The University of Iowa

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AIChE FALL 2013

Advisor's Corner

By: Prof. David Murhammer, Professor and AIChE Student Chapter Advisor

Greetings to Hawkeye Chemical Engineers!! This Fall 2013 issue of our AIChE Student Chapter Newsletter begins with an article about the 2013 National AIChE Annual Student Conference held in San Francisco, CA. Our student chapter won numerous awards at the meeting, including 1st place in ChemE Jeopardy competition (National Champions!!). The team members were Nick Schickel, Danny Yocius, Matt Taylor and Austin Hangartner. Other awards included a prestigious AIChE Scholarship for Nick Schickel and an Outstanding Student Chapter award. This issue also contains articles about hosting the 2014 AIChE Mid-America Conference, hosting a Halloween Day Camp for kids, four articles about students' internship, cooperative education and study abroad experiences, and three student-written topical papers from our sophomore-level Process Calculations course.

Finally, I am very proud to announce that two University of Iowa design teams won national safety in design awards for the 2013 AIChE National Student Design Competition ("Comparison of Bio-mass to Bio-oils Reactor Systems: Direct Conversion vs. Companion Coal Gasification"). Specifically, the team of Kyle Kubat, Taylor Malott and Darren Youngs won both the Safety and Chemical Engineering Education (SAChE) Team Award (the top overall safety award) and a Safety & Health Division National Design Competition Award for Inherently Safer Design Award. In addition, the team of Matt Burian and Tyler Manning won a Safety & Health Division National Design Competition Award for Inherently Safer Design Award. Thus, University of Iowa Students won the only SAChE safety award and 2 of the 4 awards given by the AIChE Safety & Health Division; quite an achievement for such a small department!

University of Iowa American Institute of Chemical Engineers

INSIDE THIS ISSUE:

Fall 2013 National AIChE Annual Student Conference

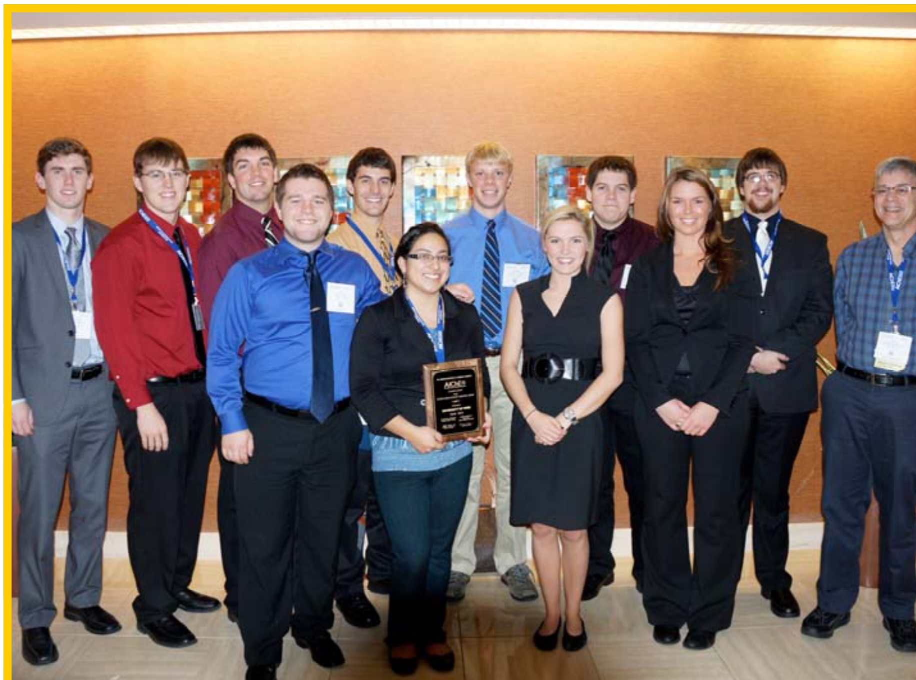
By: Austin Hangartner - Junior Chemical Engineer

On November 1-4, 2013, 11 University of Iowa (UI) students and their faculty advisor attended the 2013 AIChE Annual Student Conference in San Francisco, California. Each year the organization hosts an annual conference for both students and professionals to attend. The student conference hosted special competitive events such as research paper, research poster , ChemE car and ChemE Jeopardy competitions. In addition to the competitions, the conference provided the opportunity to attend workshops, technical seminars and presentations by student chapters on successful methods/ ideas they have applied.

Nick Schickel, Fall 2013 UI AIChE student chapter president, led a workshop about the annual Halloween Day Camp. At the presentation, Nick explained the process of hosting a successful day camp event.

This year, the University of Iowa AIChE ChemE Jeopardy team won the Mid-America Regional competition to qualify for the national ChemE Jeopardy competition. The team was composed of Matt Taylor, Nick Schickel, Danny Yocius, and Austin Hangartner. The first round competition at the Annual Student Conference was against Texas Tech University and the University of Utah. Upon overcoming an early deficit, the team successfully won the first round and proceeded to the finals. The final round competition was against Cornell University and Georgia Institute of Technology. After single and double jeopardy, the correct response to the final Jeopardy resulted in the University of Iowa ChemE Jeopardy emerging victorious by 1 point.

