raised in John's report were addressed at the Executive Council's Friday morning meeting.) Brad thanked John and Tracy Thompson for the service they have provided to the Association as previous Archivists. Brad went on to described the transition of the archive materials to Monmouth College. He briefly described the current access options to the archives, and how they will be fully digitized and searchable, hopefully by next year's Annual Meeting at Monmouth College. Access will be free of charge. A motion was made and seconded to accept the Archivist's report. The motion passed. The Association again thanked John and Tracy for their work.

   The Business Meeting minutes from Millikin University put forth my concept that the Archive office be closed and the annual updates be met with copies of the annual report. Where to put the documents was solved when Brad Sturgeon said Monmouth would be very interested in active as archive holder. The case seemed to be closed, but alas, complications arose. It is not clear to what extent we need to sign over the material. At first, I thought that was a bad deal; however, it may make sense to have the material in a secure, organized form, especially so when it is housed at the site of the original MACTLAC meeting site. As a result, I suggest that we discuss this and come to a resolution at our next meeting. I also suggest my name be removed from Archivist to be replaced by Brad Sturgeon of Monmouth. This makes sense if we pass archive materials on to Monmouth College.

   As we verify this transfer of duties, we need to have some additional information to clarify the access and essence of the archived MACTLAC holding. Some questions that we need to answer are below.

   1) What is the fate of the archival documents now at Monmouth? Will they be digitized?
   2) What is the fate of the host of prints (mostly not annotated)?
   3) What is the fate of the meeting image sets archived on Smugmug?
   4) Can we link the Monmouth archive to the MACTLAC on-line holding of meeting archives?
   5) What is the process for updating the archive?
   6) What is the process for gaining access to the MACTLAC archive? Is there a charge? Would there be access to a Xerox machine?

5. Larry Ferren presented the 2016 Placement Officer report. Larry briefly described the purpose of the Placement Officer. The Placement Officer maintains a list of candidates, sends out position announcements to candidates on the list, and places position announcements on the Association's web site. A list of positions is also posted at each Annual Meeting. Currently, 38 applicants are in the system, with 16 positions announced. He then announced that Colleen Munro-Leighton will be taking over the Placement Officer position. Larry will work with Colleen to transition the Placement Officer position. He thanked the Association for allowing him to serve the Association in this manner. A motion was made and seconded to accept the Placement Officer's report. The motion passed. The Association thanked Larry for his work. (Note: shortly after this year's Annual Meeting, Colleen informed the Executive Council that she would not be able to assume the role of Placement Officer as planned. Since the Placement Officer is a presidential appointment, Jessica Bonjour, our current President, reappointed Larry as Placement Officer for an additional year, which he was in agreement with. Since this is a temporary solution, the Association is still looking for a replacement for Larry.)

In 2016, 38 applicants used our Placement Service, while 16 positions were advertised with it. Of the positions advertised, all 16 were from MACTLAC Colleges. All the positions advertised were either located by way of advertisements placed with the Placement Service, C & E News, the Internet, or electronic notices forwarded to me by various sources. The MACTLAC positions were advertised only to those candidates who had e-mail capabilities. Of the 16 positions listed, 29% were Organic Chemistry, 23% were Analytical Chemistry, 0% were Physical Chemistry, 18% were Biochemistry, 6% were Inorganic Chemistry, and 24% were Introductory/General Chemistry.

All MACTLAC schools with positions open had their advertisements forwarded to Craig Bieler who placed them on the MACTLAC web page. The MACTLAC schools were very good at sending me notices of open positions. I appreciated the notices and tried to respond promptly when a notice came in to get it out to everyone on the electronic list and to get it to Craig for posting on the web page.

Applicants to the Placement service remained in several groupings -- graduate students, Ph.D.'s as post doctorates, and some professors at MACTLAC schools looking for positions. This past year six new candidates came into the Placement Service, and eight candidates had their names removed from the service after securing positions. Presently (September, 2016), 30 candidates are in the Placement Service looking for employment. The Placement service will have a bulletin board at this meeting to advertise positions currently available.

Colleen Munroe-Leighton of Elmhurst College has expressed a willingness to do the work of the Placement service. She is enthusiastic about doing this. However, due to some family considerations she is not always going to be able to attend the annual meeting. I am willing to try to attend the annual meeting and fill in for her in times when she is unable to do so if this would be OK with the council members. There may be times, however, when neither of us can be there. (A case in point will be next year as I will be traveling out of the country at the time of the annual meeting, and Colleen thinks that she will be unable to attend.)

The board needs to discuss what it wants to do. I can serve the coming year, but cannot attend board meeting next year. Colleen can begin to serve, and she could send the material to the meeting with someone else next year. Hopefully, after that either she or I could attend. Alternatively, we could keep looking for another person to fill the position of Placement.

6. President Paris Barnes then announced that Larry Ferren from Olivet Nazarene University and Lou Sytsma from Trinity Christian College have been granted Emeritus status. Paris then presented an Emeritus status certificate to Larry. Paris asked Mark Sinton to send to Lou his Emeritus status certificate as he was not in attendance at the meeting.

7. Paris Barnes introduced the new state representatives for Missouri (Christopher Halsey from Westminster College), Iowa (Matthew Zart from Wartburg College), and Minnesota (Christopher Jordan from Saint Mary's University of Minnesota).

8. Paris Barnes next opened the floor for nominations for the Association's next President. James Wollack nominated Kim Ha from St. Catherine University. There being no other nominations, Kim was elected by acclamation.

9. After the presidential election, a motion was made to have the Secretary-Treasurer send the following letters of thanks. The motion was seconded and passed.

Outgoing Officers: James Wollack, John Zimmerman, and Larry Ferren
Outgoing State Representatives: Kim Ha (MN), Joshua Stratton (IA)
Host Institution: CSB/SJU
Host Organizer: Ed McIntee and Anna McKenna
Others: None

10. Brad Sturgeon from Monmouth College invited the Association to his campus for the 2017 Annual Meeting. The theme of the meeting will be around food and water, and it will be held on October 13th and 14th, 2017. Debra Shore, Commissioner of the Chicago Area Water Department, will likely be one of the speakers. The other two speakers are to be determined. He briefly described some of the breakout sessions that will likely take place, as well as the launch of the digitized archives. Ed McIntee then passed the MACTLAC Banner to Brad for use at the 2017 meeting.

