

Chemical and Biomolecular Engineering Departmental Highlights

Under the leadership of Professor Lauren Anderson, the Department has continued its success as one of the leading educational institutions in chemical engineering. Currently, slightly fewer than 150 undergraduate students are enrolled in chemical engineering across all class years. Highlights of the past year include:

- The labs were very busy this summer as nearly all ChBE faculty worked with student researchers this summer through the Excel and Clare Boothe Luce Scholars Programs.

- Fifteen students travelled to the AICHE Annual Student Conference in San Francisco in November, where eleven students presented posters. Bach Nguyen '17 won second place in the Computing and Process Control Division and work performed by Kyla Dewey '18 and Rachel Young '18 won second place in the Food, Pharmacology, Ecology and Bioengineering Division.

- The AICHE Mentoring pro-

gram continues strong, and is greatly appreciated by the undergrads. A sophomore mentoring program was added this year to address the different needs of sophomores in comparison to first year students.

- Chemical Engineering was well represented at the 150th Engineering Gala, held at SteelStacks in Bethlehem. Several students exhibited their research projects while alumni, faculty and other students viewed them as they socialized. New connections were made and existing ones reaffirmed.

- Melissa Gordon, class of 2011,

recently began as the department's newest tenure track professor. She will be teaching Nature of Engineering Materials, and her research will focus on the design and characterization of polymeric and colloidal systems. You can read more about her in the following pages.

- Two visiting professors, Professor Kyle Doolan and Professor Alex Woltornist contribute to the laboratory and design sequence. Professor Doolan researches protein-protein interactions while Professor Woltornist, a Lafayette ChBE graduate, brings expertise in lean manufacturing and operations management.

- In addition to new faculty, the department expanded in other ways. (Read the last page to see how this was done!)

Polly R. Piergiovanni, Professor and Acting Head, Department of Chemical & Biomolecular Engineering



Students Barker Carlock '17 (L) and Sean McSherry '17 (R) showcase

Student Perspective: New Opportunities for Student Research

As I study chemical and biomolecular engineering, I am intrigued by the ability of engineering to serve as the bridge between STEM disciplines and consumers in society. My research experiences have provided a unique opportunity to discover new ways in which science can contribute to this connection. I have been inspired to pursue a Ph.D. in chemical engi-

neering, which will prepare me to work in the research and development department at a pharmaceutical company.

My first exposure to academic research came in the spring of 2016 when I was awarded a position in the competitive Clare Boothe Luce Research Scholars Program. Specifically designed to support women in STEM fields, the Clare Boothe

Luce Program has provided me the opportunity to work with Visiting Assistant Professor Kyle Doolan. The objective of our research is to identify the interactions between host cell proteins and monoclonal antibodies (Mabs). Mabs constitute the largest and fastest growing segment of the biopharmaceutical industry,

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Student Perspective: Using Nutella to Shape the Engineers of Tomorrow

As a senior, I have had the opportunity to experience some nostalgia returning to my very first engineering course: Introduction to Engineering (ES101). The goal of this class is to provide students with a hands-on design experience and provide a flavor of what engineering is. Currently, students take two 7-week modules in two different branches of engineering.

Over the summer, I worked with Professor Polly Piergiovanni to help develop a new culinary-centric ES101 section: Films, Foams, & Powders. The course taught a plethora of chemical engineering concepts through lectures and weekly experiments. The experiments used real world applications to help explain high-level concepts discussed in lecture. Not only were these experiments informative, but

they were also fun and often produced edible results.

One experiment I helped develop was the 'Powders' lab – an experiment showcasing the concept of lipophilicity using maltodextrin. Lipophilicity refers to the ability of certain compounds to dissolve in fats. When added to fatty foods, like Nutella, peanut butter, and chocolate, the fat molecules cling to the maltodextrin and clump together to form a powder. Although lipophilicity may be difficult to explain on a molecular level, this experiment provided a delicious visual example of how lipophilicity occurs in real-life. Other experiments included drying fruit using a dehydrator, creating edible films out of gelatin solutions, turning milk into foams, and using sodium alginate to create jelly-like hot sauce

spheres. My personal favorite experiment involved carbonating fruit with dry ice to make 'Fizzy Fruit' – an idea that came from a YouTube video that several of my fellow classmates and I discovered.

Witnessing these theoretical concepts via interactive examples can make a world of difference in the early stages of one's engineering career. Upon reflection, I am hopeful that my experiments helped encourage students to pursue chemical engineering and maybe manufacture the perfect dried fruit snack.