In addition to the National ChemE Jeopardy title, University of Iowa students received additional recognition at the awards banquet. Sean Fitzgerald won the Donald F. Othmer Sophomore Academic Excellence Award and Nick Schickel received the Donald F. and Mildred Topp Othmer Scholarship. This year, UI chemical engineering students received 3 out of the 5 awards for safety and design. The Safety and Chemical Education (SAChE) Team award for Overall Safety was received by the team consisting of Kyle Kubat, Taylor Malott and Darren Youngs. The Safety and Health Division Student Design Competition Award for Inherently Safer Design was received by two Iowa teams. One team consisted of Kyle Kubat, Taylor Malott and Darren Youngs, and the other team was composed of Matthew Burian and Tyler Manning. Austin Hangartner was awarded first place in the research poster competition on engineering materials and sciences. To top it all off, the Iowa AIChE chapter was recognized as an Outstanding Student Chapter for the 20th time out of the last 21 years.

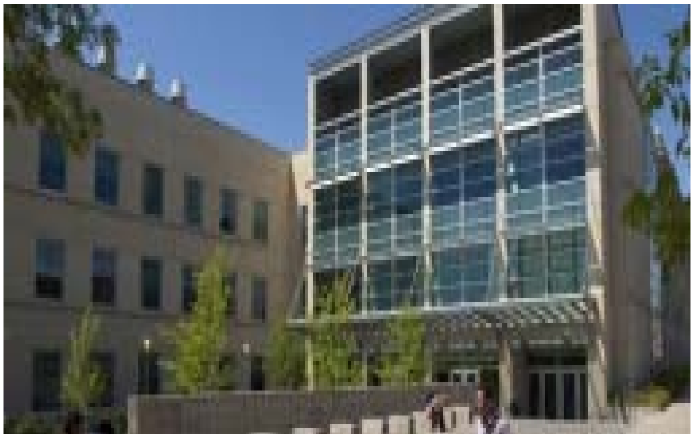


University of Iowa Chemical Engineering students and faculty advisor in San Francisco, California for the Annual AIChE National Conference.

Hosting the 2014 Regional AIChE Annual Conference in Iowa City

By: Ian Smith - Senior Chemical Engineer

The AIChE Mid-America Regional Conference will be held in Iowa City on April 11-12, 2014. There is still a lot to be done, but Dr. Murhammer, Conference Coordinator Austin Hangartner, and Co-Conference Coordinator Ian Smith are working hard to host the best possible conference.



The Seamans Center for the Engineering Arts and Sciences will be one of the primary buildings for hosting the many events during the 2013 Regional Conference.

The conference will include the Chem-E Car Competition, Research Paper Competition, and the Chem-E Jeopardy Competition. There will also be an opening student mixer and closing banquet. At the banquet, Elizabeth Bernard, a 2000 Chemical Engineering graduate for the University of Iowa, will be the keynote speaker. After Elizabeth Bernard's speech and the award presentations, comedy hypnotist Cheryl will provide the entertainment.

The rooms needed for the conference have already been reserved, including the Field House in which the Chem-E Car Competition will be held. The Sheraton Hotel has already been reserved to house the Chemical Engineering students and faculty advisors from the other 11 universities in the region. These Universities are Iowa State University, The University of Nebraska, The University of Tulsa, Oklahoma State University, The University of Oklahoma, Kansas State University, The University of Kansas, The University of Missouri, Missouri University of Science and Technology, Washington University-St. Louis, and the University of Arkansas.

The Coordinators have also appointed committees for each major event. It promises to be a very busy and fun-filled weekend for the many chemical engineering students and others in attendance.

If you would like to participate as a judge for one of our competitions or contribute financially, then please contact our chapter President, Danny Yocius at daniel-yocius@uiowa.edu or the student chapter advisor Professor David Murhammer at david murhamer@uiowa.edu.

The Old Capitol Building located in the middle of campus will be a highlight for many students traveling from throughout the Mid-American Region.

Penford Products Engineering Co-op

By: Sean Conway - Senior Chemical Engineer

During summer 2013 and the fall 2013 semester I worked as an engineering co-op at Penford Products in Cedar Rapids, IA. In this position I worked with both process and project engineers on various projects around the plant. These projects ranged from updating AutoCAD drawings to working with contractors and personnel to install equipment or update processes.

One of the first projects I was given was installing level transmitters in two storage bins. The reason they wanted to put these in is because operators currently have no way to tell how much room is left in the bins. They can only guess how much time they have left before the bin fills based on how fast they are filling it. This caused occasional overflows, resulting in loss of product and time spent cleaning it up. This project put me in a project engineering role. The project was already started before I took over, so I was overseeing the installation of the transmitters. They were installed during my summer session. One of the transmitters experienced some problems with reading the levels. The reading would be normal up to 25% and then jump to 100% shortly thereafter when the bin was not close to being full. The fix required the level transmitter vendor to come in and reprogram the transmitter. When installed there may have been material in the bin, which caused false level readings.