11. President Paris Barnes reviewed for the Association future meeting sites. He reminded those hosting a meeting to request their full reimbursement. He also asked that anyone interested in hosting a meeting should have their President send an invitation letter to the Secretary-Treasurer.

    2017: Monmouth College (Central)
    2018: Hillsdale College? (East)
    2019: St. Catherine University (West)
    2020: ? (Central)

12. Paris Barnes next handed the Business Meeting off to the incoming President, Jessica Bonjour. Jessica thanked Paris for his work as President.

13. Jessica Bonjour asked the Association if there was any other business. Christopher Halsey asked the Association if it could provide small gifts of appreciation to outgoing officers. Paris Barnes briefly described the potential gift ideas, such as pens or gift cards. A Motion was made to make a gift of $30 to out going Officers, and an annual $30 gift to the Secretary-Treasurer. The motion was and seconded. The Association discussed potential gift ideas. A friendly amendment was made to include the Placement Officer and the Archivist. The amended motion passed. Brian Johnson reminded session recorders to get their notes to him as soon as possible. He also announced that each attendee will receive a loaf of Benedictine baked bread. He also thanked the sponsoring vendors, and awarded a door prize.

14. No other business being brought forward, a motion to adjourn was made, seconded, and passed. Meeting adjourned at 9:22 AM.

Respectfully submitted,
Mark Sinton
MACTLAC Secretary-Treasurer

Discussion Groups

Alternative First-Year Chemistry Courses
Friday, October 7th, 2017
2:45-3:30 PM
Anna McKeena, College of Saint Benedict/St. John's University, Session Leader

People shared examples of their introductory course:

Participant decided to flip classroom. They were taping lectures using Atoms first. Exposed students to material before class. Worked through harder problems in class. First year. Are they enjoying it? Seem to be glomming onto it. Students could see why we are doing things. Students liked seeing more hard problems. Some may not watch lectures ahead. Any push back? Not that I've seen. Most push back was early on. After first exam saw what chem was like. What past exposure do students have to flipped? Come from varied background. Experienced - many had individual attention in high school. Do hard problems from worksheet. Work in groups. How many in a group: 3. Gave ACS pretest for skills. Mixed skill levels within groups. Would you change groups? Occasionally reminds people about power point or reminds people to look in the book.

Person who has been doing flipped for 20 years told their experience. On the first day grouped people who lived on campus near each other. Worked with 3-4 in a group. Move around groups during the term. At the end of term allowed students to pick groups and they often reform to original group. Some faculty using flipped watch group and evaluate roles. Prof has gotten feedback from some students who don't like flipped. By midterm they understood flipped. One student complained everyday for the first 2 weeks about flipped. Student expectation is that professor will lead them through the material. Rather than doing own taped lectures this person said they looked on web for suitable online videos that others made. Looks for videos that are interesting. Evidence students got more out of videos than from reading.

Used Silverberg switched to Atoms first. Colleague was concerned about labs not fitting schedule.

Used POGIL units. Have to do pre-activity and practice problems ahead. Gives some test points for doing pre activities. She has done this 2 years. Assigns roles for groups and then has evaluation of the group. Some students worked well together. Changed group and second time in class students jumped right into it. Students realized they would prefer to prepare ahead rather than being embarrassed in class. Tasks include a recorder, reporter, taskmaster: each had 3-4 people. 47 students in the whole class. Its not about finishing the worksheet or getting everything done - its about working together.

Some students don't want to waste time explaining. Now have page turn rule - group can't turn page in workbook until everyone is ready.

Haven't implemented but have been talking about structuring courses to be problem based. Haven't tried yet. How do you balance problem solving and content?

Tried Chem and Bio faculty linked class for a short time, but found it difficult

Honors students like problem based classes. Do other students?

Are there things that you leave out? One mentioned leaving out "physics". Shy away from math things that are less related to chem.

One participant said in intro class they decided to have no quantitative material - only structure and function. Some quantitative material comes in labs. In fourth semester equilibrium calculations come in. Was there push back? NSF liked it and gave grant. Biology faculty were nervous, especially pre-med. Transfers were more complex. Decided to get rid of lines between topics, so no divisions: study reactivity in Lewis acid activity and introduce nucleophilic mechanisms, for example. Class is 1/3 organic, 1/3 biochem 1/3 general interwoven. Upper division consisted of 2 credit topic courses. Integrated labs. No text books available. Online web texts are used. Developed a lot of unique labs. Conceptual stuff taught first. Numbers start to mean something after learning the mechanisms. How did you handle the transition of the program into the new format? That is difficult. Some overlap of both old and new curricula at the same time. The NSF grant helped. Administration was supportive. Use actual ACS exams. Handed them 3 packets: organic, biochem, general using 3 sets of exams. Students had a list of what problems to answer. Now ACS is designing online ACS exam for their program. ACS exam can give norms for individual questions. Motivation - Wanted to get students doing research early and wanted to start with atoms and molecules. Wanted to save time and showing how different divisions rely on same skills. It was hard to switch. Now students can take any of the first 4 intro classes every term. Can take fourth "quantitative course" after first term course. This helps bio. Normal pattern is to take reactivity 2 then reactivity 3. Now has more majors than you did before. Went from 20-25 into 40s in number of students. In fall have 10 sections - total of 300 students. Originally putting faculty with different specialties together as team to teach. Faculty got used to walking down the hall and asking colleagues questions. Workbooks used don't have answers.

What are the pros and cons of putting off quantitative parts? This delays being able determine uncertainty. Some students have a big challenge with math. How do you teach students to reason through logic of conversions. Numerical problems are sometimes easier for students to answer than qualitative or conceptual problems. Formulas can be a crutch. Some students are afraid of converting a word problem into something that they can solve. It is hard for students to distill out the data that they need to use to solve the problem. It would be helpful if the students retained the answers to conceptual questions for future advanced courses. Should understand procedure to use logical approach. It is helpful to teach students to use scaffolding - separate problem into small steps. Want student to think about metacognitive process of solving problems. In best groups, metacognitive process come out.