Matthew Katz '17



Matthew Katz '17 (L) conducts an experiment with classmate Russell Lambert '17 (R) under the guidance of Professor Polly Piergiovanni

CBL Scholar Colleen McGovern '18 (R) working in the Center for Biomolecular Engineering with her faculty mentor, Visiting Assistant Professor Kyle Doolan (L)

RESEARCH (from p.1)

and these antibodies are largely produced using Chinese hamster ovary (CHO) cell lines. Despite an extensive purification process, some CHO cell proteins remain with the Mabs, suggesting that there may be direct interaction between the two. The specific goal of our research is to characterize the interaction between CHO host cell proteins and monoclonal antibodies in an attempt to increase the efficacy of the downstream purifi-

cation process. In order to describe this interaction, I have used mammalian cell culturing and molecular biology techniques including PCR, gel electrophoresis, and cloning. I have presented this research at Lafayette, and this work will be presented at the American Chemical Society Annual Meeting in April 2017.

I am very grateful for the research opportunities Lafayette has afforded me thus far. I look forward to continuing this research with Professor Doolan this spring

semester as well as working on my own project for my senior thesis beginning next academic year. Lafayette and the Clare Boothe Luce Research Scholars Program have been an indispensable facet of my education that will help prepare me for graduate school and also my future endeavors.

Colleen McGovern '18

Redesigning Senior Design

Over the past few years, the two senior design courses have branched beyond the traditional pen-and-paper process design projects to incorporate hands-on components and even project design work, such as consulting with local companies. Throughout this year, Design Analysis and Design Synthesis instructor and ChBE alumnus, Alex Woltornist, has worked to incorporate these components in both semesters in hopes of leading towards a more comprehensive senior experience that will provide students with a solid foundation for wherever their future interests lie.

Design Analysis, the first course in the sequence, holds the traditional process design projects. This year, each student worked on a team that aimed to design a plant that converts raw corn to bioethanol. In addition, Woltornist has added a second introductory project via video conference with B. Braun in the Dominican Republic. Students worked with their design teams to find innovative solutions to improve B. Braun's process line. This provided the students with an introduction to more industrial engineering based thinking focused on driving efficiency through process design and understanding the motion of product, people, and parts

in the facility.

In Design Synthesis, the second course in the sequence, teams take on and even self-identify a variety of projects. Teams are taking their traditional process design projects to the lab to test out their processing hypotheses or out to the field (such as the local dairy farm, Klein Farms Dairy & Creamery) to gather relevant information. Other teams are working on design projects with other local companies, such as the local B. Braun site in Allentown, Pennsylvania. Each of



B. Braun (shown above a plant in the Dominican Republic) is an example of one company offering real-world projects to ChBE seniors to analyze in Design Synthesis (ChE 422)

these projects intentionally has been left wide-open for group-defined scopes to allow students to run trials, collect data, and pilot their ideas. Students are encouraged to prove their concepts with data and consider the practical aspects to their proposals.

Woltornist sees this as a mutu-

ally beneficial relationship between the students and the company. B. Braun sees value in this partnership. B. Braun is providing an educational opportunity to students, and they are getting a variety of perspectives and well-considered advice on their production facility that will hopefully result in more efficient business outcomes along with potential environmental benefits. The three B. Braun-partnered teams are working on 1) increasing the capacity of manual assembly on site, 2) improving the packaging process from inventory to warehouse, and 3) creating multi-purpose parts, which the teams will demonstrate with 3D printed prototypes of their proposed parts. The diversity of thought brought by each design team will bring creative solutions to improving a variety of aspects surrounding B. Braun's process and facility. Each team will be expected to deliver a final presentation to the B. Braun leadership at the end of the semester.

Woltornist, previously an employee for Merck & Co. for 30 years
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Remembering Peter Koval '16

ChBE was deeply saddened to learn about the passing of Peter Koval '16 on February 22, 2017 in a tragic car accident. A native of Liberty, NY, Peter entered Lafayette as a physics major, but chose chemical engineering because of its applications to everyday life.

Peter conducted research with Assistant Professor Lindsay Soh, both as an EXCEL scholar and as an Independent Study student. He also competed on the track and

field team at Lafayette, throwing javelin before being sidetracked by an injury. He had recently begun working with Kelly Services, doing contract work for Dow Chemical in the greater Philadelphia area.

Peter will be remembered by classmates and faculty alike for his quick wit and sarcastic sense of humor. He was often a visitor to many faculty offices to talk about things ranging from coursework to outer space to politics. His love of

learning, desire for knowledge of all sorts will be missed by the entire Lafayette community.



Peter Koval '16

Assistant Professor Michael Senra

Internship Experience: Making a Difference at Crayola

During the summers after my freshman and sophomore years, I had the opportunity to work on Crayola's Process Improvement Team.

My work ranged in pace and complexity, from performing downtime studies at a crayon machine for an 8 hour shift to leading two projects in which we were testing new critical variables with new measurement systems.