Another project involved changing the ion exchange vessels in the ethanol storage area from series to parallel. Sometimes, there are too many impurities in the ethanol after it has been made and those levels need to be reduced. To do that the ethanol is passed through an ion exchange vessel to extract the impurities. Prior to my project the vessels were in series, i.e., all of the ethanol passed through one vessel and then the second. This greatly reduced the efficiency of the process because the first vessel got saturated well before the second vessel. This project's focus was to split these vessels into parallel such that when one vessel is saturated and in need of replenishing, the other vessel can be running. This project was approved and the pipefitters worked on fabricating the new pipes. I was involved in working with the pipefitters to make sure they knew what needed to be done and how it should be done in order to minimize confusion when it came time to build and install the pipes. I also worked with a vendor to purchase a new filter to install in this system, and updated AutoCAD drawings, Standard Operating Procedures, and Energy Isolation Procedures. Overall, this project increased the efficiency of the vessels and is projected to save about $10,000 a year.

The main project I worked on was with a project engineer. He was installing a new chemical mixing system to improve reaction efficiencies. The first step in this project was to run small scale mixer trials to make sure that a large scale mixer would actually work. Working with pipefitters we were able to construct a very small scale process, much like that currently used in the plant. There was a hose that tapped into the initial slurry mixture to direct the product into a 330 gallon tote. This tote was then gravity fed into the mixer. A 55 gallon drum of chemical was set up and an air pump was used to inject the chemical near the stator of the mixer to effect mixing with the slurry. The newly mixed slurry was then pumped into another tote where it could be disposed of. Samples were taken at different levels of chemical flow rate, before the trial, and after the mixer. These samples were then analyzed by the R&D department to determine the efficiency results. I also worked on sizing a full scale heat exchanger that will be installed with the full scale project. The new process is considerably more exothermic, which can cause downstream process issues if not properly controlled. It was determined that a heat exchanger would be the optimal control device, so I contacted heat exchanger vendors to obtain potential options and prices for heat exchangers.

Another project that I worked on involved assisting with the installation of a new heat exchanger, which is used to cool the starch. The heat exchanger currently is too small for the current flowrates, thereby causing higher temperatures than desired. This involves drawing the P&IDs and ISOs for the heat exchanger that will be installed, which includes going into the field and determining the best locations to tie into existing pipes and where new pipes will be needed. Current AutoCAD drawings needed to be updated with the new piping and equipment. ISO drawings are used to represent a 3D model of the positioning and how the pipes will tie into the existing pipes.

Overall, this co-op was a great experience. Everyone I worked with was very helpful. The supervision I received was great and I feel like they had great projects for me to work on, both giving me experience and helping them at the same time. I would highly recommend doing a co-op in any company if there is an opportunity.

Halloween Day Camp 2013

In the spirit of this Halloween season, the U of I AIChE student chapter gave some elementary and pre-school children a taste of spooky science. At the Halloween Day Camp, over a dozen children ranging in age from kindergarten through 5th grade took part in a handful of creative activities and experiments merging holiday fun and science. The participants were welcomed by mini-pumpkins and phosphorescent paints. Each pumpkin was thoroughly decorated and then doused in glow paint, exposing the kids to the process of phosphorescence. They learned what it was that makes everyday toys, stickers, and whatever else glow in the dark after they "charge it up" under a lamp or flashlight.

An activity that was a big hit was the green slime. Polyvinyl alcohol and borax gave the children all sorts of slimy, stretchy fun. They learned about how polymers build up piece by piece until the spaghetti-like molecules turned the soupy green mess in our bowl into a big old blob of slime. The children got creative and decided that the slime was the perfect filling for balloons to become "beanbags."

The children met an obliging tarantula by the name of Harriet. They learned how the terrestrial creepy-crawlies spend their time, eat, and build little pantries to save food for later. Not everyone was eager to peek through the terrarium glass and meet the four inch arachnid, but nearly everyone wanted to know what it looked like when she sheds her exoskeleton and eats crickets.

Liquid nitrogen also made an appearance at the Halloween Day Camp. The classic demonstration got the children's attention as they watched the water in everyday objects freeze and render them brittle and breakable. Flowers frozen with the nitrogen were crushed into powder. The kids noticed how even without crushing them, they didn't return to normal after thawing. The water in the flowers' cells expanded as it froze and broke through the cell walls. Balloons subjected to the colder than -300°F temperatures immediately shrunk. They, however, went back to their normal size as soon as they got back to room temperature. The kids loved the effect, but weren't quite as interested in this demonstration of the ideal gas law. Give them a few more years! Everyone had fun chomping down on recently frozen graham crackers and watching the nitrogen fog flowing out through their lips between chews.