How much of class time is spent doing group work in flipped classroom? Most of class time. Use 5 question mini multiple choice test at beginning of class. Have groups report. Faculty member says they try not to talk very much. Faculty member tries to pull things together at the end.

Alternative First-Year Labs

Friday, October 7th, 2017

2:45-3:30 PM

Ed McIntee, College of Saint Benedict/St. John's University, Session Leader

Question 1: What are ways we can engage students in the laboratory to interest students into the chemistry major? What are you doing now that's different from the typical lab?

Ion Chromatograph located in food-safe lab. Monmouth - Brad Sturgeon
Students evaluate several drinking waters by taste, then examine the Ion Chromatograph of each.
Make salt, citric acid, fructose solutions & serial dilutions (calculations), then taste to find flavor threshold.
Another lab uses MSG (umami) and caffeine (bitterness) solutions
Miracle berry could be an expansion?

Question 2: Does anyone use Raman handheld devices? Other spectroscopy in gen chem labs?

Raman is used mostly for plastics, gases.
Thermo benchtop NMR & portable IR used in AP chem (paper in process Jessica Bonjour @ UW Whitewater).
Given an unknown and a list of potential unknowns (data), 1st semester students use NMR (polarity), IR (bond strength), to use tool and find matches/trends to identify unknown.
ACD Labs - NMR predictor/analysis software is not free anymore. Small ($600?) licensing fee. NMR pipe is free, but not as user-friendly.

Question 3: Any favorite inquiry-based labs?

Pseudo-inquiry based: Identify the gas in the balloon (He, H_2, CH_4, Ar, CO_2, Air is the hardest). Limewater test, flammability (once they have a guess). Students hate it for the first 45 minutes, then love it once they get the answer!
A lot of the inquiry labs are about training students in the process of inquiry-based labs.
Inquiry based Bomb Calorimetry lab (2.5 weeks) testing groups of salts. Student teams of 4 —each student has a specific role. Make specific plans the first week, run the second week, option to redo experiment on week three. Written report. Labor intensive for everyone.
Discovering radioactivity permeability before introduced in class using 4 materials (paper, foils, etc.).
Organic chemistry -- TLC as inquiry -- "The patient was given a pill that may or may not have been aspirin." Student's job is to figure out if it was or wasn't aspirin using TLC. They need to look up TLC and figure out how it works, experimental design, etc.).
Teaching the process of scientific inquiry throughout several labs, throughout the semester. Example of a 3-week lab where they do a lab, then select a variable to change (e.g. fermentation lab = change from 3% to 6% sugar solution). They have to research a topic (go to library), and use that to predict results & plan experiments. They then run their experiment. Write report (scaffolded). Initial reports are just replace this one section that you changed. Then by the end of term, write the whole thing.

Question 4: Anything you'd like to change from what you're doing?

Burning Cheetos instead of the classic NaOH coffee cup calorimetry.
We take for granted that we light the Cheetos from below. Students don't always know this. Beware that Ruffles splatter oils.

Question 5: How are you teaching students about safety? Waste disposal? How is this integrated in the laboratory curriculum?

TA's do a great job of policing waste disposal.
Integrating into lab design when students design their experiment.
No gloves on typing devices (phones, keyboards, etc.).
80's ACS safety video "Starting with Safety" 36 minutes.
Followed with online safety quiz.
Blood borne pathogen processes are important ("clean up your own blood") -- don't contaminate the whole broken glass container with your blood.
Every week has a "risks and hazards" section of the lab report -- list the chemicals and students fill in the blank of the specific risk or hazard (flammable, toxic, etc.).
All dispensing bottles have GHS symbols -- teach them & remind them.
Next year at Alverno: 3-D printers/maker spaces will be displayed.
3-D printing ideas: reaction profiles, enzymes, water matrix, etc.

"If I could change my curriculum I would..."
Friday, October 7th, 2017
2:45-3:30 PM
Claude Mertzenich, Luther College, Session Recorder

Three models were discussed:

Traditional
1-2-1 (one semester of introductory chemistry; 2 of organic; 1 of inorganic)
Luther's cafeteria-style upper level curriculum (see below)

Flipped classroom.
Supplemental instructor program.
Results may be dependent on assessment method(s).

How to get students to practice and take advantage of resources? Incentives?

Some other possibilities to do in the intro course:

Biochem
Bio-organic
Materials chemistry

Students need to be shown how exciting science/chemistry is.

Incorporate literature, seminal papers into classes.

Luther chemistry curriculum (http://www.luther.edu/catalog/curriculum/chemistry/):
CHEM 201 (or 151 and 152) 202, 241, 242, 361, 365 (spec & sep lab available both semesters), 490
Need total of 8 hours from following list. The 8 hours must be in at least 3 of the 4 categories. All courses in the table below are 2 credits except 301, which is 4 credits.

Biochem.	301 *spring.* Biochem.	*349 *j-term of even # years.* Biochem lab.		
Phys. chem.	351 *fall,2nd 7 weeks.* Chemical kinetics lecture.	362 *fall, 1st 7 weeks.* Thermodynamics lecture.	*366 *fall, all sem long.* Therm & kin lab.	
Chem. Analysis	344 *fall, 1st 7 weeks.* Spectro. tech. lecture.	345 *fall, 2nd 7 weeks.* Sep. electro. lecture.		
Inorg.	372 *7 weeks, normally spring of odd # years.* Organomet.	373 *7 weeks, normally spring of odd # years.* Solid State.	*379 *j-term of odd # years.* Inorg. synth. lab.	474 *7 weeks, normally spring of even # years.* Physical Inorg.

*Also need an advanced lab (to be taken in addition to the 8 hours above):
--summer research or

--one of the courses starred in the table above or
--389 (directed research, minimum of 2 credit hours) or
--490L.

Organic Chemistry
Friday, October 7th, 2017
4:00-5:00 PM
Kate Graham, College of Saint Benedict/St. John's University, Session Leader
James Wollack, St. Catherine University, Session Recorder

Started out with the discussion of a session at spring ACS – what's wrong with organic chemistry? Is there a problem with organic chemistry? This question was talked about throughout.