This summer, I had the opportunity to lead a project to define and quantify a new critical variable: crayon label stiffness. The project began when we noticed that the crayon labels behaved differently, something that was not seen in our

testing. First, we were interested in determining the labels' variation across the production floor. I began by researching measurement standards in the paper industry to determine what was applicable to our processes. After finding an appropriate measurement system, I was in charge of selecting a supplier, purchasing the equipment, performing a measurement system analysis and starting testing. This process was one of the most interesting things that I did at Crayola because I was able to learn and take an active role in every stage, from the define stage to the testing stage. My work at Crayola has really complemented my studies in the

classroom well; I am able to apply concepts that I learn in class to "real world" situations that I saw at Crayola. I am so grateful for my time at Crayola and for the members of my team who taught me so much.



Madeleine Titus '18

Madeleine Titus '18

DESIGN (from p. 3)

and a recruiter for the company, recognizes that Lafayette students are great at the theoretical components. However, one aspect that many chemical engineers need to further develop in college is the blending of technical depth with many of the soft skills currently expected in industry related to teaming, project management, the management/interaction of people, workflow in a commercial settings,

entrepreneurial thinking, lean based principles, etc. He hopes that by incorporating these site visits and hands-on tasks, students will better learn the connection between theory and practice. They will learn to use all of their resources, including who to talk to, which questions to ask, and what data will help them. Students will learn how to get valuable information and apply it in the best manner that will then help them make the most impact to the busi-

ness they work.

If local alumni would like to become involved in one of Lafayette's senior design courses for the 2017/2018 term as a partnership site, please contact Alex Woltornist (woltorna@lafayette.edu) for further discussion. These partnerships result in an enhanced student learning experience and also a positive business impact to the sponsoring partner company.

Danielle Ricciardi '17

Faculty Spotlight: Professor Lindsay Soh Receives MRI Grant

This past November, Assistant Professor Lindsay Soh was awarded the Major Research Instrumentation Program (MRI) grant, sponsored by the National Science Foundation. This grant provided the necessary funding for Professor Soh, in collaboration with Professors Melissa Galloway and Steve Mylon in the Chemistry Department, to purchase a liquid chromatography/supercritical fluid/mass spectrophotometer instrument.

Professor Soh plans to begin using this new equipment to assess the feasibility of transesterification as an alternative pathway for biodiesel production. Specifically, this

instrument will allow for the identification of molecules generated when the reaction is carried out using specific heterogeneous acid catalysts. Properly identifying and quantifying these materials is crucial to determine reaction kinetics and give insight into how to optimize the transesterification reaction.

Professor Soh also intends to use this instrument to carry out more advanced research alongside research scientists at Yale University and the University of Pittsburgh. This collaborative effort aims to investigate carbon dioxide as a solvent for certain processes

in the synthesis of biodiesel.

Rachel Elias '17



Professor Lindsay Soh works in the lab with Praphulla Prokharel '19 (L) and Eddalee Hochwalt Naumann '19

ChBE Invades the City by the Bay

Fifteen Lafayette ChemE students (the largest delegations in recent memory) went to San Francisco, California for the National AIChE Conference in November 2016. Students attended a keynote lecture, a variety of workshops on topics ranging from career development to technical lectures, a career fair, and presentations. Many were granted awards throughout the weekend.

Rachel Elias '17 and Aaliyah Shodeinde '17 both gave oral presentations of their work. The following students participated in the Student Poster Symposium: Cara Abecunas '17, Aleeza Ajmal '18, Tom Kovar '17, Patrick Leggieri '18, Steph McCartney '17, Bach Nguyen '17, Ruikun Sun '17, Rachel Tenney '18, Yuan Tian '17 and Rachel Young '18. Nguyen and Young earned recognition for finishing in 2nd place in their respective divisions. Regarding the con-

ference, Young said that "the conference gave me insight into all of the amazing things chemical engineers are doing in the world today. The poster session was a very rewarding experience and I am happy



AIChE Conference attendees enjoy a meal in San Francisco's Chinatown.

to have had the opportunity."

Sean McSherry '17 was one of 15 students nationwide to receive the Topp-Othmer award, recognizing academic achievement and dedication to AIChE. Cameron Darkes-Burkey '18 was a recipient of the Othmer Sophomore Excellence

Award. Darkes-Burkey noted that "the conference provided me with perspectives of Chemical Engineering from every angle. ChemE's go to grad school in various departments, work with energy, materials, or fluids, they design processes to create or utilize them, and they run companies and manage those who do."

Chapter co-Presidents Danielle Ricciardi '17 and Sean McSherry '17 were also in attendance at the annual AIChE Chapter Presidents' Meeting. They also attended workshops to gain an idea of what other chapters are doing and whether or not they could be integrated in our chapter .