Dry ice bubbles were another activity that demonstrated the process of sublimation. With small chunks of frozen CO_2 in a bowl of water, a cloth soaked in dish soap was drawn across the top of the bowl. The resulting soap film filled up with CO_2 fog until it got too big for the bowl to handle. Everyone had their faces right up near the bubble and there was much giggling and shrieking when it finally burst and the fog poured over the edges.

Everyone was able to spend time learning about different scientific principles and having fun. Halloween snacks, pumpkins, flowers frozen with fear, green slime, spiders, and bubbles from a witch's brew gave put all the participants in the spirit of Halloween. A free sample of "expanding snow" from Fisher Scientific gave the kids and AIChE students a taste of the winter to come.

PepsiCo Engineering Co-op

By: Megan Hall - Senior Chemical Engineer

My internship was completed at PepsiCo in Munster, IN. This facility is the fifth largest Pepsi facility in the United States and has five different lines: can, bag in box, and three bottle lines. One of the bottle lines was a blow molding line, which is a manufacturing process used to create hollow, but strong, containers for the consumer. This process reduces the cost of shipping, storing, cleaning, and sterilizing premade bottles.

“Overall, I found a potential savings of $171,000 throughout my internship experience.”

The two main projects that were given to me were resource conservation and a zero percent landfill initiative. To complete the resource conservation audit of all of the Manufacturing and Warehouse interns were flown to Burnsville, MN to be trained on water, electricity, and natural gas. For this process the amount of each utility used during the previous year was determined by looking through old bills. Once completed, it was determined where the utilities are used. For example, to determine the amount of electricity that the motors used I checked the face plate to determine the voltage, current, and efficiency. I also had to estimate the amount of time that each motor was running during the previous year. Once this was found, it could be determined if adding a solenoid or using a higher efficiency motor would be more cost efficient. Overall, I found a potential savings of $171,000 throughout my internship experience.

My other main project was a zero percent landfill initiative. This initiative consisted of three main parts: increase opportunities to recycle throughout the facility, increase knowledge and communication, and eventually make recycling second nature. Increasing the opportunities to recycle was a major contributor to reducing the amount of land filled material and involved placing receptacles in logical locations that are easy to see. To help achieve this goal a color coordinated system was used, for example, all aluminum cans had yellow receptacles. Also, by increasing knowledge and communication about how recycling is good for the facility and the environment, the initiative was kept in the employee’s minds while working and new opportunities to recycle were discovered. By the end of my internship experience, more than 14,000 pounds of annual recyclable material was discovered that was previously not recycled. The long term goal of this initiative is to achieve a zero percent landfill culture and have recycling become second nature.

Pella Engineering Co-op Experience

By Ian Armstrong - Senior Chemical Engineer

The Pella co-op was a great experience. I worked as full time engineer and learned a lot about what I want to do in my future engineering career. This position provided a wide variety of opportunities that I never would have imagined if I had not accepted this position. I appreciated the fact that the Pella Corporation treats their interns the same as their full time engineers, and gives them significant work, responsibility, and projects that are of high importance to the company, and are expected to be completed during the co-op. I never felt unappreciated or like I was not wanted here. Everyone I talked to was very friendly, willing to talk, give advice, and help with any troubles I had. The product engineering position was a good fit for my mindset and aspirations. The development of new products, improving the quality of the existing products, and having the opportunity to work in teams of other engineers was a great opportunity to experience the infrastructure and operations of a manufacturing industrial corporation.

This experience exceeded my expectations of coming into a business that makes only windows and doors. Although I knew they were a great company to work for, I did not know how interesting or engaging the work could be for products that do not directly affect the general public on a personal level. I've always wanted a position in which I can have a significant and positive impact for the greater population. My ideas of how to achieve this goal usually involved medicine, food, and clean water; however, seeing how important that windows and doors can be in someone's life is special to see. It may not affect them directly, but they can have a significant impact on the environment, heating/cooling bills and the overall comfort of people's homes, a place where everyone should feel safe, relaxed and happy.

I was involved with a wide variety of projects, ranging from new innovation, ready to serve problem solving issues, quality issues, process operation changes, discovery projects, as well as documentation changes from top to bottom. This experience has been great for my development and understanding of how a corporate organization is run, how different departments interact, and the process in which a project is brought up, carried out, tested, and implemented. Being able to work with a wide variety of people with different backgrounds, and departments, has helped me grow as a person individually and professionally.

I worked closely with other companies, and other potential partners/suppliers. This experience was a great opportunity because I learned how to professionally interact and collaborate between companies. I was the direct contact between multiple companies, deciding on the proper route to completion of the projects that I working on. I worked on the materials coating team in the Advanced Product Technology Department. I had the opportunity to work with all coatings from paints and stains, on every substrate: metal, wood, vinyl and fiberglass. Working with other companies and many different materials provided me the opportunity to learn about standard testing, qualification and certification of materials/products.