Overview of Organic sequences:

- Some teach classic Organic I and II sequence
- Some teach Gen Chem 1 followed by Organic I and II. So no Gen Chem II.
- CSB/SJU teaches organic in and integrated three semester sequence called reactivity I-III.

> Pulled out questions out of all ACS type exams from the hybrid and compare question to question to determine how they do compared to the average. Also do major field achievement test and DUCK test from ACS.

- After 25 years – learned they should do a lot of problems in lecture. Other that have taught a long time said that is a good approach. Pretty much was consensus here.

- "People hate Organic because they cannot see application" – switched to McMurry's organic chem with biological applications. Thought it did not make a difference. The students did not like it. They got lost in the applications. Good to intersperse applications while using a typical text.

- To get connection with material: John Nardarson – put out a poster of the top selling pharma drugs. One member pulled test questions from these structures. Have students name functional groups from drugs and use them as examples for the basis of other problems. This shows them the real world applications.

- Online homework – some are better than others. Sapling – students did not like it. Found it was tough to connect questions to the exam. Connect with McGraw-Hill – essentially problems from end of the chapter. Students seem to like it better. Problems – learning how to use ChemDraw – it is a little picky. Have them report a problem to the system rather then you. Some resistance to online homework. They need to learn how to draw and draw fast. Online homework does not allow you practice in this way. Can combat by having student draw inside the class.

- Guided inquiry-Mike Slade: Flipped classroom. Use Camtasia software and light board to do this. Looks like you are writing in midair. Studio costs $3500 for special glass for light board (go to lightboard.info to learn more). Time consuming to put together the videos. Has found a better lecture capture system that he uses in a studio on campus that allows him to draw structures out. Does not want to completely flip since students really need to practice drawing. This model is watch video, take quiz, then do problem in class.

- Educreation app – has a white board you can scribble on and import images. Only $99 per year. Can share link with students. Records voice and what you are writing on iPad. Camtasia is similar. Uses web cam to record your face and records what is on your screen.

- Eco smart pen. Professor gives a student and a volunteer a special notebook. Records lecture and records notes. Downloads voice along with notes. Pen times to notes. Can download it and let students who miss class get the notes and lecture. $135 for four notebooks and a packet. Several schools have used these.

- One example of a partially flipped class room: give link to short chem tube 3D video. This gives an animation of the reaction + a couple of short paragraphs. When they come into class they use b.socrative.com to give MC/fill in blank/true false questions. This makes them come to class. Once you write the question you get a number that your can share with students to access questions. Gives immediate feedback to what ideas students do not get. They get a small amount of points for this work. Makes them come to class and do reading. After the prof does 5-10 min of lecture then problems then 5-10 min of lecture then more problems. They then repeat this to get some cycles of learning.

- Resource: beSorcatic – exam type questions from Melanie Cooper.

- How do you help your students not memorize. Do a mechanistic approach. Teach them to look for patterns. Use an anthromorphogenic approach. Drive home the attraction of + and – using skits and demos (i.e. magnets).

- Advice: Pair down what are the key reactions. Do they need to know all types of all hydrides or just LiAlH4 or NaBH4. Try to not fill with extraneous mechanisms.

- Resource: Take examples from *Molecules That Change The World* by K.C. Nicolaou. Morphine, for example.

- Resource: POGIL inquiry. Strantimous.

- Resource: Maitland Jones. Princton.edu. Has problems ready.
http://www.princeton.edu/~mjjr/ORGO/GpPb301-06.html

Tip: Turn phone off when studying.

Biochemistry
Friday, October 7th, 2017
4:00-5:00 PM
Sunil Malapati, Clarke University, Session Leader
Larry Ferren, Olivet Nazarene University, Session Recorder

Flipping the classroom-some have tried it. We discussed what this involved, i.e., all definitions must be learned before class so time is not spent on definitions in class. Students have to work hard before class. Students taking these classes felt that doing the class this way made the class harder. Text used for a flipped class was *Foundations of Biochemistry* by Jenny Loertscher and Vickey Minderhout. Another text used for flipped class was *Foundations of Biochemistry* by Voet, Voet and Pratt.

The question was asked as to what labs people were doing with enzymes regarding enzyme purification and characterization. Mark Sinton usually picks an enzyme for the students to purify and research. He said that sometimes the students end up with research answers for the enzyme that he selects and sometimes they do not. The results vary from semester to semester. Kim Ha has the students work with an extraction procedure. Sometimes the results are not good, but the important part of the whole thing is the journey they go through in trying to get the thing to work. Sunil Malapati gives the students a list of enzymes that they may chose from to perform the

purification on, enzymes like lactate dehydrogenase, alcohol dehydrogenase, catalase, potato tyrosinase, or mushroom tyrosinase. Characterization of the enzymes varied in the group but usually amounted to kinetic analysis or capping off the enzyme by affinity labeling. Some questions and comments were made about the use of chicken lactic dehydrogenase, C-phycocyanin, and egg white lysozyme in doing the purification and characterization. Marie Dean from Coe College got good results with students purifying egg white lysozyme, some even being able to purify it to the point of crystallizing it.

There was a brief discussion about using a protein to show the difference between a denaturing gel and a non-denaturing gel. Mention was made of a red stain using a green fluorescing protein that could be run on both gels to show the difference. This gave easy isolation in the two gels. Lysozyme was also said to work well on the two gels. There was also some discussion of using *E. Coli* and then changing the chromophore from the green fluorescing protein tag, GFP-tag, to the yellow fluorescing protein tag, YFP-tag in the *E. coli*.

Heather Mernitz from Alverno College mentioned that their college had a cold room that was about to quit functioning forever, and she asked for some suggestions for their problem. Someone in the group suggested that the department purchase a refrigerated Deli case and place all of the items that needed refrigeration in that case. Heather felt that this potential solution might be workable.

Departments offering a one-semester biochemistry course in biochemistry asked the group for suggestions as to what laboratory experiences should be included in a single semester lab. A list of topics was assembled. This list included protein quantitation, protein identification, buffers, enzyme kinetics, gas chromatography mass spectroscopy, high pressure liquid chromatography-reverse phase amino acid analysis, and chemistry of nucleic acids.