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Alumni Spotlight: Tyler Fruneaux '14

Tyler Fruneaux '14 is a plant engineer at the Air Products facility in New Orleans, Louisiana. The facility includes two hydrogen liquefaction plants, a steam methane reformer, and an integrated nitrogen recycle circuit. He began working at Air Products with an internship and decided to continue working there after graduation.

Fruneaux says he was looking for a job in "traditional chemical engineering." He likes that his job allows for first-hand exposure to processes and units that he had explicitly learned about in his chemical engineering classes. He enjoys that he is able to continue learning on the job as well; the diversity of the technology at the site allows him to learn about numerous other engineering aspects. Additionally, the various plants Fruneaux works in were built in 1965, and he says

that it is not uncommon for equipment to break. When this happens, he is able to learn from the operators how to solve the problem quickly and safely.

On a typical day, Fruneaux attends a morning safety meeting with the operators, then performs daily monitoring and statistical tasks. Then, he usually works on a longer-term project, sometimes in an office, other times in the plant. These projects require large amounts of documentation in order to keep everyone safe and on the same page, he explains. Additionally, his job occasionally requires providing engineering input to solve problems in the event of an equipment malfunction.

Fruneaux says that being a Lafayette-trained engineer has been beneficial for his career. He explains that Lafayette engineers

have an advantage over their fellow engineers with what he calls a



Tyler Fruneaux '14

"communication factor", which he attributes to Lafayette's connection with the liberal arts. Additionally, he finds that most engineers at the company are technically competent, but his experiences at Lafayette help him to stand out, take ownership of projects, and communicate his ideas to others. Fruneaux is excited to see where these skills lead him in the future.

Colleen Lavelle '18

The Ever Growing ChBE Department

The fall semester brought some changes as three of our professors welcomed new additions to their family. First, on November 17th, 2016, Professors Lauren and Christopher Anderson welcomed their second son, Ethan Christopher, into the world. Ethan was born at 2:39pm, weighing in at 8lbs 10z and measured 22in long.

Then, on December 24th, 2016, Visiting Assistant Professor Kyle Doolan and his wife Lauren welcomed two new additions to the family, Elizabeth Rainey and Parker Samuel. Elizabeth was born at 6:41pm at 7 lbs 3oz and Parker was born at 8:06pm.

Sara Mikovic '18



Left photo: Ethan Christopher Anderson

Right photo: Parker Samuel (L) and Elizabeth Rainey (R) Doolan

Lafayette ChBE Welcomes Back Professor Melissa Gordon

The Department of Chemical and Biomolecular Engineering would like to welcome our new Assistant Professor, Melissa Gordon. Dr. Gordon earned her B.S. in Chemical Engineering at Lafayette College in 2011 and is excited to return as a professor. She earned her Ph.D. at the University of Delaware in Chemical Engineering and plans to continue her exciting research on the development and characterization of 'smart', stimuli-responsive polymeric materials, colloidal gel aging, and 3D printing.

While at Delaware, Professor Gordon was the recipient of both the NASA Space Grant Graduate

Fellowship and the Shirley and Fraser Russell Teaching Fellowship. As a Russell Teaching Fellow, Professor Gordon had the opportunity to co-teach an undergraduate level course at Delaware where she was responsible for developing course materials and working directly with students.

Professor Gordon hopes to build strong relationships with her students, contribute to the collaborative atmosphere here at Lafayette, and facilitate the success of the student body. Her research experiences bring a unique materials perspective to the department. Dr. Gordon is currently teaching Na-

ture of Engineering Materials (ES 231) and will bring back the polymers elective to the ChBE curriculum next academic year.



Assistant Professor Melissa Gordon '11

Sean McSherry '17

SAN FRANCISCO (from p.5)

In addition to the conference events, students used free time to explore the city of San Francisco. Many visited the Golden Gate

Bridge, Fisherman's Wharf, and Ghirardelli Square.

Faculty members in attendance presenting their own work included Assistant Professors Melissa Gordon, Michael Senra and Lindsay

Soh. We hope to be able to send another large contingent of students to the conference being held next year in Minneapolis, MN.

Sean McSherry '17

Connect with us!

We are always interested in connecting and reconnecting with alumni. We are grateful to alumni that have given their time by speaking at AIChE and ChBE events and/or opening their workplace to us to host a plant tour or workshop. For more about Lafayette ChBE, please join our mailing list by e-mailing us for a link at aiche@lafayette.edu.

Lafayette Chemical Engineering website: che.lafayette.edu

Lafayette AIChE website: sites.lafayette.edu/aiche

We're on Facebook! 'Friend' Lafayette AIChE

AIChE Board 2016-2017: Professor Lauren Anderson, Professor Polly Piergiovanni, Professor Michael Senra, Trent Eastman '19, Nahin Ferdousi '19, Colleen Lavelle '18, Sean McSherry '17, Sara Mikovic '18 and Danielle Ricciardi '17

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