At the Pella Corporation, the leadership was always willing to help, answer questions, and guide me in any way I needed. Acting as a new engineer, there were countless times that I needed help with proper documentation and filing the proper way the corporation. I was not micro managed, and I was given a great deal of my own time management and responsibility to get my work completed. This aspect was one of the key selling points for me during my 8 month Co-op with the Pella Corporation.

Air Pollution Engineering

By: Marlis Owen—Sophomore Chemical Engineer

As the human population on Earth escalates, air pollution from the combustion of fuel permeates our environment. Air pollution, "formed by a reaction of nitrogen, volatile organic compounds, carbon monoxide, and methane in the presence of sunlight" (Broder), is a widespread problem detrimental to all forms of life on Earth. Research consistently shows "that air pollutants contribute to increased mortality and hospital admissions" (Kampa), making this issue especially relevant. Equipped with knowledge about fluid flow, mass and energy transport, and chemical kinetics, chemical engineers are innovating ways to decrease the generation of pollutants at their source, remove pollutants already existing in our atmosphere, and lessen the burden of smog on human health. For the reduction of pollutants emitted at their sources, chemical engineers are finding ways to make combustion of fuel more efficient. Additionally, inventions like pollution-busting laundry additives and air-purifying pavement are innovative methods of cleaning pollutants from the air we breathe.

Air pollutants from "power plants and factories, fumes from volatile solvents, vehicles emissions and gasoline vapors" (Broder) are products of a process called combustion. Combustion is the burning of fuels, mainly hydrocarbons, in the presence of oxygen resulting in carbon dioxide and water. If a combustion system is maintained at constant temperature and pressure for a sufficiently long time, chemical equilibrium is reached, all reactants are consumed, and only very small amounts of carbon monoxide, nitrogen monoxide, unburned hydrocarbons and other pollutants remain. However, the relatively slow reactions that occur in our factories "allow the concentrations of these pollutants to be orders of magnitude greater than the equilibrium values when gases are finally emitted into the atmosphere" (Flagan). Because of this, chemical engineers are faced with the challenge of improving the efficiency of combustion so that equilibrium is more readily obtained and there is less chemical waste produced in the reaction. Improvement of engine operation and treatment of exhaust gases are two of the ways engineers are trying to reduce emissions of pollution at their source. However, the costs of worsening engine performance nearly outweigh the modest reduction in pollution, as engine efficiency must be sacrificed to reduce exhaust. Surely, the future holds new discoveries and advancements in technology that will solve this quandary.

In addition to the future progression of eliminating dangerous emissions at their source, chemical engineers are finding other ways to combat air pollution. One interesting invention is a liquid laundry detergent called "CatClo" that infuses nanoparticles of titanium dioxide into clothing with only one wash. "When the particles then come into contact with nitrogen oxides in the air, they react with these pollutants and oxidize them in the fabric" (Pollution). A person's clothing could remove about five grams of pollutants each day, the equivalent of the amount produced by the average car.

Another innovative solution is air-purifying pavement. In the Netherlands, a full scale experiment of a street built with concrete pavement containing TiO_2 was monitored for "traffic intensity, NO, NO_2 and ozone concentrations, temperature, relative humidity, wind speed and direction, and the visible UV light irradiance" (Ballari). In an average day, the NO_X concentration was 19% lower than in the Control street, and under ideal conditions, a "decrease of 45% could be observed" (Ballari). This technology, called Heterogeneous Photocatalytic Oxidation, "involves a solid semiconductor catalyst, most often titanium dioxide (TiO_2), which is activated with ultraviolet light of the appropriate wavelength" (Ballari). It has enormous potential for effectively oxidizing NO_X, but chemical engineers must find a way to make it practical and inexpensive.

Despite advancements in technology in recent years, air pollution is still an important problem with no easy solution. Chemical engineers are working to find ways to improve the efficiency of combustion in factories to reduce the amount of pollution emitted. Also, new technology utilizing titanium dioxide is used on a small scale in clothing and pavement of streets; however, this method of cleaning pollution from the air is not yet practical enough for widespread use. Chemical engineers play an important role in finding ways to reduce the emission and decrease existing air pollution by innovating new solutions and improving the existing technology. Progression in technology is imperative now as humans have already experienced health effects that "can range from nausea and difficulty in breathing or skin irritation, to cancer" (Kampa).

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NASA Space Flight Center Summer Engineering Internship

By: Nick Schickel—Senior Chemical Engineer

As expected, my time spent as an intern at NASA's Marshall Space Flight Center was invaluable. Because my particular project was outside of the type of work typically assigned to someone with a chemical engineering background, I was given ample opportunity to learn about different types of engineering, as well as get acquainted with specific applications of the knowledge I gained. Furthermore, I became familiarized with the research process, as well as how large research projects can be broken down and assigned to multidisciplinary teams in order to effectively accomplish a lot of work in a short time. Beyond work, I was able to make friends and other connections that will undoubtedly benefit me throughout the rest of my college career and my life.