There was a general discussion of the biochemistry curriculum. Some discussion centered upon whether the medical college admissions test (MCAT) should or should not drive the biochemistry curriculum. There was some feeling in the group that we should not let the MCAT control what we teach. Some schools represented in the group taught data analysis in their curriculum. Many acknowledged that there was no way to include everything in the curriculum. Some tried to give students extra questions to cover some of the additional material.

The question was asked whether biochemistry programs have seen an overall increase in the number of people getting majors or concentrations in the field. The overall consensus was, “yes”. Many people in the discussion group noticed more people taking a biochemistry concentration. Sunil Malapati dealt with this increased number of people in his classes by splitting the lab part of biochemistry from the lecture portion of biochemistry. Not all of his students taking the biochemistry lecture needed the lab.

The question was ask as to what things people would like to cover but are unable to cover and how would people deal with this? Alternatively, how do people get students ready for biochemistry so they have the proper background? One school took two weeks to review background topics and to give a series of quizzes over cellular organelles, solution preparation, thermodynamics, pH, and organic chemistry. Other schools used other means of review of background topics.

There was a discussion of how students compartmentalize- of how they learn and not apply it. They do this in general chemistry, again in organic chemistry, and then again in biochemistry. It was felt that as faculty we need to help with the problem of compartmentalization in some way, perhaps by using the same words in the same way consistently from course to course. We have to keep reminding them that they will see the material again.

There was a discussion of molecular model kits and some of their inadequacies. For example, model kits will not let you see the flat nature of the peptide bond. It was mentioned that you can go to Menard's and purchase materials to show the molecular model of protein structure. It was also mentioned that it was better to build your own models with "collected" material than with model kits. It forces the students to think in three dimensions rather than two dimensions.

The question was asked as to how many biochemistry teachers were doing models on three dimensional printers. Several people responded to this inquiry. At Clarke College people are doing some three dimensional printing with glucose molecules. At Alverno the students design a three dimensional model for three dimensional printing. Marie Dean at Coe College was told that there were some three dimensional printers on the market for less than $1000. During discussion this fact was confirmed by the group members, but the consensus was that you get what you pay for in a three dimensional printer. The cost of several three dimensional printers was discussed as well as the names of several software packages that went along with the printers.

Finally, several summer workshops involving molecular modeling for educators were discussed. These included the CSM Molecular Modeling Workshop at Hope College, the MSOE Center for Biomolecular Modeling at Milwaukee School of Engineering, and a workshop at the University of Northern Colorado.

Analytical Chemistry

Friday, October 7th, 2017
4:00-5:00 PM
Christopher Halsey, Westminster College, Session Leader
Mark Nussbaum, Hillsdale College, Session Reader

Topics of Discussion:

1. How to Incorporate Modern Research/Technology into Curriculum

    a. Microfluidics (e.g., lab-on-a-chip demo's using paper & toner) – show in Inst. Analysis.
    b. Electrochemistry (e.g., Pine instruments) – using small, inexpensive equipment.
    c. Negotiate with colleges as they hire you to get the most funding for what you want.
    d. Have students read the literature, present on a recent journal article.

2. Sharing Instrumentation with other colleges

    a. Larger universities will often gladly share resources with smaller schools, especially if we're willing to go to their lab and let them teach/show us how to use their equipment.
    b. Larger universities often benefit by including relationships with smaller schools as part of their grant funding (e.g., NSF).
    c. Some concern about obtaining training to use their equipment; some universities will supply the lab tech or TA or professor to run the equipment, others will train you or give you the operator's manual and let you go. But ask questions!
    d. Be proactive and network with others. Organizations like MUACC, pharma companies, or other industrial sources are often willing or eager to help.

3. Curricula: Electrochem & Equilibria – how much do you cover in the first Analytical Chemistry course?

    a. Redox/equilibria, Nernst equation; yes, that much is important.
    b. Cyclic Voltammetry and more detailed electrochem – No.
    c. Separations are important, so don't sacrifice that topic for doing all electrochem.

d. Electrochem/Redox helps them think and learn more about heterogeneous systems.
e. Electrochem is also important for biochemical reactions.
f. Systematic Treatment of Equilibrium – how far do we go? The concepts are important, but do they need to solve multiple equations for charge balance & mass balance? Wolfram-Alpha software is a useful tool for solving the difficult algebra problems. One or two lectures on the systematic treatment is enough.

4. Keeping instruments working:

   a. Use Maintenance Underwriters Group (insurance policies) instead of service agreements to save money. Alternatively, set aside a chunk of your budget for maintenance/service like a "health savings account" to draw from when you need it, but the money's still your Department's.
   b. Have a deal with an instrument manufacturer to provide service in exchange for demonstrations to prospective buyers (but location would matter).
   c. Getting students to help with maintenance and/or repair of instruments.
   d. Buying used equipment to save money or to get parts.
   e. Getting equipment/instruments donated from larger universities or corporations.

5. Money for instruments & funding

   a. Grants (e.g., NSF) – some success, but takes a lot of time to write the grant.
   b. Hire grant-writers to help write the grants and find the best grant sources.
   c. PittCon and other smaller sources; Research Corporation; Howard Hughes; corporations.
   d. Can get demo instruments for a time.
   e. Can rent instruments.
   f. Team up with grant writers/fund-raisers at your Advancement or Development Office to seek out donors to fund particular instruments.

6. How do you teach things without the instrumentation (or the money for it)

   a. *J. Chem. Ed.* – articles on building instruments with Legos; using cell phones as detectors
   b. Can teach the instrumentation with cut-outs of components and placing them on whiteboards (magnets).
   c. Borrow or rent or build your own (*J. Chem. Ed.* and internet sources).
   d. Arduino or Raspberry Pi to build your own electronic instruments.
   e. Can submit samples for analysis or reactions on-line (*J. Chem. Ed.*); HPLC-NMR or other on-line experiments where students can control parameters.

7. Electronic or paper lab notebooks

   a. Mike Seymour has been using computers/electronic lab notebooks (LabArchives) for a couple years; students must get their data into them and submit them electronically.
   b. Important to learn how to keep a good notebook, so incorporate that either way.
   c. Can still write manually, then scan into LabArchives and make it permanent & searchable. But typed reports are more legible than hand-written.
   d. Possibly use tablets where you can write directly on the surface and not have to scan (but lab hygiene and costs are of concern).
   e. Current users: Mike Seymour and Chris Halsey and one of the grad students (as a TA for gen chem—she didn't like it). Indiana representative tried using LabArchives a couple years ago but found it unwieldy while trying to learn and use it simultaneously.
   f. Also suggested: OneNote software (one faculty and one grad student use this).

Inorganic Chemistry
Friday, October 7th, 2017
4:00-5:00 PM
Claude Mertzenich, Luther College, Session Leader
Brian Johnson, College of Saint Benedict/St. John's University, Session Recorder

We began with a brief discussion of what inorganic chemistry courses were taught at each school. One school had two seven-week courses (roughly a physical inorganic course and a solid state course). In addition they offer an organometallic January Term course. Another school offered two semesters of inorganic, one taught from the Rodgers text and the other using a small solid state text. A MACTLAC visitor noted that her undergraduate school (non-MACTLAC but a small liberal arts college) had an advanced general chemistry course that included some inorganic as well as an advanced inorganic course. One other participant indicated that their school used a similar approach. A final school noted that they have foundational inorganic split between three "reactivity" courses (some ligand field theory, organometallic chemistry/catalysis, kinetics, bio-inorganic chemistry are included). Further inorganic topics are included in other advanced courses such as "Materials", "Inorganic Molecular Design", and "Electrochemistry, Batteries and Sensors".

We also discussed whether we included much descriptive chemistry in our inorganic courses. One noted that they did at their school, although most (at least of this small group) did not. The most common reasons cited for not doing more were the difficulties in doing it without being an exercise in memorization as well as not knowing the chemistry of all of the elements ourselves.

A One-Semester Introductory Class
Saturday, October 8th, 2017
11:00-12:00 PM
Anna McKenna, College of Saint Benedict/St. John's University, Session Leader

Anna gave out handouts of pages of a workbook from Chem 125 "Chemical Structure and Properties". Originally, they called the course "shape". It is not like what high school teachers told them college would be like. Initially, course spends a lot of time talking about aspects of homework. There are lots of working parts. Hands out a daily schedule. Sometimes they get lost in it. Usually after first week they get into it. Some familiar topics from general chemistry. Start with Atoms and Trends: how atoms interact with each other. Hardest thing according to students is unit cells and solid state. Unit cells keep coming back. Structure tells us a lot about function. Showed map of topic pie chart. Depth comes from worksheets. Some of workbook comes from literature.

One source of assessing involves using Colorado learning Attitudes (CLASS). From this a class survey data chart is produced looking at pre-post shift in favorable responses. Someone asked "Why are more students signing up as chem majors?" Women may be helped by approach. They want to see why they are doing what they are doing. Also school added scholarship program for underrepresented minorities. Looked at DFW data: %DFW numbers have gone down. Part of improvement may be from increased individual support. Looked at ACS exam scores. For assessment they pick questions from a combination of relevant questions from ACS General Chemistry, GOB and Organic exams. Showed results from Chem 125 Final Exam Data.

Anna thinks that new content is harder, even without the math content. In the class is a student TA who recently took the class. Most classwork is group. Prof and TA walk around. Students can easily set up appointments when they have questions. Class has 2 evenings a week tutor sessions. Students required to go to 70% of week tutor sessions. Tutor at "coffee shop". The make a point of encouraging good students to learn from teaching or explaining to others.

Students are given a daily schedule. All faculty teach from the same schedule. Set of tutorials presented using Canvas. Those are due at 11 PM before class. There are videos to watch. A lot of the videos are from Kahn Academy. They use an online textbook. At beginning of class talk about 10 minutes about big points. Put them in groups. Have groups make specific list of topics they want the teacher to cover. Sometimes do small quiz on Socrative (phone app). Sometimes give them a quiz. Homework is due about every day. They can submit pages that they don't have time to cover in class. The homework is due at 11 PM or 8 AM depending on teacher. They don't allow for extensions. Use Sapling online homework for first course and Owl for later classes. In lab they are doing separation and identifications.

Students in previous sequence program didn't remember or connect what a substitution reaction is when they first had it in organic and then in inorganic. Now students see them presented together. Talk about how to stabilize a base. Now done in conceptual way first. Some math comes in when class talks about equilibrium.

Are students more prepared under new program for upper division courses? Under old system some people had not had quantum and were lost sometimes. A lot of upper division 2 semester hour courses are taught from literature. Periodic properties keep coming back.

Faculty talked about this for a long time before implementation. Catalyst was seeing reformatting of the ACS curriculum in 2008. Another catalyst was that the organic people never got to teach topic classes. Quantitative people were concerned about less quantitative skills. Traditional chemistry is heavily based on physical chemistry. Physical chemists took over after WW2. At St. Benedict the students are taught out of first "atoms first" text.

St. Benedict doesn't give "exams". They use problem solving assignments (called PSA). For example: have them draw Lewis dot structure, structures and shape. Look at a larger molecule to see solubility of something they are interested in like cocaine.

Reactivity Classes

Saturday, October 8th, 2017

11:00-12:00 PM

Ed McIntee, College of Saint Benedict/St. John's University, Session Leader

James Wollack, St. Catherine University, Session Recorder

- Take five sub disciplines and convert into quantitation, reactivity, and structure. See *J. Chem. Educ.*, 2014, **91**, 321. This curriculum started by listing all topics they taught and then pooled them to tell a better story.

- Series is loosely 1/3 organic, inorganic, and biochem.
- Each course has a theme. Students remember things better if a story is involved.
- Reactivity 1: very little traditional general chemistry. Addition to C=O, polymers, enzyme catalysis, biochem pathways, and coordination compounds.
- Reactivity 2: kinetics is the story – nucleophilic sub, enzyme kinetics, electrophilic addition, organometallic reactions, aromatic substitution, and kinetic vs. thermodynamic control. Not much math. Nice because when there is math students, will either focus on the chemistry OR the math. Removing math allows more concentration on chemistry.
- Reactivity 3: Single electron and pericyclic reactions both in organic and biochemistry. Redox, radical reactions, oxidative phosphorylation, and reduction reactions.

- One professor teaches the whole course - So they are not an expert in each area. Cohorts teach their own section of one of these classes but have a support network that can help with instructional support. Tough to hire adjuncts to teach this new type of curriculum.