My project was called a scaling investigation, and it primarily focused on thrust chamber assemblies for rockets with oxygen-rich combustion cycles. A thrust chamber assembly includes the fuel injector, the combustion chamber, and all of the small parts that connect the two together. My work was based in a fluid mechanics branch of the center, and the majority of the people I worked with had mechanical engineering backgrounds. That being said, the initial part of my project dragged on. I had to take a lot of time to read and understand aspects from other engineering disciplines in order to get started, but once I had a handle on the type of information I was dealing with, starting the project was easy. After that, there was not a single day that I didn't open a textbook or sit down to read a technical paper. Learning is a never-ending process, and that is something stressed by everyone at Marshall. Aside from my project, I also had the opportunity to experience work life in the real world. This was the first job I had that provided me a desk in a cubicle in an office full of other engineers. I attended departmental meetings on a biweekly basis, which allowed me an opportunity to hear and learn about other projects going on in my department, as well as become familiar with some of the other employees and their work. Finally, and most importantly, I was responsible for part of a much larger effort to benefit the scientific community, which is the primary goal of many research institutions.

Outside of work there were ample opportunities for me to get involved socially. I started work at Marshall Space Flight Center with over a hundred other interns, and through weekly meetings with smaller, more associated groups, we were able to meet each other pretty quickly. There was also a volleyball tournament that I got involved in, and another intern and I co-captained a volleyball team to a championship victory during the first few weeks of the summer. After that, a lot of the interns that were interested in volleyball and other sports got together three to four times a week outside of work to stay active. Our closer group added new members all the time, so it was a great way to meet new people, and experience life as an intern. The internship took place in Alabama, and the majority of us weren't from the area. It was nice to have a couple people that were familiar with the city to show us the weekend and evening hotspots, so there was never a time when we were bored.

While we weren't working on our projects or out being social, the Marshall Space Flight Center staff gave us tours of the labs and other facilities on our base. Through these tours we were able to see mission control in action, and see first hand what the life of an astronaut is like. We learned about wind tunnels, x-rays used in deep space telescopes, nuclear and electric propulsion systems, and a wide array of other aerospace-related topics. Later tours gave us the opportunity to climb to the top of the testing stands that used to house space shuttles during vibration and ignition testing. I also got to see, and touch, the Lunar Lander called The Mighty Eagle. In late July, about two thirds the way through the internship, I drove to the Kennedy Space Flight Center in Florida with five other interns, and we were given a tour of the facilities there. A lot of the labs serve functions similar to those at Marshall, but Kennedy is where many of the shuttle launches took place during their career. That being said we were able to see the launch pads up close. I also got to go on a tour of the Vehicle Assembly Building (VAB), which is basically a five-story warehouse with cranes inside it that was used to assemble the shuttles before driving them out to the launch pads. To give a better understanding of the immensity of the building, there was an American flag painted on one of the walls, and the blue rectangle that holds the stars was the size of an NBA basketball court. During the tour of the VAB, we also got to see the machine called "the Crawler" that was responsible for holding the shuttles and driving them out to the launch zones. The Crawler has eight sets of treads that are approximately twelve feet tall, and it can lift upwards of six million pounds. It is by far one of the most impressive machines, and engineering marvels, that I have ever seen.

Overall, my internship went extremely quickly. I was responsible for an in depth technical paper about my scaling investigation, which allowed me to show what I learned about different scaling methods that can be used with fuel injectors and thrust chamber assemblies. I also got to present my research at a poster competition at the end of the summer. I was immersed in engineering throughout the entirety of the summer, and I learned an immense amount about the technical and social aspects of what it means to be an engineer. Although I didn't get to experience much chemical engineering, I do believe that the problem solving skills and perseverance I have acquired through my time as a chemical engineer are some of the main reasons my project was a success. I feel as though this opportunity opened a lot of doors for me as a young engineer, and I wouldn't hesitate to go back and experience life at NASA again. That being said, the most important thing I learned all summer is that life as we know it is never all there is. There are so many people, so many opportunities, and so many aspects of the scientific world that are simply waiting to be experienced by young professionals like myself. My time and experiences at NASA taught me to think outside the box when it comes to my potential and what I'm capable of, and I'm confident that that lesson will propagate through my engineering career and carry me to exciting new places.

The Rapid Growth of Nanotechnology

By: Valerie Renkor - Sophomore Chemical Engineer

The word "nano" comes from the Greek word for "dwarf" and is one *billionth* of a meter; one *billion* nanometers equal one meter (Paddock, 2012). It is hard to fathom an object so small, yet there are engineers and scientists who work with these minute particles on a daily basis. Many materials at the nanometer length scale exhibit unique properties that are extremely different from their macroscopic behavior, and being able to "control and characterize materials at the molecular level" has stimulated the science of nanotechnology (Stanford…1997-2013). Nanotechnology and the use of nanoparticles affects so many different areas, and chemical engineers have already had and will continue to have a huge impact on the rapidly growing field.

Nanotechnology is the "manipulation of matter at the atomic and molecular scale to create materials with remarkably varied and new properties" (Paddock, 2012). Nanoparticles are used for research in a number of different areas—from construction to electronics to medicine. A chemical engineering researcher from Argonne National Laboratory that I talked to as a junior in high school told me all about her projects on nanotechnology and their effects on cancer. She spoke about nanoparticles' ability to come in direct contact with tumors and identify whether or not they are cancerous by observing the way that the nanoparticles respond. She explained that the nanoparticles "wiggle" a specific way when the cells being tested are cancerous, which is a result of the nanoparticles' novel properties.

The nanoparticles do not just detect cancer, however. In fact, these particles may soon be used to treat cancer. Traditional cancer treatment makes use of chemotherapy, which is extremely damaging to the body, causing intense pain, nausea, and damage to other parts of the body. Nanoparticles can be used to lessen the side effects of traditional cancer methods. These particles are packed with cancer-fighting drugs and sent directly to the cancerous cells, which reduces the toxins that enter the patient's body and therefore reduces the amount of harm done to the non-cancerous parts of a patient's body

Similar usage of nanotechnology and nanoparticles is researched in the Chemical Engineering Department at the University of Iowa. Application, characterization, and development of nano materials are studied in the Iowa Advanced Technology Laboratories. Implications of nanoparticles on certain aspects of the environment are also studied (Nanoscience… 2013). Research is currently being done with nanoparticles to improve areas dealing with healthcare and medical treatment. Specifically, Dr. Jennifer Fiegel's research on lung disease and drug delivery to the lungs makes use of nanotechnology. Her lab uses nanoparticles to target the diseased area of the lungs and deliver treatment. The methods used are similar to the ones described above. Research in nanotechnology clearly has a huge impact on numerous areas of study—the environment, medicine, and development of new materials are just three of these areas.

"Research in nanotechology has a huge impact on numerous areas of study—the environment, medicine, and development of new materials"

While nanotechnology is a relatively new area of study, it has the ability to really help people. Nanotechnology has various applications and could possibly be used to save many lives; it has already begun to move into active structures like specific drug therapies. These therapies have been more effective with less harmful side effects than traditional medicine (Nanotechnology Project, 2013). With such great potential, nanotechnology is developing at an alarming rate. Within the next 20 years, nanotechnology may become the new face of medicine as well as being used in other fields. And at the forefront of this emerging technology are chemical engineers.

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Studying Abroad in Wales

By: Natalie Northup - Senior Chemical Engineer

Chemical engineering can be stressful. As students, we often have large amounts of homework, tests, and labs due each week. With this rather heavy workload, we often wish for a chance to get away from it all for just a little while. I got just the break I needed when I studied abroad at the Swansea University in Swansea, Wales. I decided to study abroad about a month before the signup deadline, a very short time frame considering that a lot of students plan trips a year in advance. With such a short time to gather passport and visas, application information, and abroad class information, I didn't really give myself a lot of time to sit down and create expectations and goals for my time abroad. If I did have the opportunity to do this, my expectations would not have even come close to some of the things I got to experience while abroad. To say that my time at Swansea University was life changing would be an understatement. This trip gave me the opportunity to step back and really look at my life goals while at the same time meeting new people and experiencing new places.

About a year ago to this date, I was boarding a plane alone in the windy city of Chicago. The flight would take me directly to London where I would catch a bus or train to Swansea. Upon arriving in Swansea I needed to find a taxi to the university. After gather some information at the university I needed to find the flat in which I would be staying for the next five months. To some this traveling may not seem stressful, but to me I was sure I would turn up dead or kidnapped before I would be able to reach my final destination. It was during this little expedition that I realized how far maps, signs, and a little common sense would assist a foreigner. I made it to my destination with only the slightest issue of trying to figure out which coins I needed to pay the taxi driver with. My traveling didn't stop here though. Within the next five months I would be maneuvering my way through 12 major cities throughout Europe and the United Kingdom by means of ferry, bus, planes, and trains. Chemical engineers can often be placed in positions where they need to travel. I now feel confident enough travel in a group or alone that I could navigate to a variety of locations without breaking a sweat.

Swansea University is well known for their engineering department in the United Kingdom. This was one of the many reasons why I choose to attend this university for a semester. Unfortunately, the engineering classes I need to take the semester I went there weren't offered until the following semester. Instead of taking this as a negative, I used it as an opportunity to explore different types of classes. I took the majority of my courses within the political science department at Swansea. One of the most beneficial classes I took involved looking at policies and institutions different states around the world. Not only did we look at states from the United Kingdoms point of view but from American interpretations as well. These classes greatly increased by interests in politics so much that I would like to add a minor in political science.