- Concept of the mole comes in during the lab. Stoichiometry is most important there. Pick some up by association but not by math. This is done in the 3rd lab – synthesis lab. Percent recovery in purification lab. In synthesis lab they do percent yield.

- Labs are all project based. Example: 6 projects in purification I course. Write an experimental and do a data interpretation for each one. Less emphasis on if they got it right. It is more about the process.

- Book: Places for notes in workbook. Fill in problems during lecture. Problems are difficult so they are meant to be collaborative. Assigned group homework. CSB/SJU is working with Sapling to break the book into modules. Constantly going through iterations of the book every two or so years, so they change. Can get a workbook at XanEdu (www.academicpub.sharedbook.com). Working to get them online to print out parts. All sections use same workbook so they are all on the same page. Open access to the book on the CSB/SJU website.

- Book broken into subtopics within topics. Example: addition to carbonyls then certain types of addition.

- Faculty have developed a user's guide to the curriculum that is an open document where they can add information about what topics are more difficult for students. This helps when adjunct teach.

- Labs are published.

- CSB/SJU have coordinators for each class and each lab. This keeps all faculty that are teaching the course on the same schedule.

- Emery has changed their curriculum this way as well. Very similar to CSB/SJU.

Labs

Saturday, October 8th, 2017
11:00-12:00 PM
Alicia Peterson, College of Saint Benedict/St. John's University, Session Leader
Christine DeVries, Wartburg College, Session Recorder

Question 1: Give a Quick Description of each lab course.

201: Separations I and Spectroscopy

Meet weekly, 3 hours lab + 1 hour recitation.
5 longer projects + 3 shorter projects (1-week activities; IR, NMR introductions, etc.).
First week is just the 1-hour recitation. Start with discussion of:

Our way is different.
Why we do it this way--can get into an REU after first year, resume builder for pre-meds, etc.
Get good student buy-in when benefits are clear.

First four weeks are dry labs--introductions, IR, NMR, etc.
All the rest are labs based on unknowns--students given selection of options that unknown could be. They answer: Which is it? and How pure is it?

EXAMPLE: liquid-liquid extraction lab. Unknown is an organic molecule and told that glucose is the contaminant. The 1-hour recitation covers intermolecular forces and helps them predict that glucose will go into aqueous layer.

No pre-lab lectures. Students have to come prepared to lab--videos, readings, find safety information, answer embedded quiz questions. They come to lab having written a flow chart for procedures.
Mini-Videos: previous students made a set of videos of experimental procedures (set up a filter flask, column chromatography, etc., for example). This covers the technique part of pre-lab lectures.

202: Separations II

Focus is on chromatography.
4 hours in lab/week.

Synthesis

4 hours in lab/week.

Measurements

First quantitative lab (analytical + physical experiments).
1st week--statistics (dry lab).
Several 2-week labs--students rotate through, ending with final titration.

Calibrate glassware.
Titrations--find better accuracy/precision with phenolphthalein than with microLABS.
Protein of unknown concentration--BSA assay.
Vapor Pressure lab (classic Physical Chemistry lab)--cyclohexane P vs T to get enthalpy of vaporization.
Spec 20 analysis of 2-dye mixture (standard additions).
Titration (scored on results only).

Integrated Lab

For Juniors and Seniors.
4 credits, 9 hours/week
Write four formal lab reports, and keep bound notebook, which is signed daily.

Question 2: Which lab manuals are used?

All are generated in house.
Acquired labs from *J. Chem. Ed.* articles and *Making the Connections* by A. B. Padias
Have published some SJU/CSB labs in *J. Chem. Ed.*
Happy to work with faculty to share labs/activities.
Lab textbook for ALL the labs (not measurements).

Question 3: Keeping a good lab notebook is a skill. How are different people teaching this skill? Do you use digital notebook software or what alternatives?

Type in notes & submit after lab online (word file, google docs, etc).
OneNote could be a good option for digital notebooks?

CamScanner--high definition pdf emailed to instructor/placed into management software.
Focus more on Junior/Seniors--they are reading someone else's notebooks so they better appreciate the need for good notebooks.
Pre-lab info--give "example data table" but they will need to prepare 5 in their notebook ahead of time.
Emphasize data work-up in Excel, not in notebook. Give them a sample spreadsheet with equations embedded at first, then fewer equations over the semester.
"Lab Zero" is a competency lab--weigh pennies, skittles, smarties, etc. Learn how to do statistical analysis in Excel (Brian Kamuzinga @ Principia). Memorable, enjoyable.

Question 4: Any concerns about not having lab supporting lecture concepts?

Some activities come into lectures--model kits always available in cabinets in lecture rooms, bring in demos, hands-on (dry) activities or stations in lecture.
An interesting data point: Student performance in lab doesn't correlate with whether student is in a chemistry lecture course simultaneously.

Question 5: How was faculty buy-in during the transition to a new curriculum?

Some faculty are the ones to drive the change, so they do most of the development work.
Some faculty are semi-supportive. They will implement the new curriculum, but don't drive the change.
Some might be nearing retirement, so they would not invest in developing the new curriculum, but willingly teach in it.
In the end, the non-supportive faculty simply have to accept the changes implemented by the majority of their colleagues.

Integrated Lab
Saturday, October 8th, 2017
11:00-12:00 PM

1. Experiences with integrated labs
    a. CSB/SJU integrates the upper division Analytical, Physical, Biochemistry, Inorganic, and Organic into one 4 credit course that meets 9 hours a week.
    b. University of Minnesota has an advanced lab where students use techniques from all fields but not necessarily distributed evenly.
    c. Not many other schools have an integrated lab experience.
2. Challenges in developing, implementing, and sustaining an integrated lab
    a. Faculty time not always evenly distributed.
    b. Making sure each discipline is well represented.
3. Modules vs. full integration
    a. CSB/SJU uses modules to accommodate faculty strengths.
    b. Modules also allows for an easier addition/subtraction of experiments if necessary.
    c. Rotation of available instrumentation.
    d. Independent research questions can encourage students to integrate laboratory techniques better.

4. Independent vs. cookbook labs

    a. CSB/SJU relies mostly on independence, but give students a set direction or starting point.
    b. Other institutions use more open ended research projects where students design an experiment to answer a given question or set of questions.
    c. Research questions often play to instructor's strengths.

5. Staffing

    a. CSB/SJU uses more than half of faculty to staff a team-taught course.
    b. Others have one instructor and don't use team teaching, but do have TA's.

6. Assessing student performance

    a. CSB/SJU uses group lab reports, individual recitation quizzes, and individual final exam.
    b. Other institutions with TA's can have students hand in individual reports and don't necessarily have a final exam.

CSB/SJU Upper Division Courses

Saturday, October 8th, 2017

11:00-12:00 PM

M. Abul Fazal, College of Saint Benedict/St. John's University, Session Leader
Brian Johnson, College of Saint Benedict/St. John's University, Session Recorder

This session expanded on the Saturday morning plenary presentation by Chris Schaller. There were many good questions and much discussion, and the answers have been incorporated into the paragraph below.

In the CSB/SJU model, advanced courses are a half-semester long. There are about 18 such courses that have been approved; in addition, Special Topics courses can also be offered. Some of the courses taught include the following: Sustainable Energy, Nanomaterials, Analysis of Biomaterials, Structural Elucidation, Chemical Biology, Climate and Habitat Change, Medicinal Chemistry, Signal Transduction and Instrumental Design.

The school offers three concentrations (Industrial/Materials, Chemical Biology or Environmental) within the chemistry major; in addition, a student may elect to have no concentration. Students typically take four advanced courses, about half of which must carry the appropriate designation for that concentration. To achieve ACS certification, students take two more advanced courses on top of this. None of these courses have a lab. (All chem majors also take an integrated lab course.) Typically six advanced courses are offered per semester. Most advanced courses are offered every other year, the exceptions typically being the gateway course required for a concentration which is taught every year. The projected offerings for the next three years are made available to students so they can plan for study abroad.

Enrollment varies from ten to twenty students. Topics are selected based on criteria such as connection to one or more concentration, delivery of a core aspect of chemistry, background/interests of faculty and perceived student interest. Often new or visiting faculty are asked to teach a class in their specialty to take advantage of their expertise. The CSB/SJU teaching load is three "sixth's" per semester. A full term course is one-sixth, a lab counts as a twelfth, and an advanced course counts as a twelfth. Instructors are occasionally able to find a small textbook suitable for their topic. In other cases they use papers from the literature or online texts.

Advantages for this system include giving students a background in areas of chemistry that have high current interest; the names of courses may be familiar to students and create interest; it allows delivery of upper division content to what can be small groups of students in a smaller "per course cost" than a full term course with a lab; and it is consistent with the rest of the CSB/SJU chemistry curriculum where the divisional "silos" have been removed.

No reports were submitted for the following sessions:

Friday, October 7th, 2016, 2:45-3:30 PM

Meet the Speaker: Dr. Melanie Cooper
Introduction to the CSB/SJU Curriculum (session was cancelled)

Friday, October 7th, 2016, 4:00-5:00 PM

Physical Chemistry

Vendors and Sponsors

The organizers of this year's meeting wish to express their thanks to the following vendors and sponsors:

3D Molecular Designs
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MACTLAC Weather Report

It has become somewhat of a tradition to mention something about the weather surrounding the MACTLAC meeting.

Friday's Weather

Friday's weather was partly cloudy, with a high of 41°F (5.0°C), a low of 32°F (0.0°C), and 71% humidity. It was a windy day with 18 mph (29 kph) winds out of the WSW, with gusts of 21 mph (32 kph). The barometric pressure slowly rose throughout the day starting at 30.2 inHg (767 mmHg) in the morning. There was no precipitation.

Saturday's Weather

Saturday's weather started out cloudy, but then became sunny as the day progressed. The high for the day was 40°F (4.4°C), and the low was 32°C (0.0°C). The humidity was a bit higher than Friday at 79%, and there was a small bit of precipitation, 0.1 in (0.24 cm), in the early morning. There was very little wind during the day, with only occasional gusts of 6 mph (9.6 kph). The barometric pressure remained steady all day at 30.0 inHg (762 mmHg).

MACTLAC News

Placement

MACTLAC's Placement Officer maintains two lists: 1) a list of faculty positions available within the MACTLAC member colleges, and 2) a list of candidates seeking positions with member colleges. Our goal is to ensure that candidates are in contact with the colleges having positions available. If you are currently recruiting new faculty, are looking for a teaching position at a Liberal Arts college, or have any other questions, please contact the Placement Officer. A copy of the list of available positions can also be found at www.mactlac.org.

Website

The address for the Association's website is www.mactlac.org. Feel free to visit this site to get information on our organization and the services that it offers. Be sure to check out the links page as there are some things on that page that may be of interest to you.

Honorary and Emeritus Membership

Honorary membership is granted only by a unanimous vote of the Executive Council, and shall be reserved for those persons who have rendered extraordinary service to the Association or who have made noteworthy contributions to the improvement of chemistry teaching in member colleges. To be considered for honorary status, the candidate must be nominated by a colleague in a letter submitted to the Secretary-Treasurer at least one month prior to the Annual Meeting at which the letter is to be considered by the Executive Council. A second letter of support from another colleague should also be submitted at least two weeks before the Annual Meeting to the Secretary-Treasurer. These letters should attest to the criteria needed for honorary membership status. An Honorary member will be excused from further payment of dues and will be listed as an Honorary member.

Emeritus membership is reserved for any person who has been an active member of MACTLAC for 10 years and who has retired from teaching. An Emeritus member will be excused from further payment of dues and will be listed as an Emeritus member. Anyone seeking emeritus membership should request it, preferably by sending a letter to the Secretary-Treasurer of MACTLAC.

2017 Meeting

The Chemistry Department at Monmouth College invites the Association to the 65th Annual Meeting of MACTLAC on October 13th and 14th, 2017. The theme of the meeting will center on food and water. Debra Shore, Commissioner of the Chicago Area Water Department, will likely be one of the speakers. The launch of the Association's digitized archives will also hopefully take place as well. The faculty at Monmouth College are excited to have the Association back at Monmouth, where the first Annual Meeting of the Association was held in 1952.