One of the largest surprises I received while in Wales was the cultural similarities while at the same time being such a similar nation to the United States. Upon my initial arrival I hardly noticed a difference at all minus the fact that the British drive on the opposite side of the road and have accents. The technology that the students used was just as up to date as ours, there were coffee shops on every corner, and the food for the most part didn't seem extremely different. It wasn't until I had been at Swansea for a couple of months that I began to notice slight differences between the British and the American people. A British sense of humor is not the sarcasm that most people think are funny. It is customary to have three or four cups of tea a day along with a quality conversation. The British I met also seemed to be very content with themselves and their lives. You often see Americans striving for more and questioning if what they are doing is enough. It was the little things like these that made me really appreciate Swansea, the place I had come to love. Being in Wales for such an extended period of time gave me the opportunity to really experience another culture. As engineering and technology expands, so do the people and locations that chemical engineers will deal with everyday. I believe that it is helpful for me to even slightly understand another culture in order to work at the international level.

The five months I spent abroad were willed with great times and memories. I will always treasure the days I spent there and the friends I was able to make. I can also look back and say that I learned a lot about myself and grew as a person. The skills I developed while abroad cannot be taught in a classroom or in a textbook. Things I learned could only be built through experiences; and these experiences will hopefully help me in my career as a chemical engineer.

Meeting the World's Food Needs through Chemical Engineering

By: Taylor Soltys - Sophomore Chemical Engineer

In an ever changing and evolving world, it seems as if almost nothing is a constant anymore. But there is one constant that is as worrying as it is self-evident: each person on this planet needs to eat. It seems obvious enough, but coupled with UN estimates of a world population approaching 10 billion by 2050(1), some are starting to question whether or not the planet can support such a huge population. Luckily, chemical engineers are leading the charge in pioneering developments to help feed a hungry 21st century.

On the forefront of chemical engineering developments to increase global crop yields and food production are the introduction of genetically modified (GM) foods. In concert with food scientists and biotechnologists, chemical engineers are proving essential in ushering in a new era of genetically modified crops that will help address global food supply issues. Using various genetic engineering techniques, chemical engineers are developing crops that are more resilient to environmental hazards, take less resources to grow, and are more nutritionally dense than currently available crops. Methods like gene splicing, where desirable genes from other organisms are "cut off" and reinserted into a new organism(2), are redefining our ability to select for favorable traits in our foods. Current projects by chemical engineers worldwide are focused on developing improved techniques for transferring genetic material between different organisms(3), in an effort to ease the creation of new GM foods with desirable traits.

One of the most important traits chemical engineers are trying to impart on next generation food is a natural pest resistance. Currently, the vast majority of crops planted in the United States have been modified to withstand the application of commercial pesticides and herbicides(4). While these advancements have allowed for increased crop yields (on the order of a doubling of global cereal production over the past 40 years(5)), they also have created an agricultural system heavily dependent on pesticides and fertilizers. According to a United Nations report done in 2005, 9 of the 12 most dangerous and persistent chemicals in use today are pesticides(6). The chemical engineers of today are working to change that, with the creation of improved pesticides with equal efficacy and fewer dangerous side effects. This means the synthesis of new pesticides and the chemical modification of existing ones so they can breakdown more easily in the environment. Further on the horizon, chemical engineering is moving towards the creation of genetically modified crops with natural pest resistances in hopes of eventually producing crops resilient enough to "eliminate pesticide use in the future(7)." These advances will not only secure global food production, but also reduce humanity's reliance on fossil fuels required in the production of conventional agricultural chemicals.

Large-scale crop yield increases mean little, however, if the food is being lost to spoilage before it can reach the dinner table. As such, chemical engineers are also working towards the advancement of food safety and storage techniques to decrease the amount of food lost between production and consumption. As of 2011, roughly 40% of global food losses occurred at post-harvest and production levels(8), a number chemical engineers are seeking to reduce. A major point of interest is the continued development of techniques for purifying and sterilizing harvested foods. With microorganism contamination remaining the leading cause of foodborne contamination and spoilage(9), chemical engineers are looking to continue developments of methods to reduce food contamination. One novel development in recent decades has been the use of irradiation techniques to reduce or eliminate contaminants in food products. By briefly exposing foods to low levels of radiation, their pathogen levels, and hence chance of spoilage, can be significantly reduced(10). And while irradiation is not a new front in food science, chemical engineers will be at the forefront of developing it into an even more viable technique for food treatment in coming years. In addition to irradiation, methods such as membrane-based separation systems, commercial scale sterilization, and genetic engineering techniques are among the many techniques being developed by chemical engineers to help solve global food contamination problems.

As we move into the 21st century, uncertainties about global food production abound. With a booming global population, many question the capacity of the human race to feed itself into the middle of the century. Yet while problems mount, chemical engineers continue to research new techniques in genetic modification, pesticide usage, and food processing that will be needed to feed an exploding worldwide population. And in a dynamic world where change seems to be the only rule, it is comforting to know that the insight and resourcefulness of the chemical engineer will always remain a constant.

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The Fall 2013 senior class

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Your help is much appreciated!

Interested in speaking at professional seminar? If so, then contact AIChE Student Chapter President Danny Yocius at Daniel-yocius@uiowa.edu or Student Chapter Advisor Prof. David Murhammer at david-murhammer@uiowa.edu for details and availability!

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